Based on Delphi-AHP Research on ESG Evaluation System of Chinese Automobile Industry

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Abstract. Based on the reference to the research methods of the mainstream evaluation institutions at home and abroad and the development characteristics of the automobile industry, this paper sets up a pioneering ESG evaluation system for China's automobile industry, extracts 171 evaluation indicators, and uses Delphi method and analytic hierarchy process to determine the weight coefficient of the indicators. This paper sets up a pioneering ESG evaluation system for China's automobile industry, extracts 171 evaluation indicators, and uses Delphi method and analytic hierarchy process to determine the weight coefficient of the indicators, and then builds a scientific evaluation model and evaluation process. The evaluation system constructed in this paper fills the gap in social responsibility evaluation research of China's automobile industry. The evaluation system constructed in this paper fills the gap in social responsibility evaluation research of China's automobile industry, is conducive to "promoting reform through evaluation", promotes enterprises to clarify the weak links that need attention in social responsibility practice, promotes enterprises to continuously deepen their social responsibility practice, improves their sustainable development ability, and upgrades their social responsibility practice. Promote more market players in the automotive industry, and promote the concept of sustainable development from one-way transmission to two-way transmission. Promote more market players in the automotive industry to actively participate in the construction of social responsibility, and promote the good and healthy spread and development of ESG concept in the automotive industry. Promote more market players in the automotive industry to actively participate in the construction of social responsibility, and promote the good and healthy spread and development of ESG concept in our country.

Keywords: Automobile industry; ESG evaluation; Delphi process; Analytic hierarchy process; Social responsibility evaluation research

1.Introduction

The concept of ESG originated from the initiative of the United Nations Global Compact in June 2004, which advocates that enterprises, while focusing on operational efficiency, should also incorporate environmental, social and governance performance into their decision-making process. and governance in the decision-making process, and to deeply integrate them with their own business.

China's 20th National Congress drew a grand blueprint for Chinese-style modernization, promoting the harmonious coexistence of human beings and nature, which is highly compatible with ESG's philosophy of promoting multiple values and pursuing win-win

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situations for the economy and society, thus promoting the accelerated development of local ESGs.

This paper will start from ESG issues, rely on the reality of the development of the automobile industry, construct a forward-looking, professional and authoritative ESG evaluation system in the automobile industry, scientifically assess the stage characteristics of ESG development in China's automobile industry, construct China's automobile evaluation model, determine the content of the evaluation indexes, and conduct a study on the weighting of the indexes and the assigning of values based on this, so as to take ESG as a new yardstick to measure the value of automobile enterprises. On the basis of this, we will conduct research on the weighting and assignment of indicators, and take ESG as a new yardstick to measure the value of automobile enterprises. At the micro level, we will provide ideas for more automobile enterprises to practise ESG concepts, strengthen ESG governance, and carry out ESG practices, upgrading the concept of sustainable development from a one-way transmission to a two-way transmission; at the macro level, we will drive the industry's enterprises to be more responsible and sustainable, encourage them to take up the important responsibilities of carbon reduction and green sustainable development, and promote the market players in the automobile industry to devote themselves to ESG practices in a more active manner. It encourages market players in the automotive industry to devote themselves to ESG practices in a more positive manner, guides ESG pioneers to play an exemplary role, reshapes pluralistic values, expands the boundaries of ESG practices, and builds a green, low-carbon and sustainable automotive industry ecosystem together.

2.Research on the Construction of ESG Evaluation Model for China's Automobile Industry

Based on the theory of sustainable development, enterprises should not only focus on economic benefits, but also fully consider the impact of production and operation behavior on the environment and society; according to the analysis of the theory of externality, enterprises should avoid the risk of negative externalities in the process of practice, and increase the practice of positive externalities, so as to enhance the value of the enterprise; according to the theory of stakeholders, enterprises want to achieve the goals of the organization, and need to be from the perspective of the supply chain According to the stakeholder theory, in order to realize the organizational goals, enterprises need to have a comprehensive insight into the demands of all stakeholders from the supply chain perspective. Relying on the above theoretical guidance, this paper constructs a "three-in-one" ESG evaluation model for the automobile industry (**Figure 1**).

