



A Study on the Assessment and Status Quo of Environmental Information Disclosure in China's Automotive Industry

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Abstract. The environmental information disclosure system has now been an effective instrument for the international community in environmental governance, and means a lot to businesses in terms of green transition and ESG and sustainability. This paper takes a hard look at the management status and performance of international governance policies and analyzes the existing problems in combination with China's case. In addition, it establishes an assessment system for corporate environmental information disclosure through the concept of ecological design from a life cycle perspective, provides an analysis of the status quo and shortcomings of Chinese automotive OEMs and parts enterprises in environmental information disclosure, and proposes a path to improve the quality of disclosure based on multi-agent participation.

Keywords: automobile · information disclosure · life cycle

1 Introduction

Environmental Information Disclosure (EID) is one of the meaningful reflections of the shift from traditional government-mandated, top-down administration to open and transparent multi-agent social governance [6]. Governance, which emphasizes the diversity of participants, is the sum of the many ways in which individuals and institutions manage their common affairs, and is to establish cooperation, consultation, and partnership through coordination of all parties and to implement the management of public affairs with a common goal. In the context of social governance changes and increasing environmental awareness among communities [9], EID has become the third wave of environmental monitoring, following command-and-control and market-based incentives [7].

The Aarhus Convention, which entered into force in 2001, was a landmark in the establishment and development of EID internationally. The purpose of its treaty is to institutionalize the measures for public access to environmental information, public participation in the administrative decision-making process and judicature and others,

in order to address environmental pollution and disruption and protect human rights to environmental health. In the more than 20 years since the treaty came into force, over 60 countries and regions around the world have established corresponding EID systems, which have borne fruit in ecological protection. At present, the EID systems are mainly classified into two. The first is the Pollutant Release and Transfer Register (PRTR) procedure, which requires businesses to report pollutant releases, and the second is the Performance Evaluation and Ratings procedure (PERP), which discloses the quality and content of corporate disclosures based on the information disclosed by the enterprise [3].

Since the 1990s, developed countries have been valuing the disclosure of environmental information by enterprises. In 1990, the European Community adopted the Council Directive on the Freedom of Access to Information on Environment 90/313/EC, clarifying, for the first time, the public's right to access environmental information and the government's responsibility and requiring member states to take the initiative to provide environmental information to the public, followed by the EU's Non-Financial Reporting Directive (NFRD) in 2014, which is currently the most widely used act on environmental information disclosure, with all member states that have completed the establishment of relevant regulations at the national level. The United States was one of the first countries requiring listed companies to disclose environmental-related data. For example, Regulation S-K adopted in as early as 1977 required companies to disclose costs and results related to environmental compliance. In 2010, with an increasing demand for listed companies to disclose information related to climate change, the Securities and Exchange Commission (SEC) issued guidance on climate change disclosure, mandating companies to include climate change related impacts in their disclosures. Canada, the United Kingdom and Australia issued their air pollutant emission inventories in 1993 and 1998, respectively, while Japan began to implement its PRTR system in 2000. Other than direct reporting as a management tool, the PERP is also widely used across many countries. For instance, China has implemented its environmental credit evaluation and ratings since 2013, which evaluates companies in terms of pollution control, ecological protection, environmental supervision and others with four color codes: green, blue, yellow, and red. In Indonesia, the Program for Pollution Control Evaluation and Rating (PROPER) scheme, launched in 1995, targets major industrial water polluters and uses a five-color scale to grade the environmental performance of different facilities [2].

Environmental information disclosure (EID) in China dates back to 2003. Since the State Environmental Protection Administration (now the Ministry of Ecology and Environment) issued the Announcement on Corporate Environmental Information Disclosure, China has improved its EID management system every year and placed stricter disclosure requirements on listed companies and enterprises in key industries (nonferrous metals, petrochemicals, power generation, etc.). In 2021, the competent authorities issued a package of reform programmes and management measures on EID matters one after another, proposing to basically complete a compulsory information disclosure system by 2025 when EID will be in full swing in China [10].

