

Study on Influencing Factors and Mechanism of ESG Development in Chinese Energy Enterprises

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Abstract Under the dual carbon goal and the national energy security strategy, improving the ESG development level of China's energy enterprises is undoubtedly an important issue at present. Based on relevant theories of ESG development, this study constructs a model of influencing factors of ESG development of energy enterprises in China on the basis of summarizing factors that will have an impact on ESG development of energy enterprises. Then, combined with 501 effective studies obtained by questionnaire survey, it analyzes the interrelationship and action mechanism among various influencing factors. The results show that government factors have the greatest impact on the ESG development level of China's energy enterprises, followed by enterprises, investors, the third-party rating agencies and financial institutions. The results of this study will play a certain reference role in China's energy green transformation, ensuring national energy security, and promoting the sustainable development of energy enterprises.

Keywords energy enterprises; ESG; influencing factors; ESG development

1 Introduction

Under the background of global sustainable development, the concept of ESG has gradually entered people's vision and become the focus of academia^[1]. ESG (environmental social governance) was first proposed by the United Nations Global Compact's "Who Cares Wins" report in June 2004^[2], and its origin is "ethical investment" or "socially responsible investment"^[3]. Evolved on the basis of corporate social responsibility theory^[4,5], and sustainable development theory^[6], it can comprehensively evaluate and measure the level of corporate environmental sustainability, social value and governance ability^[5].

As a new concept to achieve sustainable development from the comprehensive perspective

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of E, S and G^[7], ESG evaluation currently has multiple technical dimensions and complex levels, and the connotation of ESG is not uniform at home and abroad^[8]. In addition, there are objective differences in policy formulation, industry and institutional framework, economic development of different economies, scholars suggest to carry out research on the heterogeneity of ESG regions and industries^[9–11]. Above all, representative typical industries such as environmentally sensitive and resource-based industries are selected as pilots, and gradually promoted on this basis^[10,12].

At present, the world is undergoing the third energy transition toward sustainable development^[13]. Countries differ in economic development stage and resource endowment. How to balance secure energy supply and low-carbon transition is both a common goal and a difficult problem. As the world's largest energy producer, consumer and carbon emitter^[14], China's solemn commitment to "strive to peak carbon dioxide emissions before 2030 and strive to achieve carbon neutrality before 2060" and the long-term goal of the Paris Agreement require a profound transformation of China's energy economic system. At the same time, China's primary energy resource endowment has the characteristics of "rich coal, poor oil, less gas", which leads to the industrial structure biased towards the high-energy industry, the energy structure of coal is relatively high, and the resource and environment constraints exist for a long time. The 31 provinces, autonomous regions and municipalities in China have set up energy groups successively. China's energy enterprises are burdened with the mission of how to walk out a road of energy transformation that conforms to national conditions, conforms to the global development trend and adapts to the requirements of The Times under the guidance of the new strategy of energy security of "four revolutions and one cooperation". Therefore, it is particularly important to carry out ESG research on China's energy enterprises at this stage.

Empirical studies^[15] have found that the overall performance of ESG in China's energy enterprises is average, and G performance is not ideal. There is significant polarization in ESG synthesis and in all dimensions. The development of different dimensions of E, S and G is mostly unbalanced and uncoordinated, which is mainly reflected in the imperfect ESG information disclosure system, the lack of incentive and restraint mechanism of ESG disclosure, the lack of integration between green finance and ESG investment, the low degree of ESG disclosure, the lack of initiative, the poor ability of ESG information disclosure, and the lack of effective combination of ESG idea and corporate strategy.

In order to improve the development level of energy enterprises ESG, accelerate the green transformation of energy, ensure the national energy security, and enhance the sustainable development ability of energy enterprises in our country, it is necessary to explore the influential factors of ESG development of energy enterprises in our country and analyze its action mechanism.

Compared with the existing research, the two contributions of this paper are as follows: 1) From the perspective of theoretical enrichment, based on the literature analysis method, this study comprehensively sorts out five factors that affect the ESG development level of China's en-

ergy enterprises: government factors, the third-party rating agency factors, financial institution factors, investor factors and enterprise factors. It innovatively summarizes 6 latent variables and 21 observed variables of ESG development level and influencing factors of energy enterprises to build a conceptual model of ESG influencing factors of energy enterprises in China, and proposes relevant hypotheses. 2) From the perspective of empirical analysis, this study used structural equation model for the first time to empirically analyze the influence of factors on ESG development level of China's energy enterprises by building a model of influencing factors and mechanism of action, identify key influencing factors, and verify the action path of ESG influencing factors of China's energy enterprises. The research results will provide reference for improving the ESG management level of China's energy enterprises and promoting high-quality development, and can theoretically enrich the scope of China's sustainable development theory research.

This paper is organized as follows. Section 2 is devoted to a literature review on ESG influencing factors. Section 3 builds the theoretical model framework of ESG development influencing factors and presents the research hypotheses. Section 4 constructs a structural equation model and carries out an empirical study of ESG development level and its influencing factors in Chinese energy enterprises by means of questionnaire survey. Finally, we present research conclusions, the originality of the research, managerial recommendations, limitations and further research ideas in Section 5.

2 Literature Review

Our study draws from five areas of research: four external factors of government, financial institutions, the third-party rating agencies and investors, and the internal factors of enterprises themselves. The development level of ESG in Chinese energy enterprises is influenced by multiple factors inside and outside the enterprises. We provide a comprehensive review of each ESG influencing factor in succession.

2.1 ESG Influencing Factors

1) Government factors. Drempetic, et al.^[16] based on institutional theory and legitimacy theory, believed that ESG performance of enterprises was a response to the pressure of government and other stakeholders in environmental, social and governance concerns to meet their expectations. Ben Lahouel, et al.^[17] believed that the transformation of environmental protection system affected the ESG performance of enterprises, and government coercive policies would force enterprises to implement more substantive ESG behaviors^[18], such as adopting energy-saving equipments to improve environmental performance, making charitable donations to improve social responsibility performance, and establishing reasonable corporate governance structure to improve governance level^[1].

