

Research on the Quality Evaluation of Environmental Information Disclosure of W Chemical Company Based on Text Analysis

Hanqing Gao *

Department of accounting, Nanjing University of Science and Technology, Nanjing, China

* Corresponding Author Email: 834796242@qq.com

Abstract. As a heavily polluting sector, the chemical industry's environmental information disclosure quality is pivotal to regulatory compliance, green transformation, and stakeholders' decision-making. Following a literature review to synthesize the research landscape, this study integrates the chemical industry's characteristics and policy requirements, employs text analysis techniques for quantitative measurement across five dimensions—content completeness, information reliability, text readability, text similarity, and text objectivity—and adopts the entropy weight method to determine indicator weights, thereby constructing a quality evaluation system for chemical enterprises' environmental information disclosure. Taking W Chemical Company as a case study, it assesses the company's disclosure quality from 2020 to 2024, analyzes score trends and indicator performance, and verifies the system's credibility and advantages through comparison with the conventional EDI index.

Keywords: Environmental information disclosure, Text analysis, chemical industry.

1. Introduction

Sustainable development is a global consensus, yet rapid economic growth has exacerbated environmental issues like pollution, ecosystem degradation, and resource scarcity. Obtaining sufficient, accurate environmental information is essential to addressing these challenges, making environmental information disclosure increasingly critical for governments, enterprises, and academia. In October 2024, the CPC Central Committee's Decision on Further Comprehensively Deepening Reform and Promoting Chinese-Style Modernization proposed deepening the legal disclosure system for environmental information, a key measure for ecological governance modernization.

As a high-energy-consumption, high-emission sector, the chemical industry's transparent, accurate, and comprehensive environmental information disclosure not only meets regulatory and investor requirements but also underpins green transformation, climate risk management, and brand building. It is a core environmental and social responsibility, enabling social supervision through disclosing environmental management, pollutant emissions, resource utilization, and ecological protection data.

Focusing on chemical enterprises' environmental information disclosure quality, this paper aims to establish a targeted evaluation system. Taking Company W as a case study—founded in 1998, listed on the Shanghai Stock Exchange's main board in 2001, the world's largest MDI producer with core businesses in polyurethane, petrochemicals, and fine chemicals—the system is applied to assess its disclosure quality. The research seeks to raise stakeholders' attention to chemical enterprises' environmental information and promote sound disclosure mechanisms across the industry.

2. Literature review

2.1. Research on Environmental Information Disclosure

The factors influencing environmental information disclosure can be categorized into external and internal dimensions. External factors include public attention, regulatory pressure, and industry competition. Patten et al. (1992) demonstrated that major environmental incidents drive enterprises

to improve disclosure quality, while Liu Qiongzhi and Zhang Lisha (2020) confirmed that government incentive policies are more effective than institutional constraints in promoting corporate environmental responsibility. Internal factors encompass corporate scale and governance structures. Gamerschlag et al. (2011) found a positive correlation between corporate size and environmental information quality, with heavy-pollution industries and state-owned enterprises exhibiting stronger disclosure willingness (Zhu Jinfeng et al., 2008; Meng et al., 2013). Regarding disclosure consequences, environmental performance shows a nonlinear relationship with disclosure levels (Dawkins et al., 2011; Shen Hongtao et al., 2014), while high-quality disclosures can reduce capital costs, foster green innovation, and enhance performance (Zhai Yuming et al., 2022).

2.2. Research on the Quality Evaluation of Environmental Information Disclosure

In terms of evaluation systems, Wiseman (1982) classified information by its level of detail, while Clarkson et al. (2007) established the dichotomy of hard disclosure versus soft disclosure, laying the groundwork for subsequent research. Evaluation methods have evolved from early subjective survey techniques to mainstream approaches such as content analysis, Analytic Hierarchy Process (AHP), and fuzzy comprehensive evaluation, with text quantification scoring becoming the core methodology. Disclosure is categorized by disclosure drivers into mandatory and voluntary types, and by measurement attributes into monetized and non-monetized information (Al-Tuwaijri et al., 2004; Ye & Chen, 2015).