The automotive industry is an important industrial sector in China and a pillar industry of the national economy, with generally large individual enterprises at scale which can connect both a wide range of enterprises in the upstream of the supply chain and

social consumers in the downstream [11]. The management of the automotive industry can expand to everything from steel, power generation, petrochemicals, logistics and transportation, parts manufacturing to market consumption, and acts as an important task in time of policy management. At the same time, in the context of the introduction of “30/60 goals” or “dual carbon goals” in China and the global response to climate change, green & low-carbon transition and electrified product transition have been a must for auto companies, and environmental concerns have received further attention. Additionally, auto companies face a highly transparent market and are subject to social and public supervision. Higher levels of social attention, in turn, will propel them to disclose information [5].

2 Data Acquisition and Assessment Methods

2.1 Coverage of Sample and Data Acquisition

In the study, the sample of OEMs was selected from 48 enterprises including those that sold more than 10,000 vehicles in 2020 and others that have received widespread attention in the Chinese mainland, while that of auto parts enterprises from 108 enterprises including those among the top 100 Chinese auto parts enterprises in 2020 and other power battery manufacturers that have aroused general concern. The essential data of the study was derived from the information on the environmental protection and green development of enterprises through public channels (official websites of enterprises, websites of regulators), as well as non-financial information of companies through Wind Data Service.

2.2 Assessment System

This study is based on the idea of product eco-design from a life cycle perspective, with reference to the Carbon Disclosure Project (CDP), the Task Force on Climate-related Financial Disclosures (TCFD), other international frameworks and the concept of corporate environmental performance (CEP) [8], covering 11 domains, namely, general information, development strategy, management policy, development and application of new concept technologies, life cycle design optimization, mitigation of material-related environmental impact, material consumption reduction, production process optimization, distribution system optimization, service process optimization, and recycling optimization. We used all these 11 domains as primary indices for the establishment of an assessment system [1].

The assessment of environmental information disclosure in the automotive industry was divided into three levels of index. Depending on different information involved, each index was subdivided into three categories – qualitative disclosure, quantitative disclosure and improvement disclosure – all of which were assigned a different weight. The three categories were assigned 0.5, 1 and 1.5 points respectively in the absence of special circumstances (Tables 1 and 2).

Table 1. Environmental information disclosure in the automotive industry.

Focus	Description
General corporate information	The fundamental condition of the enterprise from several dimensions such as main products, business scope, and scale
Development strategy	Focus on strategic industry chain management, carbon neutrality and other aspects
Management policy	Achievements and performance in occupational health and safety management, environmental management, energy management and other systems as well as green supply chain management
Application of new concept technologies	New ideas and requirement implementation approaches for developing product system functions that cater to social needs
Optimization of life cycle design	Carbon emission management throughout the product life cycle
Mitigation of material-related environmental impact	Give priority to low-carbon, green, eco-friendly, non-toxic and non-hazardous or low-toxic and low-harm materials in the selection of raw materials for products
Material consumption reduction	Minimize the amount of materials used, including reduced weight and volume in the development and design of products
Production processes optimization	Reduce energy resource input and pollutant emissions through measures such as optimizing production technology, introducing energy-efficient equipment, and strengthening production management
Distribution system optimization	Optimize the distribution system in terms of logistics management, product packaging materials and methods, sales and transportation methods, storage layout, etc., and deliver products to factories, distributors and users in the most effective mode of transportation
Service process optimization	Advantages of products produced by the enterprise in the industry can reduce or minimize the impact on the environment and users during the service process of products under the condition that user needs are met
Recycling optimization	Properly deal with or dispose of products at the end of their initial life cycle and reuse valuable parts and materials to ensure the correct disposal of wastes and the reduction of the impact of product parts or materials on the environment

Table 2. Scoring framework for environmental information disclosure in the automotive industry