2) Enterprise factors. Zhang, et al.^[19] found that the government puts pressure on enterprises through mandatory policies, and enterprises respond by fulfilling ESG responsibilities, which could achieve a win-win situation of obtaining organizational legitimacy and enhancing

their own competitive advantages. Galbreath^[20,21] argued that formal strategic planning was a key factor affecting ESG performance. Galbreath^[22] synergized institutional theory with strategic choice, arguing that ESG performance improvement was not only a passive response to institutional pressure from external governments, but also the result of active strategic choice within enterprises. At the same time, corporate strategy plays different roles in different dimensions of E, S and G^[23], and different strategic choices also have different impacts on the development of corporate ESG^[24]. Manasakis, et al.^[25] conducted an empirical study on the motivation of corporate owners' commitment to ESG strategic choices based on the background of corporate governance. It was found that because consumers could not observe the social responsibility attributes of products, enterprises sent a signal to consumers to take the initiative to assume social responsibility by entrusting the CEO to exercise the strategic means of ESG decision-making power, and consumers' willingness to pay for ESG products was relatively increased, and enterprises were more motivated to participate in such activities strategically to obtain market competitive advantages. However, Barnea, et al.^[26] argued that agents (CEOs) might seek to over-invest ESG performance for private gain, thereby enhancing their reputation and creating a "warm halo" effect. Therefore, it is crucial to improve the supervision and balance mechanism of corporate governance^[19]. Strengthening party organization governance^[27], diversified board of directors^[28–31] and director values^[32] can have a positive impact on ESG performance of enterprises. In addition, Castelo, et al.^[33] combined institutional theory with resource-based theory and argued that ESG was a strategy for enterprises to develop valuable intangible assets (resources and capabilities) to gain competitive advantages. Through strengthening the construction of ESG culture^[21,34] and innovation^[35], improving the digital level^[36–38] and the ability of environmental information disclosure^[39] and other strategies, enterprises can promote more efficient allocation of resources, more transparent information, better ESG performance and stronger competitiveness.

3) Financial institution factors. Bauer, et al.^[40] found that the fund investment style of financial institutions would affect the ESG development level of enterprises. Fund managers included enterprises with good ESG performance in their portfolios and launched ESG funds to guide socially responsible investment^[41]. Financial institutions integrate ESG information into their credit decisions, incentivizing enterprises with good ESG performance to improve ESG performance by reducing their debt costs^[42], so that enterprises can benefit while achieving sustainable development.

4) The third-party rating agency factors. Wong, et al.^[43] found that the third-party rating agencies are the determining factor of ESG development level of enterprises. Once enterprises are ignored by the third-party ESG rating agencies, they will deliberately strive to improve ESG performance, and different rating agencies have different incentive effects on enterprises' participation in costly ESG activities^[44]. ESG rating by private rating agencies can maximize the overall profits of enterprises. ESG rating by public rating agencies can maximize the total welfare of enterprises, and ESG rating by non-governmental organizations can maximize the

consumer surplus.

5) Investor factors. Some scholars have investigated the impact of investors' investment preferences^[45] and investment strategies^[46] on ESG of enterprises, and believe that investors pay more and more attention to ESG investment ideas and take ESG performance of enterprises as an important reference to determine investment strategies^[47]. Companies implementing effective ESG strategies to create additional value for their products can attract investors to increase their willingness to invest^[48]. By improving ESG performance, enterprises can send good signals to investors and obtain sufficient sources of project funds and key resources. Investors' recognition of enterprises will improve their social reputation^[49], and help to form a positive feedback loop mechanism. Institutional investors can also form network groups through co-ownership relationships to take concerted action to increase information transparency, prevent major shareholder self-interest, and enhance corporate ESG performance^[50]. Sustainable investing makes companies more environmentally friendly and has a positive social impact by shifting actual investments to green companies.

2.2 ESG Influencing Factors of Energy Enterprises

There are few existing studies on the influencing factors of ESG development in energy enterprises, which mainly focus on the single factor of government policies and corporate governance. Some scholars have found that the government positively affects the ESG performance of energy enterprises through regulations and policies^[51] such as green taxation^[52], "Internet+" Smart Energy^[53], low-carbon city pilot^[54], and Environmental Protection Tax Law^[55,56], emphasizing that the government plays a key role in guiding the sustainable development of energy enterprises by improving policy initiatives, strategic measures and legislation such as the Energy Law. At the enterprise level, it focuses on studying the impact on ESG performance from the perspective of corporate governance such as gender diversity^[57,58] and other board characteristics^[51], board diligence^[57], ESG staff allocation^[59], etc. In addition, Zainullin, et al.^[60] found that the digitalization of corporate culture made ESG investment more attractive through the empirical study of five sample companies: EDF, Rosatom, Rosneft, Sinopec and PJSC Gazprom. Existing research on ESG influencing factors of energy enterprises has not fully covered government factors and enterprise factors, and has not carried out research on investors, the third-party rating agencies and financial institutions. In this study, scholars' research literature on influencing factors of enterprise ESG development is summarized in detail, as shown below in Table 1.

In sum, domestic and foreign scholars' attention to ESG has enriched relevant studies presently, but most relevant literatures use qualitative or quantitative analysis methods to study a certain factor affecting the development level of ESG, and the research perspective is relatively single, and there is a lack of comprehensive analysis of the relationship between these influential factors. There are few literatures on ESG influencing factors of energy enterprises at home and abroad, and most domestic researches on ESG influencing factors of energy enterprises focus on the government. On the basis of refining the ESG influencing factors of energy enterprises, this study will analyze the relationship between various factors, build a theoretical model of the

Table 1 Influencing factors of ESG development level

Latent variables	Observed variables	References
Government	Policies and regulations system	Xi, et al. ^[61] , Yuan, et al. ^[62] , Arminen, et al. ^[63] , Du, et al. ^[64]
	Reform and regulatory efforts	Bai, et al. ^[18] , Zhan, et al. ^[65] , Sanches, et al. ^[66]
	Incentive and constraint mechanism	Lee, et al. ^[67] , Xu, et al. ^[68]
Enterprise	ESG and enterprise strategy integration degree	Galbreath ^[20,21] , Galbreath ^[22] , McWilliams, et al. ^[23] Wang, et al. ^[69] , Wang, et al. ^[70]
	ESG governance efficiency	Galbreath ^[32] , Yi, et al. ^[71] , Shaikh ^[72] , Díaz, et al. ^[73]
	innovation level	Gregory, et al. ^[35] , Wang, et al. ^[38]
	ESG corporate culture importance	Galbreath ^[21] , Wang ^[34] , Zainullin, et al. ^[60]
	Environmental information disclosure ability	Wang ^[39]
	Digitization level	Wang, et al. ^[74] , He, et al. ^[75] , Bi, et al. ^[76] , Xiao, et al. ^[77] , Liu, et al. ^[78]
Financial institution	Green finance support	Zhang, et al. ^[79] , An, et al. ^[80]
	ESG risk management system integrity	Su, et al. ^[81] , Song, et al. ^[82]
	Guidance on socially responsible investment	Barnett, et al. ^[41] , Eliwa, et al. ^[42]
Investor	ESG investment preference	Muhammad, et al. ^[47] , Dyck, et al. ^[83] , Bai, et al. ^[84]
	ESG investment strategy	Hill, et al. ^[85] , Pedersen, et al. ^[86] , Qi, et al. ^[87]
	Supervision and governance function	Wang ^[39] , Chen, et al. ^[88] , Azar, et al. ^[89]
The third-party rating agency	The third-party certification rate of enterprise ESG information	Xi, et al. ^[90] , Sun, et al. ^[91]
	Rating index scientificity	Chodnicka-Jaworska ^[12] , Feng, et al. ^[92] , Wu, et al. ^[93]
	Rating methods transparency	Shen, et al. ^[94] , Li, et al. ^[95] , Shi, et al. ^[96]