2.3. Research on Text Analysis

Text analysis is primarily applied in three key areas: Text readability is measured using Fog index and average sentence length, with significant differences observed between Chinese and English metrics (Li et al., 2008; Xu Wei et al., 2021); Text similarity is calculated using cosine similarity, categorized into horizontal (between enterprises) and vertical (within enterprises across years) dimensions (Hoberg et al., 2016; Wang Xiongyuan et al., 2018); Text tone analysis focuses on extracting emotional tendencies, which holds significant value in capital market forecasting (Zhao Cheng et al., 2020; Xu Xuochen et al., 2021).

2.4. Research on the Quality Evaluation of Environmental Information Disclosure Based on Text Analysis

Unlike conventional content analysis, text analysis focuses on linguistic attributes to identify semantic manipulation in corporate environmental disclosures and reveal underlying disclosure motives. Li Zhe (2021) employed Java web scraping technology to search, identify, and extract specific keywords from sample companies' annual reports and social responsibility reports, applying this approach to analyze corporate environmental strategies and practices. Lü Pin (2021) emphasized that corporate reports contain rich value information, suggesting that analyzing multi-dimensional features such as textual tone, emotional tendency, language style, and readability can more effectively uncover latent value in formal texts. Lü Wendai (2021) utilized Python text collection tools to extract the total word count and page count of corporate environmental information from reports, serving as quantitative indicators for environmental disclosure. Zhou Maochun and Ma Ling (2022) employed machine learning to obtain annual report tones and constructed EDI quality metrics through content analysis, finding a significant negative correlation between the positivity of annual report tones and the quality of corporate environmental disclosures.

3. Case Analysis of Environmental Information Disclosure Quality Evaluation of W Company Based on Text Analysis

3.1. Background of W Company

3.1.1 The Development History of W Company

The predecessor of W Company was established in 1978, initially focusing on the production of synthetic leather and its raw materials. After restructuring in 2001, it was listed on the Shanghai Stock Exchange. Through decades of development and growth, W Company has now become one of the most valuable and profitable listed companies in China's basic chemical industry, and the only enterprise in China with independent intellectual property rights for MDI that can achieve large-scale industrialization, breaking the long-term monopoly of international giants. Currently, W Company has evolved from a single MDI producer into a comprehensive chemical new materials company covering three major industrial clusters: polyurethane, petrochemicals, and fine chemicals as well as new materials.

3.1.2 Status of Environmental Information Disclosure by W Company

Since its IPO in 2001, W Company has integrated safety and environmental protection principles into its operations, sporadically disclosing environmental information in annual report notes. The company launched its first "Corporate Social Responsibility Report" in 2009, initiating an organized and systematic disclosure process. As a voluntary initiative in the global chemical industry, "Corporate Social Responsibility" focuses on improving HSE performance. During this phase, disclosures followed industry guidelines, emphasizing practices and commitments in the HSE domain. With growing global attention to sustainable development, the company continuously upgraded its disclosure practices. Starting in 2017, it began compiling a "Sustainability Report" in line with the widely adopted GRI standards, comprehensively disclosing economic, environmental, and social impacts to align with mainstream international benchmarks, significantly enhancing the systematic and standardized nature of its disclosures. Since the 2020s, under China's "dual carbon" strategy and capital market scrutiny, ESG concepts have become a core measure of corporate high-quality development. In 2021, W Company added an "Environmental and Social Responsibility" section to its annual report, and in 2023, it released its first ESG report, marking a new phase of more comprehensive, strategic, and investor-focused environmental disclosures.

3.2. Evaluation of Environmental Information Disclosure Quality of W Company

3.2.1 Evaluation of Environmental Information Disclosure Quality Indicators of W Company

(1) Evaluation of integrity indicators

The content completeness index measures whether the content coverage of corporate environmental information disclosure is comprehensive. Based on the environmental information disclosure documents issued by various national departments summarized in the previous section, and referring to the evaluation system construction by Ye Chenguang et al. (2015) and Wang Wanqing et al. (2021), the selected completeness indicators include four secondary indicators: environmental management information, environmental performance information, environmental financial information, and environmental responsibility information. According to the "Guidelines for Environmental Responsibility Information Disclosure of Petrochemical and Chemical Enterprises" released by the China Petroleum and Chemical Industry Federation in 2022, and considering the characteristics of the chemical industry, 24 tertiary indicators such as "chemical safety management", "hazardous waste discharge" and "biodiversity" were established. Scores were assigned to each dimension of W Company's environmental information completeness indicators based on the scoring rules, and the total scores are shown in Table 1.