Primary Index (Focus)	Secondary Index	Qualitative	Quantitative	Improvement	OEM	Auto Parts Enterprise
General corporate information	General product information	1	–	–	✓	✓
	Business scope	0.5	–	–	✓	✓
	Enterprise scale	–	3	–	✓	✓
Development strategy	Strategic industry chain management	3	–	–	✓	✓
	Carbon neutrality	1.5	–	–	✓	✓
Management policy	Occupational health and safety management system	1	–	–	✓	✓
	Environmental management system	1	–	–	✓	✓
	Energy management system	1	–	–	✓	✓
	Green supply chain management	2.5	1	1.5	✓	✓
Development and application of new concept technologies	Development and application of new concept technologies	1	–	–	✓	✓
Optimization of life cycle design	Product life cycle carbon emission	1	1	–	✓	✓
Mitigation of material-related environmental impact	VOC controls for materials	0.5	1	–	✓	✓
	Control of hazardous substances of materials	0.5	2	–	✓	✓
	Use of recycled materials	0.5	–	–	✓	✓
	Use of biodegradable materials	0.5	–	–	✓	✓

(continued)

Table 2. (continued)

Primary Index (Focus)	Secondary Index	Qualitative	Quantitative	Improvement	OEM	Auto Parts Enterprise
Material consumption reduction	Vehicle lightweight	1	2	–	✓	✓
Production processes optimization	Energy consumption	3	2	–	✓	✓
	Energy intensity	–	2	1.5	✓	✓
	Water consumption	0.5	1	–	✓	✓
	Water intensity	–	1	1.5	✓	✓
	Wastewater emission	0.5	4	1.5	✓	✓
	Enterprise greenhouse gas emissions	0.5	1	–	✓	✓
	Exhaust emissions	1.5	1	–	✓	✓
	Emissions from solid waste	0.5	3	1.5	✓	✓
	Boundary noise levels of factory premises	1	–	–	✓	✓
	Green factory	0.5	1	1.5	✓	✓
Distribution system optimization	Green packaging	1.5	–	–	✓	✓
	Green transportation	1	1	1	✓	✓
	Green storage	0.5	1	–	✓	✓
	Distributor management	0.5	1	1.5	✓	
Service process optimization	Energy consumption of the product mix	0.5	2	1.5	✓	
	In-vehicle VOC	0.5	1	–	✓	
	Vehicle noise	0.5	2	–	✓	
	Exhaust emissions	0.5	1	–	✓	
	Eco friendly products	1	–	1.5	✓	
Recycling optimization	Power battery traceability	0.5	4	4	✓	
	Dismantling information disclosure	0.5	–	–	✓	

(continued)

Table 2. (continued)

Primary Index (Focus)	Secondary Index	Qualitative	Quantitative	Improvement	OEM	Auto Parts Enterprise
	Reusability / recyclability	0.5	1	1.5	✓	✓
	Use of remanufactured parts	0.5	2	–	✓	

Accordingly, the accounting method of EID of each enterprise can be expressed as below:

$$EID\ Index = \frac{N_1 + N_2 + N_3}{M} \times 100 \quad (1)$$

where:

$EID\ Index$ is an enterprise's environmental information disclosure score;

N_1 is the score of the assessment items that meet the requirements of qualitative determination;

N_2 is the score of the assessment items that meet the requirements of quantitative determination;

N_3 is the score of the assessment items that meet the requirements of improvement determination;

M is the full score in the scoring framework.

After the scores of each enterprise are calculated, the overall score of the industry can be obtained according to the following formula.

$$EID\ Index_{Industry} = \frac{\sum S_V \times EID\ Index}{S_t} \quad (2)$$

where:

$EID\ Index_{Industry}$ is the overall score of the industry;

S_V is the product sales of an enterprise in the year;

S_t is the gross sales of all enterprises in the year.

3 Evaluation Results of Automotive Oems

3.1 Overall Industry Level

The EID Index score for automotive OEMs in 2021 comes at 35.02/100. Overall, the level of information disclosure of Chinese automotive OEMs needs to be further improved, and there is a marked degree of polarization, as underscored by 7 of the 48 enterprises under evaluation with higher scores and 40 with lower scores. Among them, the gross sales of the top 10 enterprises accounts for 26.8% of the total of all accounting enterprises, and that of the top 20 for 68.5%. There is a positive correlation between the sales scale and the EID score (Table 3).