mechanism of the influencing factors of ESG development, and conduct empirical research, in order to improve the ESG development level of China's energy enterprises, and provide certain references for the transformation and upgrading of energy enterprises and the formulation of national energy security policies.

3 Hypotheses and Theoretical Model

The ESG concept is highly in line with the new development concept proposed by the Fifth Plenary Session of the 19th CPC Central Committee and the sustainable development strategy of "Promoting green development and promoting harmonious coexistence between man and nature" in the 14th Five-Year Plan for National Economic and Social Development and the

Outline of the Vision Goals for 2035, and has become a hot topic of close attention of various stakeholders. Based on ESG related theories^[16,22,33,97], and combined with domestic and foreign scholars' research results on the influencing factors of enterprise ESG development^[40,75,85], this study summarized the main factors affecting the ESG development of Chinese energy enterprises into five categories: government, the third-party rating agencies, financial institutions, investors and enterprises.

3.1 The Hypotheses of the Relationship Between the Influencing Factors

1) The relationship between the government and other factors. Government plays an important role in enterprise ESG development^[63]. The government acts on enterprises through macro-control, formulating policies, regulations, and information disclosure systems to guide enterprises in their green and low-carbon transformation. For example, the China Securities Regulatory Commission (CSRC) issued the Guidelines on Investor Relations Management of Listed Companies (2022), which for the first time included "Corporate environmental, social and governance information (ESG)". Guide investors to participate in the investment, construction and operation of green and low-carbon projects, and correspondingly, enterprises strive to improve ESG performance in order to obtain legitimacy^[19]. The government formulates financial standards and guides financial institutions to provide reasonable financial support for the green and low-carbon development of enterprises. In addition, the government guides the introduction of industry norms leading the development of ESG, encourages the development of ESG rating and the third-party certification systems, and cultivates the market supervision force of ESG information disclosure^[90], which promotes each other with the mandatory regulatory measures of the government, forming a joint force to encourage enterprises to comply with information disclosure requirements and improve ESG performance. This study proposes hypotheses:

H1 The government has a significant influence on the ESG ratings of the third-party rating agencies.

H2 The government has a significant influence on financial institutions's providing ESG financial support.

H3 The government plays a significant role in investors' ESG decisions.

2) The relationship between the third-party rating agencies and other factors. International and domestic listed companies are being evaluated on their ESG performance by a variety of the third-party rating agencies, and institutional investors, asset managers, financial institutions and other stakeholders are increasingly relying on these ratings to measure corporate ESG performance. This assessment and measurement often forms the basis for informal investor-firm engagement on ESG matters in relation to shareholder proposals^[98]. By improving the ESG evaluation system^[94], the third-party rating agencies can strengthen the standardization of ESG rating and improve the recognition degree of investors, thus enhancing the availability of ESG rating results in the financial market. Companies take the opportunity to improve their overall reputation and image, and seek the financial resources of institutional investors

and financial institutions concerned about ESG performance to obtain financial support for corporate sustainable development. This study proposes hypotheses:

H4 The third-party rating agencies have a significant impact on financial institutions's providing ESG financial support.

H5 The third-party rating agencies play a significant role in investors' ESG decisions.

3) The relationship between financial institutions and other factors. Financial institutions launch green-themed ESG funds^[79], to attract investors to pay attention to and invest in enterprises with excellent ESG performance^[41], establish a multi-level ESG investment research system, incorporate ESG factors in financial analysis, and provide risk management advice and support for enterprises to better cope with ESG challenges^[81,82]. Based on China's dual-carbon goal, financial institutions give full play to the role of "accelerators" "amplifiers" and "stabilizers" in the market, tap diversified financial products and data services, and guide funds to invest in technological innovation and low-carbon transformation enterprises^[40]. This study proposes hypothesis:

H6 Financial institutions play a significant role in investors' ESG decisions.

3.2 The Influence of Each Factor

As the main body of ESG behavior implementation, the influence of ESG development level of enterprises comes from the external factors and internal factors of enterprises. Government factors, the third-party rating agencies, financial institutions and investors, as external factors, not only affect the development of enterprises, but also affect the development level of enterprises' ESG.

1) The influence of government. The government influences the development of enterprise ESG through system design^[66]. ESG idea coincides with China's new development concept and security development concept. As an ESG regulatory department, the government, on the basis of drawing on existing international standards and rules^[61], establishes ESG system arrangements that are in line with national conditions, formulates principles and standards for ESG information disclosure, guides enterprises to disclose ESG information^[62], promotes the coverage of ESG information disclosure subjects from listed companies to non-listed bond issuers, implements reward and punishment mechanisms^[68], and create a policy environment for ESG information disclosure. The external supervision function of government and the internal governance ability of enterprises^[71-73] complement each other, and jointly improve the ESG performance of enterprises^[65]. This study proposes hypotheses:

H7a The government has a significant influence on the development of enterprises.

H7b The government has a significant influence on the ESG development level of enterprises.

2) The influence of the third-party rating agencies. The third-party rating agencies play an important role in promoting corporate sustainability^[43]. ESG rating results can supplement the information that traditional financial statements lack and cannot cover, help investors more comprehensively understand the risk and development quality of the investees^[12], and become

the decision-making basis for financial institutions to provide green financial support for enterprises. Accordingly, enterprises will take measures to improve the development level of ESG in order to obtain investor support and reduce financing costs. This study proposes hypotheses:

H8a The third-party rating agencies have a significant impact on the development of enterprises.

