Uncertain Supply Chain Management 12 (2024) 921–936

Contents lists available at GrowingScience

Uncertain Supply Chain Management

homepage: www.GrowingScience.com/uscm

The effect of environment, society, and governance (ESG) information disclosure on high-quality development of Chinese companies: Investigating the mediating role of green technology innovation

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A B S T R A C T

China listed companies play a significant role in fostering the economy's quality development and are leaders in the application of ESG principles by businesses. The application of ESG principles by listed companies is crucial to achieving a 'win-win' situation of social benefits and corporate economic benefits and raising the bar for high-quality development. Nevertheless, studies on the connection between corporate high-quality development and ESG information disclosure by China listed companies are few and contentious. This paper examines the role that ESG information disclosure plays in the development of corporate high-quality and the intermediary mechanism of green technology innovation in enterprises using panel data of China A-share non-financial listed companies from 2013 to 2022. The empirical results show that ESG disclosure and its three dimensions can significantly promote high-quality enterprise development. The study also discovers that high-quality enterprise development and ESG information disclosure are partially mediated by green technology innovation. The article's findings serve as a guide for businesses, investors, and governments looking to adopt ESG practices.

Article history:
Received September 4, 2023
Received in revised format October 28, 2023
Accepted December 17 2023
Available online December 17 2023

Keywords:
ESG Information Disclosure
High-quality Development
China Listed Companies
Green Technology Innovation

1. Introduction

Sustainable development has attracted worldwide attention (Drempetic et al., 2020). Environment, society and governance (ESG) are sustainable development values that aim at the harmonious coexistence of human beings and nature. This idea is an expansion of the notions of corporate social responsibility, green economy, and sustainable development (Deng & Cheng, 2019). It can be argued that ESG factors play an important role in achieving both high-quality enterprises development and sustainable economic development. China is now experiencing high-quality development instead of rapid growth in its economy. As the micro-subject of the market economy, enterprises are the most active part of market activities (Ge et al., 2022). Therefore, high-quality economic development should be based on the high-quality development of enterprises. Listed companies practice the ESG concept, which is of great significance to realize the 'win-win' of social benefits and enterprise economic benefits and improve the level of high-quality development. Therefore, this triggered the thinking of this article, that is, can corporate ESG information disclosure improve the level of corporate high-quality development? What impact do the three dimensions of environmental disclosure, social disclosure and corporate governance disclosure have on the development of high-quality companies? As people attach importance to the concept of ESG and ecological environment, green technology innovation has become a strategic choice of more and more enterprises. Green technology innovation is the integration of 'green' and 'technological innovation', with two perspectives of social responsibility and economic development. From a social responsibility standpoint, going 'green' can help with environmental and ecological issues, conserve energy and resources, lessen environmental degradation and pollution, and safeguard natural resources. According to Du et al. (2021) from the standpoint of economic development, 'technological innovation' can boost enterprise value by lowering production costs, increasing enterprise efficiency, and implementing unique business strategies through R&D innovation. In addition, companies provide impetus to improve total factor productivity through technological innovations (Kong et al., 2022; Lee et al., 2023).

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ISSN 2291-6830 (Online) - ISSN 2291-6822 (Print)

doi: 10.5267/j.uscm.2023.12.014

Both green technology innovation and corporate ESG information disclosure are driven by the sustainable development of companies to help enhance corporate value and help companies achieve high-quality development (Ge et al., 2022). These two factors can help enterprises establish a positive image in front of the public and gain their goodwill and trust to create more value (Dai & Xue, 2022; Molden & Clausen, 2021; Xu et al., 2023). Therefore, can the promotion of green technology innovation through ESG information disclosure raise the high-quality development of companies? This paper will further analyse the mechanism by which ESG information disclosure influences the high-quality development of enterprises from the perspective of green technology innovation.