Table 1. Environmental Information Integrity Score of W Company from 2020 to 2024

integrity indicator		2020	2021	2022	2023	2024	average value
Environmental Management Information	Environmental Management System	1	0	1	1	1	0.8
	The establishment of environmental protection agencies	0	0	1	1	1	0.6
	Environmental Goals	1	1	1	1	1	1
	Public welfare and environmental protection activities are being carried out.	0	0	1	0	1	0.4
	Employee Training on Environmental Protection and Education	0	0	1	0	0	0.2
	pollution discharge permit	1	1	1	1	1	1
	Implementation of the "Three Simultaneities" System	1	1	1	1	1	1
	Information on pollution prevention and control facilities	1	1	1	1	1	1
	Environmental Emergency Management Plan	1	1	1	1	1	1
	Chemical Safety Management	1	1	1	1	1	1
Environmental Responsibility Information	biodiversity	1	1	1	1	1	1
	Situations involving sudden environmental accidents	0	0	0	0	0	0
	Environmental petition cases	0	0	0	0	0	0
	Environmental violation information	0	1	1	1	1	0.8
	Status of hazardous waste emissions	2	2	2	2	2	2
Environmental performance information	Energy consumption	2	2	2	2	2	2
	Resource recycling status	2	2	2	2	2	2
	The situation of the discharge of the "three wastes"	2	2	2	2	2	2
	Cleaner production practices	0	2	2	2	2	1.6
	Carbon emissions	2	2	2	2	2	2
environmental financial information	Investment in environmental protection	1	1	1	1	1	1
	environmental subsidy or tax incentive	2	2	2	2	2	2
	revenue from environmental rights trading	0	2	2	2	2	1.6
	Disclosure of environmental liabilities	2	2	2	2	2	2
total points		23	27	31	29	30	28

The integrity index is scored on a scale of 34 points. As shown in Table 1, Company W's environmental information integrity scores ranged from 23 to 31 points between 2020 and 2024, averaging 28 points. The lowest score was 23 points in 2020, while the highest was 31 points in 2022. Subsequent years consistently maintained a high score around 30 points, indicating overall strong performance with a fluctuating upward trend. However, a distinct hierarchical differentiation pattern emerged: environmental performance and financial disclosure were highly comprehensive, environmental management information showed gradual improvement with fluctuations, while environmental responsibility information remained notably underdeveloped.

(2) Evaluation of reliability indicators

This study evaluates the reliability of W Company's environmental information through two key metrics: third-party verification and stakeholder feedback mechanisms. As shown in Table 2, all sustainability reports released by W Company over the past five years include stakeholder feedback questionnaires on their final pages, demonstrating the company's commitment to stakeholder engagement. Notably, W Company's ESG reports have undergone independent third-party audits since 2023: the 2023 report was certified by TÜV SÜD, and the 2024 report by SGS, significantly enhancing the credibility of its environmental disclosures.

Table 2. Environmental Information Reliability Score of W Company from 2020 to 2024

reliability index	2020	2021	2022	2023	2024
Whether the report has been audited by a third party	0	0	0	1	1
Is there a stakeholder feedback mechanism	1	1	1	1	1
amount to	1	1	1	2	2

(3) Evaluation of text readability metrics

Text readability refers to the ease with which users can understand environmental information. The "Measures for the Administration of the Lawful Disclosure of Corporate Environmental Information" requires that such information be concise and understandable. This characteristic affects investors' judgment and corporate value, necessitating a balance between professionalism and accessibility in disclosure (e.g., annotating technical terms, using charts), in compliance with the comprehensibility requirements outlined in the "China Corporate Social Responsibility Report Rating Standards (2019)". Drawing on the research of Wang Keming et al. (2018), this paper selects two metrics for measurement: first, average sentence length, referencing Chen Xiao (2018), by counting the total number of words and punctuation marks in the text using Python, calculated as "words/punctuation". After standardization and normalization, longer sentences indicate poorer readability; second, the density of technical terms, sourced from the Sogou Chemical Dictionary, by counting the number of technical terms per hundred words using Python. Higher density correlates with poorer readability.