H8b The third-party rating agencies have a significant impact on the ESG development level of enterprises.

3) The influence of financial institutions. Financial regulators, in light of the green development goals and tasks in their respective fields and the construction of green financial systems, formulate and implement supporting policies related to green bonds, develop green finance^[80] and sustainable finance, and support enterprises to carry out green industries, green projects or green economic activities through the issuance of green bonds. In order to pass the entry threshold and obtain green financial support, energy enterprises accelerate the green and low-carbon transformation. In addition, financial institutions issue green funds to guide investors^[99], and enterprises will improve ESG performance in order to obtain financing, which reduces financing costs^[42] on the one hand and promotes good ESG performance on the other hand. This study proposes hypotheses:

H9a Financial institutions have a significant impact on the development of enterprises.

H9b Financial institutions have a significant impact on the ESG development level of enterprises.

4) The influence of investors. In order to reduce investment risks and obtain sustainable returns, investors not only pay attention to the financial performance of enterprises, but also pay more attention to non-financial performance such as environmental performance, social performance and corporate governance performance^[85–87], when making investment decisions. Therefore, attracting institutional investors to increase their holdings is one of the ways for listed companies to enhance corporate value through good ESG performance^[84,92]. Cultivate ESG investment preference of large institutional investors, and conduct ESG investment through insurance institutions, pensions and social security funds to form a demonstration effect^[90], which is conducive to deepening investors' ESG idea, promoting ESG investment practice, and guiding enterprises' sustainable development. This study proposes hypotheses:

H10a Investors have a significant impact on the development of enterprises.

H10b Investors have a significant impact on the ESG development level of enterprises.

5) The influence of enterprises. Some scholars believe that the internal effect of enterprises is the strongest determinant of ESG performance changes in recent decades^[11]. From the perspective of resource-based theory, enterprises identify ESG as the source of competitive advantage^[100,101]. According to this theory, in order to build competitive advantage, enterprises need to own valuable, rare, imitable and irreplaceable resources^[102]. Through the implementation of ESG strategy^[69,70], innovation^[38], digital transformation^[74–77] and other ways, enterprises will develop ESG into scarce resources and unique capabilities, and seek resources such as brand

reputation, human capital (including top management) and low-cost capital, so as to obtain sustainable competitive advantage^[103–105]. This study proposes hypothesis:

H11 Enterprises have a significant impact on the level of ESG development.

3.3 Theoretical Model Framework

As shown in Figure 1, according to the research hypotheses, the theoretical model framework of this study is obtained.

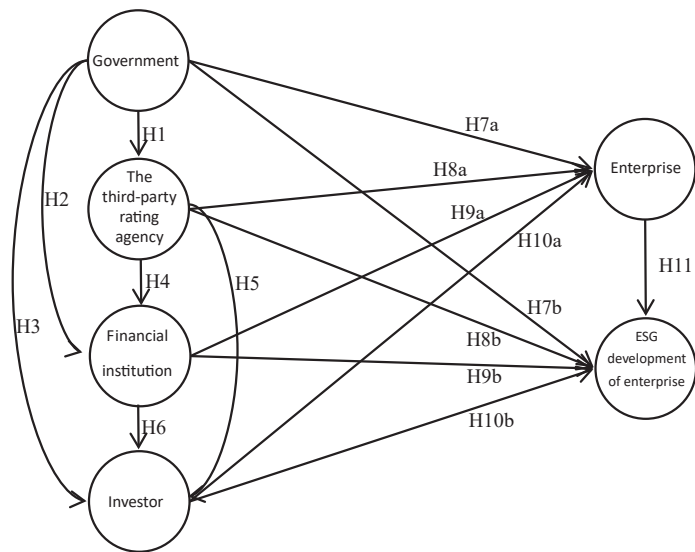


Figure 1 Influencing factors of the ESG development

4 SEM Construction and Analysis

4.1 Research Methods

This research lists five factors that affect the ESG development level of Chinese energy enterprises: government, the third-party rating agencies, financial institutions, investors and enterprises, including variables that cannot be directly observed and measured (i.e., latent variables or hidden variables), and there is a strong correlation between some factors. Traditional regression models based on basic assumptions such as OLS regression, logistic regression and other analytical tools and statistical methods can not solve this problem. Structural equation model (SEM) is an empirical research method widely used in many disciplines such as psychology, management, sociology and economics. It is an extension of regression analysis and has more advantages than regression model^[106]. It can not only deal with the causal relationship between observed variables, but also discuss the complex relationship between latent variables or between latent variables and observed variables^[107], and reveal the direct and indirect effects between variables. Therefore, structural equation model becomes the best choice for this study.

4.2 The Model Setup

According to the theoretical model framework in Figure 1, this study builds a conceptual model of various factors affecting ESG development in China, among which, government factor (GF) is an exogenous latent variable; the third-party rating agency factor (TF), financial institution factor (FF), investor factor (IF) and enterprise factor (EF) are endogenous latent variables. Policies and regulations system (GF1), reform and regulatory efforts (GF2), and incentive and constraint mechanism (GF3) are exogenous observed variables. The third-party certification rate of enterprise ESG information (TF1), rating index scientificity (TF2), rating method transparency (TF3); green finance support (FF1), ESG risk management system integrity (FF2), guidance on socially responsible investment (FF3); ESG investment preference (IF1), ESG investment strategy (IF2), supervision and governance function (IF3); ESG and enterprise strategy integration degree (EF1), ESG governance efficiency (EF2), innovation level (EF3), ESG corporate culture importance (EF4), environmental information disclosure ability (EF5), and the digitization level (EF6); corporate environmental performance (ESG1), social performance (ESG2) and governance performance (ESG3) are endogenous observed variables.

4.3 Data Collection and Analysis

4.3.1 Data Collection

This paper collects data mainly through questionnaire survey and supplemented by expert interview. Firstly, Likert's 5-point measurement scale was used to design the scale. In August 2024, we began to conduct expert interviews with ESG managers of energy enterprises and experts in business management to confirm and modify the observed variables of various influencing factors in the questionnaire. In September 2024, we conducted a pre-survey on more than 10 sample enterprises to check the practical operability and easy understanding of the questionnaire, revised and improved the questionnaire content design.