Table 3. Distribution of the scores of automotive OEMs

Score Range	Number of Enterprises
≥80 points	7
70–80 points	0
60–70 points	0
50–60 points	1
40–50 points	0
≤40 points	40

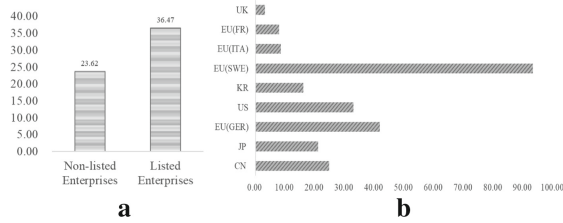


Fig. 1. Scores of different categories of automotive OEMs (a. listing classification; b. attribution classification)

3.2 Classification Level

According to the level of regulation they are subject to, OEMs can be categorized on their listing status and the location of their parent company. In China, listed companies are subject to more stringent information disclosure and sustainability regulation than non-listed companies, while the foreign party of a joint venture brand will also be regulated by the location of its parent company (e.g., Europe, the U.S.). Different regulation will directly affect corporate information disclosure.

As both the China Securities Regulatory Commission (CSRC) and the Hong Kong Stock Exchange have clearly defined corporate environmental information disclosure, the average EID Index score of listed car manufacturers within the scope of accounting has improved by 56% compared to non-listed companies (Fig. 1).

Analyzed from the perspective of auto brand classification, the 48 companies calculated in 2021 include 23 from China, 10 from Japan, 5 from German (in the Europe lineage), 4 from the US, 2 from Korea, and 1 from Sweden, Italy, France, and the UK (in the European lineage) each. The corporate information disclosure of each classification varies significantly, with European (Germany), American and Chinese brand enterprises in a better situation. The German and American auto industries have an early start and are more sophisticated in the development of information disclosure management. The Chinese auto brand enterprises are in large amounts, but most of them are still in the initial stage of corporate information disclosure. There is an urgent need to improve the information disclosure mechanism in China and narrow the gap between them and the German and American auto brand enterprises (Table 4).

Table 4. Distribution of the classification of automotive OEMs calculated

Classification	Quantity
Chinese brands	23
Japanese brands	10
EU brands (Germany)	5
American brands	4
Korean brands	2
EU brands (Sweden)	2
EU brands (Italy)	1
EU brands (France)	1
EU brands (UK)	1

3.3 Level of Each Disclosure Item

As for the index dimension, the scoring average of qualitative environmental information is higher, while the level of the disclosure of quantitative and improvement indices is lower. The companies involved have better disclosure of non-sensitive and green information (e.g. general corporate information including product information, business scope, and management policy, as well as regulatory information including exhaust emissions, green factory, boundary noise level of factory premises, and water consumption), but it is difficult for them to obtain high-value information on discretionary environmental protection behaviors, including product environmental indices such as product life cycle carbon emissions, and parts remanufacturing, as well as product logistics indices such as packaging, storage, and transportation.

The reason for the high disclosure of manufacturing indices is that the ecological and environmental authorities have released relevant requirements. Moreover, with the release of the *Plan for the Reform of the Legal Disclosure System of Environmental Information*, an increasing number of companies recognize the importance of disclosing environmental information and have started to consciously disclose information on environmental management, pollutant generation, management, and emission [4] (Fig. 2).

4 Evaluation Results of Auto Parts Enterprises

4.1 Overall Industry Level

Based on the disclosed information in 2020, the EID Index of the 108 auto parts enterprises in the accounting list is 18.50. Among them, the gross sales of the top 10 enterprises in terms of EID Index score accounts for about 27.0% of that of all accounting enterprises, and that of the top 20 enterprises for about 43.6%. However, when comparing the auto parts sales list with the EID Index score list, only seven companies are ranked in the top 20 of the two lists at the same time.