Regarding text readability metrics, Company W's average sentence length exhibited a fluctuating trend—initially decreasing before stabilizing at 78.80 characters per sentence. This figure demonstrates a marked improvement over the industry average of 99.20 characters, reflecting the company's preference for concise and impactful phrasing that enhances readability. The average density of technical terms stood at 3.14 per 100 characters, significantly lower than the industry benchmark of 3.74. These findings indicate that Company W's environmental information content employs relatively few specialized terms, resulting in overall strong readability.

Table 3. Readability Score of Environmental Information Text of W Company from 2020 to 2024

Text readability metrics	2020	2021	2022	2023	2024	mean
Average sentence length	71.89	75.27	68.45	91.51	86.89	78.80
Density of technical terms	2.94	3.38	3.43	3.03	2.93	3.14

(4) Text similarity index evaluation

This study employs two indicators to measure the text similarity of environmental information disclosures by Company W: vertical similarity (comparison with the company's own texts in different years) and horizontal similarity (comparison with texts from the same industry). Specifically, the calculation of horizontal text similarity refers to the method proposed by Qian Aimin and Zhu Dapeng (2020): first, environmental information texts of the chemical industry obtained earlier are segmented using jieba and converted into TF-IDF vectors by year; second, the average of standardized vectors of other peer companies (excluding the target company) is calculated; finally, the cosine distance

between the target company’s vector and the industry average vector—i.e., cosine similarity—is adopted as the horizontal similarity indicator. Similarly, for vertical text similarity, the environmental information texts of the target company in each year are segmented and vectorized, and the cosine similarity between texts from different years is computed as the vertical similarity indicator. In terms of specific value assignment, considering practical circumstances, the annual vertical similarity value is taken as the maximum cosine similarity with all previous years' texts, and the resulting scores are presented in Table 4; additionally, since 2020 is the first year of the study period, its vertical similarity value is imputed with the average of the values from the subsequent four years.

Table 4. Similarity scores of environmental information texts of W Company from 2020 to 2024

Text similarity	2020	2021	2022	2023	2024	mean
Vertical text similarity	0.7201	0.6557	0.6543	0.7156	0.8549	0.7201
Horizontal text similarity	0.6392	0.5750	0.7787	0.7512	0.7669	0.7022

(5) Evaluation of text objectivity indicators

Textual objectivity in corporate environmental disclosures refers to the degree of impartial reflection on an organization's environmental performance. This principle requires environmental disclosures to present both positive and negative information without deliberate avoidance of unfavorable content, and must not employ subjective adjustments to wording or tone for impression management purposes. Drawing on the measurement framework proposed by Lin Le and Xie Deren (2017), this study establishes a quantification method for textual objectivity in environmental disclosures by listed chemical companies, as detailed in Table 5. The methodology utilizes the CNKI Sentiment Dictionary to identify emotional attributes of words through Python programming. After counting word frequency, the proportion of positive emotional words (pos) and negative emotional words (neg) is calculated relative to the total word count. A lower calculated index value indicates higher textual objectivity and quality in environmental disclosures, while a higher value suggests poorer objectivity and lower quality.

The textual objectivity metrics of W Company's environmental disclosures exhibited a fluctuating trend over the past five years, showing initial growth followed by a decline. Notably, the metrics reached exceptionally high levels in 2022 and 2023, likely due to the company's strategic shift from sustainability reports to ESG reports as its primary disclosure medium. Initially, driven by impression management considerations, the company may have adopted a more assertive communication approach during the early stages of adopting this new reporting format. However, this trend significantly improved in 2024, with the textual objectivity metrics achieving their highest level in five years.

Table 5. Objective score of environmental information text of W Company from 2020 to 2024

	2020	2021	2022	2023	2024
Proportion of positive vocabulary	89.90%	89.00%	93.30%	91.20%	87.30%
Proportion of negative words	12.10%	11.00%	6.70%	8.80%	12.70%
Objective indicators of text	0.78	0.78	0.87	0.82	0.75

3.2.2 Comprehensive Evaluation of Environmental Information Disclosure Quality by Company W

This study employs the entropy method to compare with subjective weighting approaches like expert scoring and Analytic Hierarchy Process (AHP). The entropy method's weighting logic is fundamentally rooted in the inherent patterns of the data itself, effectively avoiding biases caused by human assumptions and ensuring that weight distribution aligns more closely with the actual information distribution characteristics of the evaluation object. This data-driven weighting approach not only enhances the objectivity of weight determination but also improves the credibility and

persuasiveness of subsequent comprehensive evaluation results, providing more reliable support for the construction of evaluation systems.