The questionnaire distribution method of this study was mainly carried out by questionnaire star. Questionnaires were issued in October 2024, and the whole survey involved 99 energy enterprises, with 2 senior managers, 2 middle managers and 2 general employees in each enterprise participating in the survey. A total of 594 questionnaires were issued. By November 2024, 549 valid questionnaires were received, and the questionnaire recovery rate reached 92%. According to the completion of the questionnaire, 48 invalid questionnaires were excluded, 501 valid questionnaires were obtained, and the effective questionnaire recovery rate was 84%.

In terms of the nature of the surveyed enterprises, state-owned enterprises accounted for 73.74% and private enterprises accounted for 26.26%. In terms of industry distribution, coal mining and washing industry accounted for 34.35%, oil and natural gas mining industry accounted for 16.16%, petroleum processing, coking and nuclear fuel processing industry accounted for 32.32%, electricity and heat production and supply industry accounted for 13.13%, gas production and supply industry accounted for 4.04%. In terms of the region of the enterprise, there were 33 enterprises in the eastern region, accounting for 33.33%, and 51 enterprises in the west-

ern region, accounting for 51.52%. There were 15 enterprises in the central region, accounting for 15.15%. In terms of enterprise size, according to the National Bureau of Statistics “Measures for the Statistical Division of Large, Medium, Small and Micro Enterprises (2017)”, there were 71 large enterprises, accounting for 71.72%, and 13 medium-sized enterprises, accounting for 13.13%. There were 10 small enterprises, accounting for 10.10%, there were 5 micro-enterprises, accounting for 5.05%.

4.3.2 Data Analysis

1) Reliability analysis

Table 2 illustrates the reliability analysis of the scale. In this paper, SPSS19.0 statistical software is used to conduct reliability analysis on the data obtained from the survey. The analysis results show that the reliability index of each variable of the scale is higher than 0.8, indicating that the results are stable and the reliability quality of the scale is good.

Table 2 Reliability analysis

Variable	Quantity	Cronbach's alpha
Government	3	0.867
Enterprise	6	0.929
Financial institution	3	0.876
Investor	3	0.863
The third-party rating agency	3	0.875
ESG development	3	0.826

2) Validity analysis

In order to check the quality of the items in the questionnaire, exploratory factor analysis of variable items is needed. The results showed that the KMO value of the scale items was 0.904 and the Bartlett sphericity test was significant ($p < 0.001$), and the data were suitable for exploratory factor analysis.

As shown in Table 3, principal component analysis (PCA) was adopted to analyze the data in this study, factors with eigenvalues greater than 1 were extracted, and the component matrix was orthogonal rotated by the maximum variance method. There were 6 components with eigenvalues greater than 1, and 77.376% of the variance was cumulatively explained.

As clearly shown in Table 4, the six components were extracted and rotated by the maximum variance method. The lowest factor loading of the results is greater than 0.5 and there is no large cross loading. The structure between the factors is clear, consistent with the expectation, and has good structural validity.

Table 3 Total variance interpretation

Compo- nents	Initial eigenvalue			Sum of squares of loadings			Rotation sums of squared loadings		
	Sum	Variance (%)	Cumulative (%)	Sum	Variance (%)	Cumulative (%)	Sum	Variance (%)	Cumulative (%)
1	8.313	39.585	39.585	8.313	39.585	39.585	4.474	21.307	21.307
2	2.297	10.940	50.525	2.297	10.940	50.525	2.434	11.589	32.895
3	1.665	7.930	58.456	1.665	7.930	58.456	2.402	11.438	44.333
4	1.440	6.856	65.312	1.440	6.856	65.312	2.387	11.369	55.702
5	1.382	6.580	71.892	1.382	6.580	71.892	2.287	10.888	66.591
6	1.152	5.485	77.376	1.152	5.485	77.376	2.265	10.785	77.376
7	0.475	2.260	79.636						
8	0.419	1.996	81.632						
9	0.405	1.930	83.562						
10	0.394	1.877	85.439						
11	0.394	1.874	87.313						
12	0.375	1.784	89.096						
13	0.334	1.588	90.685						
14	0.316	1.507	92.192						
15	0.294	1.402	93.594						
16	0.272	1.295	94.888						
17	0.245	1.166	96.054						
18	0.236	1.124	97.178						
19	0.222	1.056	98.234						
20	0.194	0.923	99.157						
21	0.177	0.843	100.000						

Extraction method: Principal component analysis (PCA).

4.4 SEM Analysis

4.4.1 SEM Fitting Test

1) Overall fit test

As shown in Table 5, that all fitting indexes of the model are within a reasonable range and reached the standard at the same time after AMOS20.0 software calculates the fitting index. Therefore, the model has a good degree of fit and is suitable for further testing.

2) Basic parameters fitting test

As shown in Table 6, *T*-value results show that the data is significant, with the combined reliability (CR) above 0.7 and the average variance extracted (AVE) above 0.5, indicating that the observed variables are valid for latent variables, and the data collected in this study is up to standard. Different from previous studies, which were limited to a certain external or internal influencing factor affecting the ESG development level of enterprises, on the one hand,

Table 4 Rotation component matrix of variables

The component matrix after rotation ^a						
Observed variables	Components					
	1	2	3	4	5	6
GF1					0.747	
GF2					0.824	
GF3					0.819	
EF1	0.817					
EF2	0.825					
EF3	0.804					
EF4	0.840					
EF5	0.809					
EF6	0.802					
FF1			0.820			
FF2			0.837			
FF3			0.831			
IF1				0.842		
IF2				0.843		
IF3				0.832		
TF1		0.799				
TF2		0.887				
TF3		0.814				
ESG1					0.814	
ESG2					0.795	
ESG3					0.800	

Extraction method: Principal component analysis (PCA)

Rotation method: Kaiser normalization maximum variance method

a: The rotation has converged after 6 iterations.

this study comprehensively includes government factors, the third-party rating agency factors, financial institution factors, investor factors and enterprise factors, and systematically analyzes the influence mechanism of these five factors on the ESG development level of enterprises. It complements the lack of multi-factor comprehensive impact analysis in previous studies. On the other hand, this study innovatively applies structural equation model, scientifically verifies that 21 observed variables could accurately and effectively measure and explain 6 latent variables, successfully screens out specific indicators, and provides a theoretical basis for accurately identifying factors affecting ESG development level of enterprises.