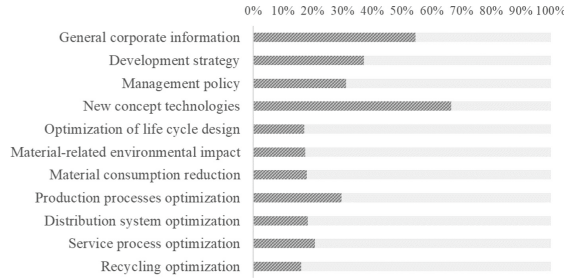


Fig. 2. Scoring average of the primary indices of automotive OEMs

Table 5. Distribution of the scores of auto parts companies

Score Range	Number of Enterprises
≥80 points	0
70–80 points	0
60–70 points	2
50–60 points	3
40–50 points	4
≤40 points	99

The accounting of auto parts enterprises is more complicated than that of automotive OEMs, with the overall situation inferior to that of the latter, mainly for two reasons: (1) some auto parts enterprises operate business in different industries such as finance, real estate, and healthcare. The accounting only for the auto parts business leads to the discrepancy between the accounting volume and the real volume of enterprises. (2) As they are in the upstream and midstream of the industry chain, auto parts enterprises draw less social attention than OEMs, resulting to the difficulty to obviously reflect the role of social supervision. Included in the voluntary disclosure required by the state at this stage, social supervision is in a ramp-up phase from low to high. In this context, the disclosure of relevant information depends more on the subjective wishes of managers (Table 5).

4.2 Classification Level

According to the main categories of production activities and products, the 108 auto parts enterprises can be divided into six categories: powertrain production, integrated production, renewable energy product production, tire production, electronic product production, and others. Among them, the tire and renewable energy-related enterprises have higher scores due to the combined influence of regulatory concerns and industry development trends (Table 6 and Fig. 3).

The EID Index of listed auto parts enterprises is 24.3, while the average score of non-listed enterprises is 9.3. As the regulatory authorities and stock exchanges gradually

Table 6. Distribution of the accounting categories of auto parts enterprises

Classification	Quantity
Powertrain production	12
Integrated production	34
Renewable energy product production	11
Tire production	9
Electronic product production	11
Others	29

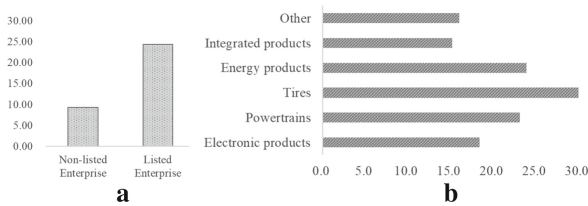


Fig. 3. Scores of different categories of auto parts enterprises (a. listing classification; b. segment classification)

strengthen the requirements for EID, the transparency of EID of listed enterprises is generally higher than that of non-listed enterprises. In the ranking of auto parts enterprises, the top 25 are all listed enterprises, and 44 of the top 50 are listed enterprises. Among the top 10 listed companies, 8 disclose environmental information by releasing ESG reports or CSR reports, and 13 of the top 25 do that. Overall, in most reports, the information on ubiquitous environment of enterprises is not what corporate disclosure focuses on, and the relevant information still needs to be improved in terms of disclosure scope, content quality, quantitative data and other levels.

4.3 Level of Index Items

The level of information disclosure of auto parts enterprises can fall into three echelons:

The first echelon includes the index items with a scoring rate of higher than 40%, which mainly focus on general corporate information and R&D information, covering product information, business scope, enterprise scale, strategic industry chain management, environmental and occupational health management, and new technology development and application.

The second echelon refers to the index items with a scoring rate of 10% to 40%, which mainly focus on the information of corporate environment pollution, including carbon neutrality initiatives, energy consumption, energy intensity, wastewater emissions, exhaust emissions, emissions from solid waste, boundary noise level of factory premises, green factory and other disclosure items. Since some accounting enterprises

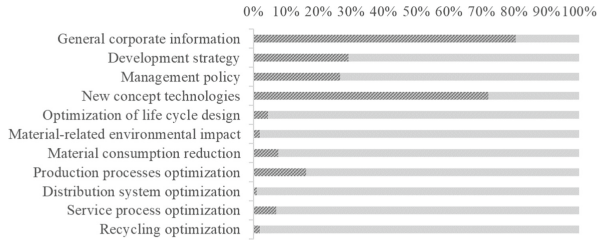


Fig. 4. Scoring average of the primary indices of auto parts enterprises

belong to key pollutant discharge organizations, which are obliged to disclose environmental pollution discharge information compulsorily, and the management policy has been improved after years of development, the score in this part is higher than other information items.