Figure 1. The "Trinity" ESG Evaluation Model of China's Automobile Industry

Specifically, the evaluation model consists of three main segments: ESG governance, social value, and risk management.

ESG governance is evaluated in three dimensions: corporate governance, board ESG governance and ESG management. Corporate governance mainly examines whether the company has rationally set up the rights, responsibilities and benefits of the "three committees and one layer", and established a sound governance system with clear rights and responsibilities and efficient operation; ESG governance of the board of directors mainly examines the participation of the board of directors in ESG work from the top-level structure of ESG; and ESG management examines the ESG management department from the perspective of the ESG coordination and management department, ESG management examines the management system established by the company to ensure the effective implementation of ESG strategic decisions from the perspectives of ESG system construction, performance assessment and capacity building [1].

Social value covers a wide range of sustainable development values in this evaluation model, specifically differentiated into four dimensions: national value, industrial value, environmental value and people's livelihood value, which refer to the value created by the enterprise to serve the national strategy, help industrial development, guard the ecological civilization, and satisfy the people's needs for a better life, respectively.

Based on the characteristics of the automotive industry, Risk Management has selected 10 social and environmental risk issues, such as climate change, ecological security, responsible supply chain management, etc., and measured the level of enterprises' management of the industry's risk issues in four dimensions: system construction, practice initiatives, performance management and negative disclosure [2]. Institutional construction examines whether the enterprise has established goals, policies and systems for managing risk issues; practical initiatives examine the actions and initiatives taken by the enterprise to address each risk issue; performance management evaluates whether the enterprise pays attention to, counts and continuously follows up on key risk performance indicators; and negative disclosure examines whether the enterprise takes the initiative to disclose negative matters in order to prevent

misjudgement of the enterprise's social and environmental risks by investors as a result of deliberate concealment of the lack of responsibility. risk [3].

In addition, the evaluation model also follows the common practice of domestic and international ESG ratings by including an adjustment item in the ESG evaluation of the automotive industry to provide additional bonus points for companies that have achieved significant innovation in the ESG governance process, and deducting the corresponding points as appropriate for companies that have experienced significant annual ESG incidents.

3.Research on ESG Evaluation Indicator System of China's Automobile Industry

On the basis of domestic and foreign ESG standards, industry ESG report research, and industry policy background analysis, the research team built a three-level ESG evaluation index system for China's automotive industry, including 171 subdivided indicators, including 48 industry characteristics.

Specifically, the first level of the evaluation index system is the ESG target level, which systematically summarizes the ESG practices of the automotive industry in three dimensions: ESG governance, social value and risk management. The second level is the ESG guideline level, which is a refinement of the three objectives and summarizes a total of 17 guidelines that need to be focused on. The third level is the ESG program level, which summarizes the ESG practices of each automotive company in a specific and comprehensive way, and finally forms representative indicators of the automotive industry. According to the research team's preliminary findings, the current ESG disclosure in the automotive industry has not yet formed a standardized and normalized statistical caliber, and there are still large differences in the specific dimensions and indicator connotations determined by different evaluation systems. Accordingly, this paper will systematically explain the secondary indicators under the three major evaluation dimensions of ESG governance, social value and risk management, as well as the characteristic indicators of the automotive industry, so as to provide an innovative and standardized paradigm for ESG research in China's automotive industry.

3.1 ESG governance

The ESG governance segment consists of corporate governance, board ESG governance and ESG management. First, at the governance system level, indicators such as board independence, information transparency, law-abiding and compliance training performance,and anti-corruption training performance are set to examine whether the company's decision-making and operations are standardized and transparent. Second, at the organizational structure level, indicators such as board of directors' ESG target review and executive compensation linked to ESG are set to measure the performance of the board of directors in governance. Finally, at the practical initiative level, indicators such as participation in automotive industry ESG research or the development of industry ESG standards, the number of social responsibility/ESG reports published, and independent third-party validation of ESG reports are set to identify whether automotive companies have implemented the concept of ESG governance into their main responsibilities and businesses based on the perspective of industry development [4].