This study's primary goal is to shed light on the role that ESG plays in the high-quality development of China listed companies. The research scopes are expanded based on the following limitations of existing research. First of all, there is very little empirical analysis on the impact of ESG information disclosure on the high-quality development of enterprises under the institutional background and market environment with Chinese characteristics. Besides, the degree to which ESG dimensions influence the high-quality development of businesses is not adequately addressed in the literature currently in publication. Therefore, this study examines the influence of ESG factors on the high-quality performance of Chinese listed companies from both theoretical and empirical perspectives. In addition to examining the impact of overall ESG performance on the development of high-quality companies, the paper also examines the impact of three dimensions on the development of high-quality companies: environmental (E), social (S) and corporate governance (G) information disclosure. This classification helps to assess which dimension of ESG information disclosure is the key driver of a company's high-quality development, and which variable contributes the most to the company's high-quality development. Secondly, there is little research on the mechanism of ESG information disclosure affecting the development of high-quality companies. This article delves deeper into the path by which ESG information disclosure affects enterprise high-quality development and reveals the intrinsic mechanism by which ESG information disclosure affects green technology innovation and, in turn, enterprise high-quality development.

2. Literature Review

2.1 ESG Information Disclosure and High-quality Development of Enterprises

The overview of existing empirical studies tends to support the positive correlation between ESG practice and financial performance (Birindelli et al., 2015; Liu & Zhang, 2017; Ng et al., 2020). Friede et al. (2015) find that ESG information disclosure could promote the improvement of corporate financial performance, and this conclusion was more significant in the company-centred empirical studies. According to Liu and Zhang (2017), firms that disclose ESG information will see a short-term decline in profits, but over time, good ESG information disclosure will help businesses build their reputation, achieve sustainable development, and increase their long-term value. Miralles-Quirós et al. (2018) find that ESG is positively correlated with the economic performance of Brazilian listed companies. According to empirical research conducted by Ge et al. (2022), high-quality enterprise development is promoted by effective ESG information disclosure. However, some studies have shown that corporate ESG practices can harm financial performance (Lee et al., 2009; Nollet et al., 2016; Duque-Grisales & Aguilera-Caracuel, 2021) and decrease the valuation of companies (Fatemi et al., 2018). Based on the theory of shareholder value maximization, ESG activities represented by corporate social responsibility behaviours are the loss of shareholders' equity. In addition, as the actual operator of the enterprise, enterprise managers may take ESG investment as a tool to realize their own interests, resulting in negative or no correlation between enterprise ESG information disclosure and enterprise performance(Atan et al., 2018; Duque-Grisales & Aguilera-Caracuel, 2021).

Some literatures focus on examining the impact of E, S or G, ESG indicators of a single dimension, on corporate value, but such research is still relatively rare. According to Balachandran and Faff (2015), good corporate governance can help increase corporate value; however, opinions on the relationship between corporate value and social and environmental responsibility vary greatly and can be characterised as positive, negative, or unclear. Fatemi et al. (2018) argues that environmental advantages raise a company's valuation, and conversely, environmental disadvantages lower it. Companies do not gain (or lose) significant gains from investing in social or governance advantages. According to Xie et al. (2022), state-owned companies' corporate governance increases enterprise value in China. Lee et al. (2023) find that corporate governance disclosure has no significant impact on corporate performance. The improvement of corporate value does not mean that the company has achieved high-quality development, and research on the connection between ESG and high-quality corporate development is still lacking.

2.2 ESG Information Disclosure, Green Technology Innovation and High-quality Development of Enterprises

Enterprise green technology innovation is the key factor that decides the development direction, development speed and development model of an enterprise. It involves many aspects such as organization innovation, technology innovation, product innovation, management innovation and strategy innovation, which is an important aspect of business management. Ishak et al. (2017) propose that green technology plays a fundamental role in achieving global and local sustainable development goals, which can alleviate the negative impact of traditional economic development models and improve living standards. It also emphasizes that when realizing commercial value, it can lead technological innovation to protect resources and promote

high-quality development of enterprises. Pavelin and Porter (2008) point out that enterprise technology innovation is not only pure technology innovation, but also a new combination between production elements and production elements. Enterprise innovation provides necessary support for improving enterprise ESG information disclosure through product and technology innovation. At the same time, the improvement of enterprise ESG information disclosure will also enhance the competitiveness of enterprises and promote the improvement of enterprise performance. Zhang & Jin (2022) tested the relationship between ESG and corporate green technology innovation. The empirical analysis of the fixed effect model shows that ESG information disclosure plays an important role in increasing green technology innovation capabilities. Xu et al. (2021) utilise multiple regression analysis and demonstrate that ESG information disclosure can boost green innovation performance and lead to a rise in the number of patents for green inventions. From the standpoint of innovation input, Ge et al. (2022) point out that a company that discloses its ESG information well increases its investment in corporate innovation, boosts total factor productivity, and encourages the company to develop into a high-quality enterprise.