The calculation process of entropy method includes the following four parts:

(1) Data standardization processing

Since the dimensions, units, magnitudes, or properties (positive or negative) of different indicators vary, direct comparison is meaningless. Therefore, the original data must first be standardized to map all data into a unified comparable range. For positive indicators where higher values indicate higher evaluations, the calculation formula is as shown in Equation (1):

$$Y_{ij} = \frac{X_{ij} - \min(X_{ij})}{\max(X_{ij}) - \min(X_{ij})} \quad (1)$$

For negative indicators where higher numerical values indicate lower evaluations, the calculation formula is given in Equation (2):

$$Y_{ij} = \frac{\max(X_{ij}) - X_{ij}}{\max(X_{ij}) - \min(X_{ij})} \quad (2)$$

X_{ij} $\max(X_{ij})$ $\min(X_{ij})$ Y_{ij} Indicates the original data. If the value is the maximum in the metric, it represents the minimum, which is the result after standardization.

(2) Calculation of Information Entropy

The information entropy value serves as a metric to assess the dispersion level of evaluation indicators, which helps determine their relative weight in the comprehensive evaluation results. Indicators with higher dispersion levels demonstrate stronger ability to differentiate characteristics among evaluation subjects, consequently exerting more significant influence on the evaluation outcomes. Conversely, indicators with lower dispersion levels contribute less to differentiation and consequently have a weaker impact. The specific calculation formula is as follows:

$$P_{ij} = \frac{Y_{ij}}{\sum_i^n Y_{ij}} \quad (3)$$

$$E_i = -\ln n^{-1} \sum_{i=1}^n (P_{ij} \ln P_{ij}) \quad (4)$$

In the above formula P_{ij} E_i , represents the specific gravity, and represents the information entropy value.

(3) Calculation of the index weight

The weights of each indicator can be calculated based on the information entropy value obtained from the previous step. The calculation formula is given in Equation (5):

$$W_i = \frac{1 - E_i}{k - \sum_{i=1}^k E_i} \quad (5)$$

In Equation (5), k is a constant W_i and represents the weight value.

(4) Calculate the comprehensive score

After the weights of each index are determined, the product $W_i Y_{ij} S_j$ of each index weight and the standardized result of each index is calculated, and then the sum is obtained to get the final score. The calculation formula is shown in Equation (6):

$$S_j = \sum_{i=1}^n Y_{ij} W_i \quad (6)$$

To comprehensively evaluate the environmental information disclosure quality of Company W, the comprehensive score is calculated using the entropy method based on the evaluation results of the five aforementioned indicators. Since the scoring ranges of these indicators vary, direct summation is not feasible. To eliminate dimensionality issues, the evaluation results of these five indicators are first standardized to ensure all values fall within the [0,1] range. The processed results are presented in Table 6 (results rounded to two decimal places).

Table 6. Standardization Results of W Company's Indicators

	2020	2021	2022	2023	2024
Content integrity	0.00	0.50	1.00	0.75	0.88
information reliability	0.00	0.00	0.00	1.00	1.00
Text readability	0.87	0.70	1.00	0.00	0.21
Text similarity	0.67	1.00	0.48	0.40	0.00
Objectivity of the text	0.75	0.75	0.00	0.42	1.00

Table 7 presents the calculated entropy values and weights for the five evaluation indicators of Company W. By multiplying each indicator's weight by its standardized score and summing them up, the comprehensive evaluation score for Company W's environmental information disclosure quality from 2020 to 2024 is obtained, as shown in Table 8.

Table 7. Weight of Environmental Information Disclosure Indicators of W Company

	<i>Entropy e</i>	<i>weight w</i>
Content integrity	0.806592	20.14%
information reliability	0.770412	23.90%
Text readability	0.837320	16.94%
Text similarity	0.827889	17.92%
Objectivity of the text	0.797269	21.11%

Table 8. Overall Quality Score of Environmental Information Disclosure of W Company from 2020 to 2024

a particular year	2020	2021	2022	2023	2024
The chemical industry is evenly distributed.	0.2850	0.5040	0.4663	0.5390	0.6234
Overall score	0.4260	0.5571	0.4574	0.5498	0.6617

The comprehensive evaluation reveals that Company W's environmental information disclosure quality exhibited a fluctuating upward trend from 2020 to 2024, reaching its highest score in five years in 2024. Except for a temporary decline in 2022, annual scores consistently showed improvement. While the company's overall environmental disclosure scores rose steadily from 2020 to 2021, a brief dip occurred in 2022, primarily due to its lowest scores in reliability and textual objectivity metrics over the previous five years. However, the 2023 report implemented comprehensive adjustments, significantly enhancing reliability and improving textual objectivity. By 2024, textual objectivity achieved its best score in five years, and the overall environmental disclosure quality reached its highest level in five years.