3.2 Social values

Based on the current development of China's automobile industry, this paper summarizes four aspects of social value. First, at the national value level, indicators such as rural revitalization, "One Belt, One Road" and major national projects are set to assess the actions and initiatives taken by automobile enterprises in the process of serving national strategies. Second, at the industrial value level, indicators such as the construction of digital intelligence system, respect and protection of intellectual property rights, and the construction of intelligent manufacturing benchmark factories were set to focus on the contribution made by automotive enterprises to promote the progress of the industry on the basis of tapping their own business advantages. Third, in terms of environmental value, indicators such as promoting carbon emission reduction along the entire value chain and safeguarding green ecology were set to measure the value created by automotive enterprises in implementing the "dual-carbon" development strategy and protecting the environment [5]. Fourth, in terms of people's value, indicators are set for the creation of special brand public welfare projects in the automotive industry, the popularization of traffic safety knowledge, and public welfare actions, to pay attention to the experience of the public in the context of the New Fourth Harmonization, and to examine whether automotive companies are able to satisfy the public's reasonable demand for employment, services, and public welfare [6].

3.3 Risk management

For the automobile industry, the risk management segments that need to be included in the scope of decision-making are environmental risk management and social risk management [7]. In the environmental risk management segment, the assessment is based on five dimensions: environmental management, resource utilization, emissions, responding to climate change, and guarding ecological safety, and industry-specific indicators such as the extension of producer responsibility for automotive products, passing the certification of green factories for automobiles, the recycling rate of batteries for new-energy vehicles, and the impact on the environment during the use of automotive products are proposed. In the social risk management section, based on an analysis of five dimensions: employment, development and training, occupational health and safety in production, customer responsibility, and responsible supply chain management, and in addition to the traditional indicators for the protection of employees' rights and interests, and in response to the outstanding characteristics of the automotive industry's supply chain with its long lifecycles and high risks, the research team formulated warranty and three-package policies, Telematics network security, care for vulnerable road users, defective vehicle recalls In addition to the traditional indicators on employee rights protection, the research team developed indicators on warranty and three-pack policy, connected car network safety, caring for vulnerable road users, defective car recalls, helping brand development, dealer management and channel construction, etc., which are used to guide automotive companies to insist on the long-term implementation of their social responsibility, emphasize on the communication of stakeholders, and pay attention to the continuity of the fulfillment of their responsibilities on key issues [8].

4.Research on the Weighting and Assignment of ESG Indicators in China's Automobile Industry

Based on the principle of operability, combined with the process of determining the ESG evaluation system of the automobile industry, this project chooses to use the Delphi method and the hierarchical analysis method to conduct research.

When using the Delphi method to conduct research, the specifics of the reviewing experts directly affect the validity of the research results, so this research team prudently carried out the selection of experts based on the evaluation requirements of ESG in the automobile industry, and finally the project invited a total of 15 experts, the specific composition of which is as follows: 3 experts on social responsibility and sustainable development, 4 experts on automobile technology, and 3 researchers on the automobile industry, 5 experts from ESG think tanks. The results of the data analysis of the experts' comments are as follows:

First, the expert positivity coefficient was derived by counting the return rate of the questionnaire to measure the experts' interest in the study. The expert positivity coefficient is calculated by the formula:

$$K = \frac{m}{M} \qquad (1)$$

Where m represents the number of experts who actually filled out the questionnaire and participated in the evaluation, and M represents the number of experts who received the questionnaire. The recovery rate of the questionnaire in this project is 100%, which means that the positive coefficient of experts is 100%, indicating that experts are very concerned about the research of ESG evaluation system in the automobile industry.

Second, the expert authority coefficient is calculated by assessing the experts' familiarity with ESG issues in the automotive industry and the basis on which the experts judge the issues. The formula for the expert authority coefficient is:

$$C_R = \frac{C_a + C_S}{2} \qquad (2)$$

Among them C_a represents the basis for experts to judge the problem, which is divided into four sources, namely, practical experience, theoretical research, information learning and subjective cognition, and corresponds to different coefficients based on reliability;C_s is used to represent the expert's familiarity with the problem, from very familiar to no knowledge, divided into five different levels, and assigned points from large to small. If$C_R \geqq 0.7$, then it can meet the requirement of expert authority. Calculated based on the correspondence results, theC_R value is 0.81, which proves that the experts involved in the assessment are more authoritative and meet the requirements of the study.