4.4.2 Model Hypotheses Testing

Upon analyzing the outcomes depicted in Table 7, the government has a significant positive impact on the third-party rating agencies ($\beta = 0.525$, $t = 10.589$, $p < 0.001$), and the government

Table 5 Fitting index calculation result

Fitting index	Critical value	Current value	Result
χ^2		314.309	
df		174	
χ^2/df	<3	1.806	Fit the criteria
RMSEA	<0.10	0.040	Fit the criteria
GFI	>0.9	0.944	Fit the criteria
AGFI	>0.9	0.925	Fit the criteria
RFI	>0.9	0.944	Fit the criteria
NFI	>0.9	0.954	Fit the criteria
IFI	>0.9	0.979	Fit the criteria
TLI	>0.9	0.974	Fit the criteria

has a significant positive impact on financial institutions ($\beta = 0.377$, $t = 6.722$, $p < 0.001$). The third-party rating agencies have a significant positive impact on financial institutions ($\beta = 0.268$, $t = 4.917$, $p < 0.001$), and the government has a significant positive impact on investors ($\beta = 0.174$, $t = 2.825$, $p < 0.01$). The third-party rating agencies have a significant positive impact on investors ($\beta = 0.157$, $t = 2.678$, $p < 0.01$), and financial institutions have a significant positive impact on investors ($\beta = 0.274$, $t = 4.613$, $p < 0.001$). The government has a significant positive impact on enterprises ($\beta = 0.333$, $t = 5.779$, $p < 0.001$), while the third-party rating agencies have no significant impact on enterprises ($\beta = 0.064$, $t = 1.205$, $p > 0.05$). Financial institutions have a significant positive impact on enterprises ($\beta = 0.155$, $t = 2.822$, $p < 0.01$), and investors have a significant positive impact on enterprises ($\beta = 0.199$, $t = 3.941$, $p < 0.001$). Financial institutions have a significant positive impact on ESG development level ($\beta = 0.122$, $t = 2.075$, $p < 0.05$), and government has a significant positive impact on ESG development level ($\beta = 0.264$, $t = 4.102$, $p < 0.001$). The third-party rating agencies have a significant positive impact on ESG development level ($\beta = 0.126$, $t = 2.225$, $p < 0.05$), and investors have a significant positive impact on ESG development level ($\beta = 0.141$, $t = 2.582$, $p < 0.05$). Enterprises have a significant positive impact on ESG development level ($\beta = 0.149$, $t = 2.668$, $p < 0.01$). The influence of the third-party rating agencies on enterprises is not significant ($\beta = 0.064$, $t = 1.205$, $p > 0.05$). It can be concluded that the influence of the third-party rating agencies on financial institutions and investors is direct, the influence of financial institutions and investors on enterprises is direct, but the influence of the third-party rating agencies on enterprises is indirect. Therefore, all hypotheses proposed in this study have passed the test except H8a. Different from previous studies, this study finds that external factors (government, the third-party rating agencies, financial institutions, investors) and internal factors of enterprises, as well as between these factors and the level of ESG development of enterprises have a significant impact, and reveals its action path. Firstly, the impact of each factor on the development of ESG is different, and the key factors are identified. Secondly, there are direct and indirect

Table 6 Basic parameters fitting result

Variable relation	Factor loading	Standard error	T-value	P	AVE	CR
Government					0.690	0.869
GF1 $\leftarrow$ Government	0.777	0.022	35.732	***		
GF2 $\leftarrow$ Government	0.843	0.018	47.651	***		
GF3 $\leftarrow$ Government	0.869	0.017	52.589	***		
Financial institution					0.705	0.877
FF1 $\leftarrow$ Financial institution	0.795	0.020	38.953	***		
FF2 $\leftarrow$ Financial institution	0.841	0.018	47.034	***		
FF3 $\leftarrow$ Financial institution	0.881	0.016	54.843	***		
The third-party rating agency					0.710	0.880
TF1 $\leftarrow$ The third-party rating agency	0.797	0.020	39.717	***		
TF2 $\leftarrow$ The third-party rating agency	0.903	0.015	60.738	***		
TF3 $\leftarrow$ The third-party rating agency	0.825	0.018	44.884	***		
Investor					0.678	0.863
IF1 $\leftarrow$ Investor	0.837	0.019	42.978	***		
IF2 $\leftarrow$ Investor	0.832	0.020	42.309	***		
IF3 $\leftarrow$ Investor	0.801	0.021	37.800	***		
Enterprise					0.684	0.929
EF1 $\leftarrow$ Enterprise	0.819	0.015	54.182	***		
EF2 $\leftarrow$ Enterprise	0.825	0.016	50.328	***		
EF3 $\leftarrow$ Enterprise	0.850	0.015	57.777	***		
EF4 $\leftarrow$ Enterprise	0.839	0.017	48.843	***		
EF5 $\leftarrow$ Enterprise	0.805	0.018	45.430	***		
EF6 $\leftarrow$ Enterprise	0.825	0.017	49.987	***		
ESG development					0.612	0.826
ESG1 $\leftarrow$ ESG development	0.786	0.024	32.805	***		
ESG2 $\leftarrow$ ESG development	0.777	0.024	31.739	***		
ESG3 $\leftarrow$ ESG development	0.784	0.024	32.537	***		

influences among all factors. Thirdly, on the basis of verifying the correctness of the conceptual model of ESG influencing factors of Chinese energy enterprises established in Figure 1 above, it is found that the third-party rating agencies indirectly affect enterprises through financial institutions and investors. Enterprises should enhance their ESG development level to enhance their reputation, so as to improve their ESG rating to win the support of financial institutions and investors.

4.4.3 Result Analysis

As clearly shown in Table 8, the predictive power and importance of the observed variables of each influencing factor to its latent variables is calculated and sorted by scientific methods. First of all, the direct effect of the government factor GF on its observed variable GF1 is 0.777,

Table 7 Hypotheses test result of the model

Variable relation	Standardized path coefficient (β)	T-value	p	Result
The third-party rating agency $\leftarrow$ Government	0.525	10.589	***	support
Financial institutions $\leftarrow$ Government	0.377	6.722	***	support
Financial institutions $\leftarrow$ The third-party rating agency	0.268	4.917	***	support
Investor $\leftarrow$ Government	0.174	2.825	**	support
Investor $\leftarrow$ The third-party rating agency	0.157	2.678	**	support
Investor $\leftarrow$ Financial institutions	0.274	4.613	***	support
Enterprise $\leftarrow$ Government	0.333	5.779	***	support
Enterprise $\leftarrow$ The third-party rating agency	0.064	1.205	0.228	refuse
Enterprise $\leftarrow$ Financial institutions	0.155	2.822	**	support
Enterprise $\leftarrow$ Investor	0.199	3.941	***	support
ESG development $\leftarrow$ Financial institutions	0.122	2.075	*	support
ESG development $\leftarrow$ Government	0.264	4.102	***	support
ESG development $\leftarrow$ The third-party rating agency	0.126	2.225	*	support
ESG development $\leftarrow$ Investor	0.141	2.582	*	support
ESG development $\leftarrow$ Enterprise	0.149	2.668	**	support