3. Hypotheses Development

3.1 ESG Information Disclosure and High-quality Development of Enterprises

This paper argues that ESG information disclosure will have a significantly positive impact on high-quality development of enterprises. According to sustainable development theory, increasing corporate value and establishing a company's social capital and reputation are both facilitated by effective ESG information disclosure (Waheed & Zhang, 2022). Enterprises with good ESG information disclosure tend to have innovation and competitive advantages, higher operational efficiency, and stronger management ability (Velte, 2017). This gives companies enough momentum to grow in a high-quality manner. Thus, the paper expects that ESG information disclosure could enhance high-quality enterprises development, which gives rise to the hypothesis:

H_1: *ESG information disclosure has a significant positive impact on high-quality corporate development.*

In terms of the relationship between enterprise environmental disclosure and enterprise performance, it is suggested that undertaking environmental responsibility can help improve enterprise performance. Theoretically, according to the stakeholder theory, enterprises save resources and reduce environmental pollution through environmental practices, which will enhance the goodwill and trust of stakeholders to the company (Yankovskaya et al., 2022), and the company will attract more investment by winning more social reputation. On the other hand, according to information asymmetry and principal-agent theory, enterprises' active responsibility for the environment will help enterprises respond positively to the government's environmental regulations and business regulations, and ease external stakeholders' environmental regulation and normative pressure on enterprises (Chen & Shen, 2022). Therefore, the following hypothesis is proposed:

H_{1a}: *Environmental disclosure has a significant positive impact on high-quality corporate development.*
From the society (S) dimension, from the perspective of stakeholder theory, companies disclose their contributions to society in their reports, including investing in green technology innovation, reducing environmental pollution, or engaging in charity, protecting the rights and interests of employees and consumers. Based on signal transmission theory, these social benefits will reduce the information asymmetry in market activities, enhance the enterprise's business transparency and stakeholders' favorability (Liu & Zhang, 2017). Investors will also be more interested in companies with good social responsibility performance, and companies will attract more investment by winning more social reputation, thereby enhancing corporate value (Harrison & Wicks, 2013). Therefore, the paper anticipates that enterprises' social disclosure could enhance high-quality development of enterprises, which leads to the hypothesis:

H_{1b}: *Social disclosure has a significant positive impact on high-quality corporate development.*

The importance of the corporate governance dimension has been widely recognized and unanimously recognized in the government, enterprise, and academic fields. Resource dependence theory shows that good corporate governance can establish contacts with high-quality stakeholders to obtain key resources (Nguyen et al., 2021). Specifically, corporate governance ability can directly affect the utilization efficiency and output elasticity of various factors in the production process, and significantly improve the long-term performance of enterprises (Bloom et al., 2013). Furthermore, effective corporate governance can coordinate the interest relationships between managers, the board of directors, and shareholders based on the principal-agent principle. An effective board of directors can lower agency costs and improve the relationship between strong shareholders and managers by having a stronger supervisory role (Bozec & Bozec, 2011). Based on the above analysis, the following hypothesis is proposed:
H_{1c}: *Corporate governance disclosure has a significant positive impact on high-quality corporate development.*

3.2 ESG Information Disclosure, Green Technology Innovation and High-quality Development of Enterprises

As one of the main ways to achieve green development and high-quality development (Wang et al., 2020), green technology innovation can not only obtain higher competitive advantages for enterprises, but also help enterprises achieve strategic

development goals. Based on stakeholder theory and signal transmission theory, good information disclosure quality helps enterprises maintain a more robust relationship with stakeholders, which is conducive to enterprises' continuous access to the resources required for technological innovation (Hu et al., 2023). The technological innovation resources will have a positive impact on green innovation performance, help companies gain competitive advantages (Xiang et al., 2023) and then influence the development of enterprises (Xu et al. (2021). This paper believes that Corporate ESG information disclosure promotes green technology innovation and is conducive to the high-quality development of enterprises. The following hypothesis is proposed:

H_2: *Green technology innovation mediates the relationship between ESG information disclosure and enterprises' high-quality development.*