4. Analysis and Suggestions on the Quality Evaluation of Environmental Information Disclosure of W Company

4.1. Analysis of the Evaluation Results of Environmental Information Disclosure Quality of W Company

(1) The incremental information is quite rich.

The company has demonstrated exceptional text similarity performance over the past five years, with both vertical (its own multi-year) and horizontal (within the same industry) similarity levels remaining low, while showing significant growth in disclosed information. Its disclosures not only

cover conventional industry topics like waste treatment and energy consumption, but also include distinctive content such as full life cycle carbon management and green supply chain development. Rather than merely repeating past frameworks, the company continuously supplements its disclosures with new practices and data, including environmental technology upgrades and expanded carbon footprint accounting for products, thereby establishing a distinct advantage in information increment.

(2) The disclosure is relatively reliable.

The company has demonstrated rapid reliability improvements over the past five years. Before 2023, its monitoring relied primarily on internal data without external verification. The introduction of third-party independent audits in 2023 marked a pivotal shift, expanding the audit scope from traditional pollutant emissions to the full lifecycle carbon footprint of products. All collaborating institutions hold ISO 14064 certification, significantly enhancing the authority and credibility of the information.

(3) The objectivity of the text needs to be improved.

Over the past five years, W Company has twice underperformed the industry average in textual objectivity metrics, with disclosures predominantly leaning toward positive narratives. While the report emphasizes environmental technology applications and focuses on positive aspects like technological innovation and industrial upgrading, it only briefly addresses critical issues such as climate-related risk quantification and full-chain emission reduction challenges. Negative disclosures regarding environmental penalties and pollutant exceedances remain insufficient, indicating room for improvement in textual objectivity.

(4) Carbon information disclosure is incomplete.

The company's carbon disclosure system exhibits notable deficiencies, with no tracking or reporting of Scope 3 value chain indirect emissions. Scope 3 encompasses multiple stages including raw material procurement, transportation, product distribution, and waste disposal. For global chemical giants with complex supply chains, these emissions account for a substantial portion of their total carbon footprint. This data gap not only hinders stakeholders' comprehensive evaluation of carbon reduction performance but may also compromise the precision and foresight of corporate low-carbon transition strategies.

4.2. Suggestions for Improving the Quality of Environmental Information Disclosure by W Company

(1) To address carbon disclosure gaps, Company W must optimize its carbon management framework. This requires establishing a board-led mechanism with cross-departmental implementation and third-party oversight, incorporating carbon intensity into core performance metrics. The company should implement phased Scope 3 data management by identifying critical lifecycle stages, standardizing supplier disclosures, leveraging blockchain for data sharing with third-party verification, and building a full-chain disclosure system to enhance environmental information integrity.

(2) To enhance the objectivity of environmental disclosures, substantive negative information disclosure should be strengthened by establishing a classification framework that mandates disclosure of environmental violations, unmet emission reduction targets, and supply chain environmental risks, eliminating ambiguous language. Simultaneously, a dynamic feedback loop should be implemented to collect stakeholder concerns through investor briefings and other channels, with regular updates on rectification progress. This approach links disclosure requirements to performance improvements, thereby steadily enhancing the objectivity of environmental information.

5. Research Conclusions

The five-dimensional evaluation framework developed in this study integrates text analysis techniques with entropy methodology. While maintaining traditional evaluation criteria for content completeness, it enhances scientific rigor and objectivity by exploring deeper textual characteristics

through dimensions such as readability and similarity. Case analysis demonstrates that Company W's environmental information disclosure quality generally surpasses industry standards, with notable improvements in incremental information and reliability. However, challenges persist in carbon disclosure and textual objectivity. This research provides a fresh perspective for evaluating environmental information disclosure quality in the chemical industry and offers actionable insights for corporate disclosure optimization. Future studies could expand the sample scope and refine the indicator system's industry adaptability.