Thirdly, the concentration of expert opinion is derived by calculating the mean value of the importance assignment of the indicators. Using the Likert five-point scale as an evaluation tool, the ESG evaluation indicators of the automobile industry are calculated one by one, and the indicators with mean value $\leqq 4$ are excluded. From the calculation results, it can be seen that the mean value of the evaluation indicators is in the range of 4.53 to 5.00, and the indicators are retained.

Fourth, the degree of harmonization of expert opinions was examined through the coefficient of variation, which was calculated by the formula:

$$C_v = \frac{\sigma}{\mu} \quad (3)$$

whereσ represents the standard deviation of the indicator, andμ If the coefficient of variation is $\geqq 0.25$, it means that the experts' evaluation of the importance of the indicator has a high degree of disagreement, and the degree of dispersion of the indicator is high, so it is necessary to eliminate the invalid data. After calculation, the coefficient of variation of the first-level indicator is 0.11, the coefficient of variation of the second-level indicator is 0.15, and the coefficient of variation of the third-level indicator is 0.19, which are all in line with the standard.

According to the data analysis of the expert evaluation results, it can be seen that the setting of the ESG indicator system of the automobile industry meets the evaluation standards, and the hierarchical analysis method can be used to conduct a more in-depth analysis and research, which can be used to assess the rationality of the existing indicator system in depth. The general steps of using the hierarchical analysis method are as follows: first, based on the results of the expert consultation and preliminary research, the target layer, criterion layer and program layer of the indicator system are clarified; second, the judgment matrix is constructed based on the evaluation results; and third, the weights of the indicators are determined by consistency test, and the evaluation results are obtained. Based on the previous section, it can be seen that the indicator system has been constructed, and the project team will construct the judgment matrix based on the scoring results of experts on the importance of the evaluation indicators, compare the existing indicator system, summarize the judgment matrices of the three levels, and carry out the weighted calculation. Since the ESG evaluation system of the automobile industry is relatively complicated and contains a large number of indicators, we only take the three first-level indicators as an example to calculate the judgment matrix relationship. The first-level indicator level's 3×3 judgment matrix is as follows:

$$\begin{bmatrix} 1 & 0.970 & 0.958 \\ 1.031 & 1 & 0.987 \\ 1.044 & 1.013 & 1 \end{bmatrix}$$

In the calculation process, the calculation of the judgment matrix continues to be converted into the operation of eigenvalues and eigenvectors. First of all, the geometric mean of the indicators in the matrix is calculated, on the basis of which the normalization process is carried out to obtain the eigenvector of the first-level indicator $W = (0.325, 0.335, 0.340)^T$. Based on the existing results calculate the maximum eigenvalue of this vector$\lambda_{max} = 3$. After that, in order to verify the reasonableness and validity of the weight coefficients, it is also necessary to carry out the consistency test for the matrix by calculating the consistency index CI and consistency ratio CR. The calculation formula is as follows:

$$CI = \frac{\lambda_{max} - n}{n-1} \quad (4)$$

$$CR = \frac{CI}{RI} (n \geq 2) \quad (5)$$

Calculation shows that in the first level of the index layer of 3×3 judgment matrix, CI=0, RI=0.52, CR=0. From the consistency test results, CR≤0.1, so the judgment matrix meets the consistency test requirements. To summarize, all the index layers are calculated and

synthesized to construct the weights of ESG evaluation system of China's automobile industry as follows, due to the complexity of the index system, only the results of calculating the weights of the primary and secondary indexes are shown here (**Table 1**):

Table 1 Weighting table of ESG evaluation system for China's automobile industry

target level	weights	standardized layer	weights
ESG governance	0.325	corporate governance	0.115
		Board governance	0.072
		ESG management	0.138
social value	0.335	national value	0.091
		industrial value	0.065
		environmental value	0.094
		People's value	0.085
risk management	0.340	Environmental management	0.031
		Resource utilization	0.027
		emission	0.029
		Responding to climate change	0.043
		Protecting ecological security	0.045
		employment-related	0.015
		Development and training	0.028
		Occupational health and safety	0.021
		Customer Responsibility	0.039
		Responsible supply chain management	0.062

5.Prospects for the Application of ESG Evaluation Research Results in China's Automobile Industry

In terms of the presentation of specific results, in order to visualize and comprehensively present the ESG level of automotive companies, the research team delineated the evaluation results into seven levels based on the ESG rating scores, and its specific evaluation method is shown in **Table 2**.