Regarding the connection between enterprise environmental disclosure, green technology innovation, and enterprise high-quality development, it can be observed that green technology innovation has the potential to both lessen environmental pressure and improve the environment (Driessen et al., 2013). First of all, Companies that want to perform well in terms of environmental responsibility must take ecological environmental factors into account. This requires enterprises to invest in research and development to help enterprises improve resource utilization efficiency (Xie et al., 2019). Secondly, enterprises that undertake environmental responsibility will increase innovation, achieve technology and product upgrades, and improve corporate competitiveness (Hojnik & Ruzzier, 2016), so as to enhance the total factor productivity of enterprises. Third, the contribution of enterprises in environmental protection can help enterprises establish a good image and win the favour of investors more easily (Xiao et al., 2022). Based on the above discussions, the following hypothesis is proposed:

H_{2a}: *Green technology innovation mediates the relationship between environmental disclosure and enterprises' high-quality development.*

As for the relationship between corporate social disclosure, green technological innovation and high-quality entrepreneurial development, socially responsible enterprises can achieve high quality through the implementation of green technological innovation. Firstly, enterprises performing social responsibilities can establish a close relationship with stakeholders, which helps enterprises share and exchange internal and external information, so as to obtain innovative resources (Xiao et al., 2022). Secondly, the investment of enterprises in CSR will promote the innovation of enterprises' products and processes (McWilliams et al., 2006; Padilla-Lozano & Collazzo, 2021), thus enhancing the competitive advantage of enterprises. Thirdly, corporate social responsibility disclosure and achievements in green technology innovation will gain the trust of investors and increase shareholders' investment in corporate R&D and other activities(Y. Liu et al., 2021; J. Xu et al., 2021), thus helping enterprises achieve high-quality development. Based on the above discussions, the following hypothesis is proposed:

H_{2b}: *Green technology innovation mediates the relationship between social disclosure and enterprises' high-quality development.*

Green technology innovation contributes positively to the relationship between ESG information disclosure and high-quality enterprise development. On the one hand, good corporate governance helps to alleviate the management's opportunistic short-sighted behaviour in corporate innovation activities (Luo et al., 2022), coordinate the interest relationship between managers and shareholders (Zhang & Fu, 2023), regulates companies management's innovative investment behaviour, and facilitating the green technology innovation of enterprises. On the other hand, according to the signal transmission theory, enterprises with high governance levels can transmit positive signals to the outside world through green technology innovation (Dai & Xue, 2022), reduce information asymmetry, and enhance stakeholders' investment confidence. Based on the above discussions, the following hypothesis is proposed:

H_{2c}: *Green technology innovation mediates the relationship between corporate governance disclosure and enterprises' high-quality development.*

The conceptual framework of this study is shown in Fig. 1.

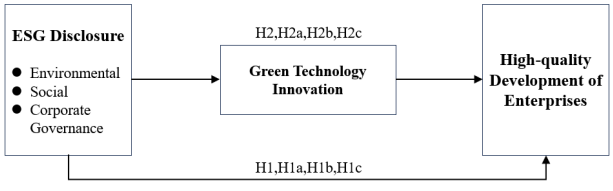

Fig. 1. The conceptual framework

4.Methodology

4.1 Variable Definition

4.1.1 Independent Variable

According to Ge et al. (2022) and Sun et al. (2022), This study assesses the ESG information disclosure of China A-share listed companies using the Bloomberg ESG rating index and the Huazheng ESG rating index. Among them, *Huazheng* ESG rating Index is used as the second independent variable measurement method for robustness test. As the world's largest financial information company, Bloomberg collects ESG metrics from multiple sources, including companies' own disclosures, government and non-governmental agency data, and news reports. In comparison, although *Huazheng* ESG evaluation system started late, *Huazheng* ESG evaluation system built an ESG database based on the actual situation of the Chinese market. For example, it added the indicator 'Rural Revitalization' to systematically measure the firms' ESG level.

4.1.2 Dependent Variable

For enterprises, the key to high-quality development is to increase total factor productivity. The calculation methods of total factor productivity (TFP) mainly include OLS method, OP method, LP method and GMM method. OP method and LP method are most used in research. Compared with the OP method, the LP method uses intermediate input instead of investment as a proxy variable, which avoids the estimation bias caused by the company's investment amount of the year being less than or equal to zero (Huo & Wang, 2015). To estimate TFP, the LP method put forth by Levinsohn and Petrin (2003) is chosen. Referring to (Ge et al., 2022; Zhao et al., 2021; Zhao, 2022) research, the model is as follows:

$$\ln(Y_{i,t}) = \beta_0 + \beta_1 \ln(L_{i,t}) + \beta_2 \ln(K_{i,t}) + \beta_3 \ln(M_{i,t}) + \varepsilon_{i,t} \quad (1)$$

where, Y is total output of a company, measured by companies' annual operating revenue.; L is labour input, measured by employee count; K is capital input, measured by net fixed assets; M is intermediate input. Intermediate inputs are measured as cash for purchases of goods and payments for services received. $\varepsilon_{i,t}$ is an independent and identically distributed random error term, which will not have any impact on the factor input choice of enterprises.