Note: *** means $p \leq 0.001$, **means $p \leq 0.01$, *means $p \leq 0.05$.

then the predictive power of GF1 on GF is $0.777 \times 0.777 = 0.604$, that is to say, the relative importance of GF1 on GF is 0.604. By the same token, the ranking of the importance of the three observed variables in GF can be obtained. Secondly, the direct effect value of financial institution factor FF on its observed variable FF1 is 0.795, and its predictive power is $0.795 \times 0.795 = 0.632$, that is to say, the relative importance of FF1 to FF is 0.632. Similarly, the importance of each observed variable in FF can be seen. Lastly, from Table 8, the importance sequence of the third-party rating agency factor TF, investor factor IF, enterprise factor EF, and observed variables of ESG development level can be analyzed in turn. On the basis of identifying the key factors affecting the ESG development level of enterprises, this study further analyzes the importance of each observed variable to its latent variable, finds out the important specific factors affecting the ESG development level of enterprises, and provides theoretical references for each subject to promote ESG improvement in a targeted manner.

In addition, Table 7 illustrates that financial institution FF, government GF, the third-party rating agency TF, investor IF and enterprise EF all have significant impacts on ESG development level, and their path coefficients are 0.122, 0.264, 0.126, 0.141 and 0.149, respectively. Among them, the government factor GF has the greatest impact, followed by the enterprise factor EF, and the financial institution factor FF has the least impact.

Table 8 Ranking in relative importance of the observed variables to their respective latent variables

	Variable relation	Factor loading	Predictive power	Ranking
Government	GF1 $\leftarrow$ Government	0.777	0.604	3
	GF2 $\leftarrow$ Government	0.843	0.711	2
	GF3 $\leftarrow$ Government	0.869	0.755	1
Financial institutions	FF1 $\leftarrow$ Financial institutions	0.795	0.632	3
	FF2 $\leftarrow$ Financial institutions	0.841	0.707	2
	FF3 $\leftarrow$ Financial institutions	0.881	0.776	1
The third-party rating agency	TF1 $\leftarrow$ The third-party rating agency	0.797	0.635	3
	TF2 $\leftarrow$ The third-party rating agency	0.903	0.815	1
	TF3 $\leftarrow$ The third-party rating agency	0.825	0.681	2
Investor	IF1 $\leftarrow$ Investor	0.837	0.701	1
	IF2 $\leftarrow$ Investor	0.832	0.692	2
	IF3 $\leftarrow$ Investor	0.801	0.642	3
Enterprise	EF1 $\leftarrow$ Enterprise	0.839	0.704	2
	EF2 $\leftarrow$ Enterprise	0.825	0.681	3
	EF3 $\leftarrow$ Enterprise	0.850	0.723	1
	EF4 $\leftarrow$ Enterprise	0.819	0.671	5
	EF5 $\leftarrow$ Enterprise	0.805	0.648	6
	EF6 $\leftarrow$ Enterprise	0.825	0.681	3
ESG development	ESG1 $\leftarrow$ ESG development	0.786	0.618	1
	ESG2 $\leftarrow$ ESG development	0.777	0.604	3
	ESG3 $\leftarrow$ ESG development	0.784	0.615	2

5 Conclusion

5.1 The Main Findings

Our research has led to the following conclusions. Firstly, we discover that the ESG development of energy enterprises in China is affected by financial institutions, government, the third-party rating agencies, investors and enterprises, and the effect relationship analysis shows that the latent variables of total effect from high to low are government, enterprises, investors, the third-party rating agencies and financial institutions. Among the observed variables, incentive and constraint mechanism, ESG investment preference, the innovation level, guidance on socially responsible investment, rating index scientificity, and the development level of environmental responsibility corresponding to the importance of their latent variables ranked high. Secondly, we establish that government, enterprises, investors, the third-party rating agencies and financial institutions can all influence the ESG development level of energy enterprises, both directly and indirectly. Specifically, the government can directly affect the ESG development

level of enterprise, or indirectly affect the ESG development level of enterprise by influencing investors, financial institutions and the third-party rating agencies; financial institutions can not only directly affect the ESG development level of enterprise, but also indirectly affect the ESG development level of enterprise through influencing investors. Furthermore, we find that the third-party rating agencies have no significant impact on the enterprises, and the third-party rating agencies have a direct impact on financial institutions and investors, while the financial institutions and investors have direct impact on enterprises, so the third-party rating agencies indirectly affect the ESG development level of enterprises through their impact on investors and financial institutions. Finally, our research shows that at present, the ESG development of Chinese energy enterprises mainly relies on the mandatory binding force of the government to promote, enterprises' own internal drive is insufficient and more passive, financial institutions have not fully played the role of enterprise ESG. At the same time, it is necessary to improve incentive and constraint mechanism, enhance ESG investment preference, raise the innovation level, strengthen guidance on socially responsible investment, augment rating index scientificity, and raise the development level of corporate environmental responsibility.

Compared with previous studies, firstly, this study innovatively constructs a conceptual model of influencing factors that affect the ESG development level of energy enterprises, covering the impact degree of five factors, namely, government factors, the third-party rating agencies factors, financial institution factors, investor factors and enterprise factors, on the ESG development level of enterprises. The structural equation model is innovatively used to verify that 21 observed variables can effectively measure and explain 6 potential variables, and successfully find the specific indicators that affect the development level of enterprise ESG. Secondly, this study finds that external factors of enterprises, including government factors, the third-party rating agencies, financial institutions, investor factors and internal factors of enterprises, as well as between these factors and the ESG development level of enterprises, have significant impacts, and identifies key influencing factors according to their different influence levels. The importance of each observed variable to its latent variable is deeply analyzed, and the important specific factors affecting the ESG development level are found out, which provides a theoretical reference for each subject to promote ESG development. Thirdly, this study empirically studies the mechanism of action among the influencing factors, and finds that there are both direct and indirect influences among the influencing factors. In particular, it is found that the factors of the third-party rating agencies do not directly affect the enterprise factors, but indirectly affect the enterprise factors through the financial institutions factors and investors factors. Enterprises should not ignore the external factor of the third-party rating agencies. They should improve their reputation and image by improving the ESG development level, so as to win the support of financial institutions and investors, and further promote the improvement of the ESG development level, to form a positive feedback mechanism and provide theoretical and practical reference for promoting the improvement of ESG.