Table 2 Weighting table of ESG evaluation system of China's automobile industry

Score range (points)	highly rated
85-100	★★★★★
70-85	★★★★☆
60-70	★★★★
50-60	★★★★☆
40-50	★★★★★

30-40	★★★
Below 30	★

This year, the research team conducted the first study on the ESG evaluation system of the automotive industry, researched and mapped 100 sample pools in the vertical direction of the industry, and conducted preliminary categorization and analysis of the evaluation results. Among them, five-star (85-100 points) represents automobile enterprises with a more complete ESG governance system, which have achieved outstanding results in the construction of the country, industry, environment and people's livelihood, and have better avoided environmental and social risks in the production and operation process, and are the pioneering leaders in the field of ESG in the automobile industry, and the number of such automobile enterprises is relatively small, with only less than 10% at the present time. Four-and-a-half-star (70-85 points) and four-star (60-70 points) enterprises have initially established an ESG governance system, made some attempts and contributions in the field of social value creation, and have certain social and environmental risk management capabilities, and are effective practitioners in the field of ESG in the automobile industry, and about 20% of the automobile enterprises that can reach such a standard. On the other hand, three-star and below automobile enterprises have not yet established an ESG governance system, with less social value contribution and relatively low risk management level, and are in urgent need of exploring a brand-new path in ESG governance and improving their governance level. Most of the automotive companies in the current evaluation sample are at this level, and even about half of the companies in the sample pool have only a one-star level.

According to the research and mapping, the overall ESG level of the automobile industry is not as good as that of other industries, and there is huge room for improvement. At the same time, many problems have been exposed during the evaluation process: the comprehensive ESG capability of some group companies is not as good as that of the second-tier companies of other groups; the content required to be disclosed by the mainstream framework is still missing, etc.

In short, the huge industrial chain of the automobile manufacturing industry also deeply affects the environment and society of global and local communities . Therefore, the ESG performance of automobile enterprises will not only have a subtle impact on the environment and society, but also affect the long-term development and survival of the company. From this point of view, ESG assessment has become an issue of concern for automobile companies. Interpreting the long-term development perspective and evaluating the current ESG situation of the automotive industry is not the ultimate goal of the research team, but to promote improvement through evaluation is the only way to enhance the level of ESG work in the entire automotive industry.

6.Conclusions

Based on the three evaluation dimensions of ESG governance, social value and risk management, this study establishes an ESG evaluation system for China's automobile industry covering 171 indicators, and adopts the expert consultation method and hierarchical analysis method, and calculates the 2023 ESG Pioneer Index of China's automobile industry through

the refinement of the weights and values of the indicators, which fills in the blank of the research on the evaluation of the social responsibility of the automobile industry.

On the basis of extensive benchmarking of domestic and international ESG disclosure standards and common standards such as ESG evaluation system, the evaluation system integrates major industry issues such as dual-carbon, new energy, industry chain supply chain, and traffic safety into the methodology, and explores the construction of China's automotive industry ESG evaluation system with professional attributes and industry characteristics to build industry-specific standards. On the one hand, it helps to promote improvement through evaluation, providing ideas for more automobile enterprises to practice ESG concepts, strengthen ESG governance, and carry out ESG practices; on the other hand, it helps to promote development through practice, based on the automobile industry of subversive transformation and upgrading, and drive the whole industry to pay attention to and think about ESG through systematic evaluation, which will guide the industry to actively practice ESG concepts, maximize the economic, environmental, and social values, serve the people's better life, help build a harmonious society, and contribute to the construction of a beautiful China. It will also help maximize economic, environmental and social values, serve the people's better life, contribute to the building of a harmonious society, and contribute to the construction of a beautiful China.

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