References

- [1] Atieh P, Rajabi R. Can reviews predict reviewers' numerical ratings? The underlying mechanisms of customers' decisions to rate products using Latent Dirichlet Allocation (LDA)[J]. *Journal of Consumer Marketing*, 2022, 39(2): 11-26.
- [2] Bonsall S B, Leone A. J., Miller B.P.,. Aplain English measure offinancial reporting readability[J]. *Journal of Accounting and Economics*, 2017, 63(2-3): 329-357.
- [3] Braam G J, De Weerd L U, Hauck M, et al. Determinants of corporate environmental reporting: Theimportance of environmental performance and assurance[J]. *Journal of Cleaner Production*, 2016, 129: 724-734.
- [4] Brown S V, Tucker J W. Large-Sample Evidence on Firms* Year-over-year MD&A Modifications[J]. *Journal of Accounting and Research*, 2011, 49(2): 309-346.
- [5] Broadstock D C, Collins A, et al. Voluntary disclosure, greenhouse gas emissions andbusiness performance: Assessing the first decade of reporting[J]. *The British AccountingReview*, 2018,50(1): 48-59.
- [6] Chung H, Judge W Q, Li Y H. Voluntary disclosure, excess executive compensation, and firm value[J]. *Journal of Corporate Finance*, 2015, 32: 64-90.
- [7] Clarkson P M,Li Y,Richardson G D. Doesit Really Pay to be Green? Determinants and Consequences of Proactive Environmental Strategies[J]. *Journal of Accountingand Public Policy*,2011,30(2):122-144
- [8] Elsayed M O, Hoque Z. Perceived interational environmental factors and corporate voluntarydisclosure practices: An empirical study[J]. *The British Accounting Review*, 2010, 42(1): 17-35.
- [9] Ertugrul M, Lei J, Qiu J, et al. Annual Report Readability, Tone Ambiguity, and the Cost of Borrowing[J]. *Journal of Financial and Quantitative Analysis*, 2017, 52(2):811-836.
- [10] Gao Y, Wang Y, Zhang M. Who really cares about the environment? CEOs' military service experience and firms' investment in environmental protection[J]. *Business Ethics, the Environment and Responsibility*, 2021, 30(1): 4-18.
- [11] Hanley K W, Hoberg G. The Information Content of IPO Prospectuses[J]. *The Review of Financial Studies*, 2010,23(7): 2821-2864.
- [12] Huang X, Teoh S H, Zhang Y. Tone Management[J]. *The Accounting Review*, 2014, 89(3): 1083-1113
- [13] Kim C, Wang K, Zhang L. Readability of 10-K. Reports and Stock Price Crash Risk[J]. *Contemporary Accounting Research*, 2019, 36(2): 1184-1216.
- [14] Lawrence A. Individual Investors and Financial Disclosure[J]. *Journal of Accounting and Economics*, 2013(56): 130-147.
- [15] Loughran T, McDonald B. Measuring Readability in Financial Disclosures[J]. *Journal of Finance*, 2014, 69(4): 1643-1671.
- [16] Malarvizhi P, Matta R, "Link between Corporate Environmental Disclosure and Firm Performance"— Perception or Reality? [J]. *The British Accounting Review*, 2016, 36(1): 107-117.
- [17] Meng J, Zhang Z. Corporate environmental information disclosure and investor response: Evidencefom China's capital market[J]. *Energy Economics*, 2022, 108:105886.
- [18] Patten D M. Intra-industry environmental disclosures in response to the Alaskan oil spill: A note onlegitimacy theory[J]. *Accounting, Organizations and Society*,1992, 17(5): 471-475.
- [19] Qian W, Chen X. Corporate environmental disclosure and political connection in regulatory andleadership changes: The case of China[J]. *The British Accounting Review*, 2021, 53(1): 100935

- [20] Zou H, Xie X, Qi G, et al. The heterogeneous relationship between board social ties and corporate environmental responsibility in an emerging economy[J]. *Business Strategy and the Environment*, 2019, 28(1): 40-52.
- [21] Ramya R S, Ganesh S, Sejal S N, Venugopal K R, Iyengar S S and L.M. Patnaik. R2DCLT: retrieving relevant documents using cosine similarity and LDA in text mining[J]. *International Journal of Information and Communication Technology*, 2021, 19(4): 36-54.