5.2 Management Insights

The management implications of the above conclusions are as follows: Firstly, it is essential to strengthen government guidance and ESG top-level design. It is necessary to establish a mandatory ESG information disclosure system in the energy field, achieve full coverage of disclosure subjects, establish environmental disclosure indicators that are in line with international GRI standards, and disclose data in the past three years to achieve vertical comparability. The government should improve the clean energy standards system, revise the renewable Energy Law and the Electricity Law, perfect the legal system for energy transformation and incorporate ESG principles into the green mine identification criteria. It is important for government to innovate a new credit-based energy regulatory mechanism and promote “Internet plus” regulation. The government should promote market-oriented energy reform, improve coal power capacity price mechanism and authority to file clean energy projects. The State-owned Assets Supervision and Administration Commission of the State Council should improve the long-term supervision mechanism on the ESG work of central enterprises, improve the functional value evaluation system of state-owned enterprises, and establish an evaluation system for enterprises to fulfill their social responsibilities. It is needful to strengthen incentive and constraint systems for conserving energy, raising development targets for non-fossil energy, giving priority to the use of renewable energy, and promoting green energy consumption. Subsidies, credit concessions, tax deductions, etc. are provided to enterprises with high quality of ESG information disclosure and good ESG performance. Establish a negative list of enterprises with poor ESG performance and poor evaluation of ESG information disclosure, and strengthen punishment for false ESG information disclosure.

Secondly, energy enterprises should consider ESG as a “value investment”, integrate ESG ideas into industrial chain and value chain management, and build a common social responsibility ecosystem. Encourage the formulation of special plans for social responsibility, and establish ESG target management and performance appraisal mechanism. Improve the ESG governance structure and operation mechanism, revise the Governance Rules for Listed Companies, implement the management functions and powers of the ESG highest decision-making body of the board of directors, establish an ESG management professional committee, and increase the proportion of external directors with ESG management background. Set up ESG special work organization, improve ESG work system, strengthen ESG talent team construction, cultivate ESG idea of senior management, and implement ESG fund guarantee. Increase investment in research and development, promote green innovation, and promote the construction of “Internet plus” smart energy projects. Improve the quality and efficiency of data collection across departments. To set medium and long term environmental governance targets and improve the level of carbon emission control. Strengthen the management of carbon assets and enhance the professional ability to collect and process complex environmental indicators. Energy enterprises should establish big data model ESG risk early warning, risk prevention and control and processing, realize ESG database intelligence, promote the digital transformation of ESG management,

and promote ESG management standardization and information.

Thirdly, the People's Bank of China, the China Securities Regulatory Commission (CSRC) and other departments should guide and improve the policies and information disclosure of green bond projects. We will formulate financial transformation standards to provide financial support for the green and low-carbon transformation of traditional energy sectors. Building a green financial system, financial institutions to increase green loans, support the issuance of green bonds. The National Development and Reform Commission (NDRC) and the People's Bank of China should increase financial support for coal power enterprises based on the coal-based national conditions. It is necessary to promote cooperation with key energy resource countries, deepen the "Belt and Road" energy cooperation partnership, take green finance as a carbon neutral implementation path in the energy industry, enrich the financial tools for green transformation and extend the life of the carbon reduction support tool. Financial institutions should improve the ESG risk management system and include the ESG performance of energy enterprises in the credit granting process. On the basis of risk assessment, It is needful to reduce the financing cost of green bonds, guide the green allocation of credit resources, encourage government financing guarantee institutions to support the development of green credit. It is essential to actively develop green equity financing, green financial leasing, green trust and other financial instruments, and promote innovation in carbon financial products and derivatives orderly.

Fourthly, It is necessary to innovate and optimize the ESG investment mechanism, encourage all types of capital to increase the proportion of ESG investment, strengthen ESG investment concept, and increase the demand for ESG product allocation. Increasing investment from the central budget, local government special bonds, and the National Green Development Fund to support key energy projects such as green and low-carbon advanced technology demonstration projects, energy conservation and carbon reduction projects in key industries, and resource efficient recycling projects should be encouraged. Social capital is encouraged to set up investment funds for green and low-carbon industries in a market-oriented manner, and with the guidance role of green industry funds and the financing support of sustainable finance, the implementation of green and clean utilization projects of high carbon energy is promoted. Eligible green transformation projects such as new energy and ecological environmental protection issuing real estate investment trusts (REITs) in the infrastructure sector should be supported. It is vital for large institutional investors to play a demonstration effect by developing ESG-themed diversified investment products, enriching and innovating green securities financial products and services, taking the initiative to follow the green index, and forcing energy companies to improve ESG performance by exercising shareholder voting rights.

Lastly, establishing a requirement that the information disclosure report be audited by a third party, ESG disclosure audits should be encouraged. It is desirable that all publicly available ESG information should be reviewed and verified by a third party auditor. For example, petrochina hired Pricewaterhousecoopers Zhongtian Accounting Firm to independently verify

its 2023 ESG performance indicators to ensure the independence, objectivity and reliability of the indicators. By disclosing rating methods and data sources, improving the transparency of ESG rating data, and regularly releasing rating results and related methods, the third-party rating agencies can enhance the recognition of the capital market and the social value attributes of enterprises, increase investors' understanding and trust of rating results, and provide opportunities for enterprises to improve ESG performance. It is necessary to ensure that the ESG rating system complies with applicable regulatory and regulatory requirements to ensure legality and compliance. Attempts should be made to reduce the diversity of ESG rating systems. Companies should be encouraged to collaborate with rating agencies, industry associations, academia and stakeholders to share ESG best practices and experiences.

5.3 Limitations and Future Research

In this study, traditional energy enterprises and new energy enterprises are regarded as a whole, and future studies will dig into the influencing factors and mechanism of ESG development of different types of energy enterprises. In addition, this study selects five factors, namely government, the third-party rating agencies, financial institutions, investors and enterprises, as influencing variables, considering that stakeholders such as public supervision and customers will directly or indirectly affect ESG decision-making and behavior of enterprises to a certain extent. The future research will explore the impact mechanism of external stakeholders such as the public and customers on the ESG of energy enterprises.

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