The third echelon consists of the index items with a scoring rate of lower than 10%, in which the disclosures see a certain gap with the ideal value, including eco friendly products, green supply chain management, green distribution system, use of recycled materials, lightweight, and product recycling. With the gradual enhancement of regulation and increases in social attention, the disclosure level is well on track to a ramp-up period with high room for improvement (Fig. 4).

5 Conclusions

The management of Environmental Information Disclosure (EID) in China is in a period of rapid transition, with constantly introduced and increasingly stringent relevant management requirements. The Ministry of Ecology and Environment has issued the Measures on the Management of Mandatory Corporate Environmental Information Disclosure, which clearly requires that corporate environmental information disclosure will be subject to mandatory supervision and regulation. It is expected that the overall level of disclosure in the automotive industry will have a rapid rise. It is important to note that, however, the mandatory regulatory requirements currently only cover environmental information with mandatory requirements, such as information on corporate stationary source emissions and regulatory compliance, which can not objectively and comprehensively reflect corporate ecological environmental protection due to limited coverage. In this case, we expect that there will be several aspects of the management of EID in China’s automotive industry necessary to be improved as follows:

- (1) Policy should be provided to guide life cycle information disclosure. To put into play the catalytic role of EID in the industry and its positive role in environmental protection, corporate behavior should not be restricted to the production process itself, but consider the environmental behavior in the whole process of procurement, service and recycling to extend producer responsibility.

- (2) Enterprises should deploy the life cycle work and implement the concept of extended producer responsibility. According to the analysis of existing data, the public information of environmental activities outside factory premises is relatively limited, which is contrary to the current international trend.
- (3) Enterprises should carry out platform construction and data acquisition. For the paper, we took a lot of time to acquire fundamental data. The fact that China currently lacks an effective and unified EID platform is not conducive to downstream enterprises, consumers, investors and other stakeholders to enhance the transparency and regulation of environmental information.

References

1. Beretta, V. Demartini, M. Lico, L. et al. (2021) A tone analysis of the non-financial disclosure in the automotive industry. *Sustainability (Switzerland)*. 13(4), 1-16.
2. García, J. Sterner, T. & Afsah, S. (2007) Public disclosure of industrial pollution: The PROPER approach for Indonesia?. *Environment and Development Economics*. 12(6), 739-756.
3. Li, Y. Zhang, X. Yao, T. et al. (2021) The developing trends and driving factors of environmental information disclosure in China. *Journal of Environmental Management*. 288.
4. Meng, X. Zeng, S. & Tam, C. (2013) From Voluntarism to Regulation: A Study on Ownership, Economic Performance and Corporate Environmental Information Disclosure in China. *Journal of Business Ethics*. 116, 217–232. A tone analysis of the non-financial disclosure in the automotive industry
5. Russo-Spena, T. Tregua, M. & De Chiara, A. (2018) Trends and Drivers in CSR Disclosure: A Focus on Reporting Practices in the Automotive Industry. *Journal of Business Ethics*. 151(2), 563-578.
6. Tan, Y. (2014) Transparency without Democracy: The Unexpected Effects of China's Environmental Disclosure Policy. *Governance*. 27, 37-62.
7. Tietenberg, T. (1998) Disclosure Strategies for Pollution Control. *Environmental and Resource Economics*. 11(3–4), 587–602.
8. Trumpp, C. Endrikat, J. Zopf, C. et al. (2015) Definition, Conceptualization, and Measurement of Corporate Environmental Performance: A Critical Examination of a Multidimensional Construct. *Journal of Business Ethics*. 126(2), 185-204.
9. Yin, H. Li, M. Ma, Y. et al. (2019) The relationship between environmental information disclosure and profitability: A comparison between different disclosure styles. *International Journal of Environmental Research and Public Health*. 16(9).
10. Zhang, L. Mol, A. He, G. et al. (2010) An implementation assessment of China's Environmental Information Disclosure Decree. *Journal of Environmental Sciences*. 22(10), 1649-1656.
11. Zhang, T. Zhao, M. & Xu, S. (2021) Research on Environmental Information Disclosure Mechanism and Development Status of Automobile Enterprises in China. *E3S Web of Conferences*.

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