4.1.3 Mediator Variable

Referring to the research method of Tan and Zhu (2022), Xu et al. (2021) and Zhang and Jin (2022), this study uses the total amount of green patents applied by enterprises in the year to measure the green technology innovation ability of enterprises. The formula is as follows:

$$Green = \ln(number\ of\ green\ patent\ applications + 1) \quad (2)$$

4.1.4 Control Variables

The high-quality development of enterprises is affected by many factors, so this study selects eight control variables based on referring to relevant research literature. They are firm size, leverage, return on total assets, firm growth, cash flow assets ratio, Tobin Q, intangible assets ratio and independent directors' ratio. Table 1 shows the specific definitions of each variable.

Table 1
Variable Summary Table

Type	Variable	Definition	Variable Description
Dependent variable	HQD	High-quality development of enterprises	the LP method proposed by Levinsohn and Petrin (2003) is selected to estimate HQD.
Independent variables	ESG	ESG information disclosure	Bloomberg ESG database.
	E	Environmental disclosure	Bloomberg ESG database environmental disclosure score.
	S	Social disclosure	Bloomberg ESG database social disclosure score.
	G	Corporate governance disclosure	Bloomberg ESG database governance disclosure score.
Control variables	Asset	Firm size	the natural logarithm of assets at the end of the year.
	Leverage	Leverage	Total liabilities/Total assets
	ROA	Return on total assets	Net Income/Total Assets
	Growth	Firm growth	Operating income growth/Total operating income of the previous year
	Flow	Cash flow assets ratio	Net operating cash flow/Total assets
	Tobin	Tobin Q	Market value/Replacement cost
	Intang	Intangible assets ratio	Net intangible assets/Total assets
	IDR	Independent directors' ratio	Number of independent directors/Total number of boards of director.
Mediator variables	Green	Green Technology Innovation	the natural logarithm of adding the number of green invention patents and green utility model patent applications of the enterprise in the year and adding 1.

4.2 Research Model

4.2.1 Baseline Model

With reference to the research by Homayoun et al. (2023), Aouadi and Marsat (2018) and Huang et al. (2022), this article chooses the panel fixed effect model for empirical analysis. The model is shown as follows:

$$HQD_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \alpha_2 Asset_{i,t} + \alpha_3 Leverage_{i,t} + \alpha_4 ROA_{i,t} + \alpha_5 Growth_{i,t} + \alpha_6 Flow_{i,t} + \alpha_7 Tobin_{i,t} + \alpha_8 Intang_{i,t} + \alpha_9 IDR_{i,t} + \sum Industry + \sum Year + \epsilon_{i,t} \quad (3)$$

In model (1), $HQD_{i,t}$ is the dependent variable. $ESG_{i,t}$ is the independent variable. It measures ESG information disclosure of the enterprise i in year t. $Asset_{i,t}$, $Leverage_{i,t}$, $ROA_{i,t}$, $Growth_{i,t}$, $Flow_{i,t}$, $Tobin_{i,t}$, $Intang_{i,t}$ and $Indep_{i,t}$ are control variables. $\sum Industry$ and $\sum Year$ are industry and year fixed effects. $\epsilon_{i,t}$ is the error term.

4.2.2 The Model of Mediation Mechanism

Stepwise testing of the regression coefficient is the most popular method for determining the mediating effect (Baron & Kenny, 1986; Judd & Kenny, 1981; Wen & Ye, 2014). This study refers to the causal approach of Baron and Kenny (1986) and the mediation effect test method of Wen and Ye (2014) to test the mediation effect of green technological innovation between ESG disclosure and high-quality company development. The models are shown as follows:

$$Green_{i,t} = \beta_0 + \beta_1 ESG_{i,t} + \beta_j \sum_j Controls_{i,t} + \sum Industry + \sum Year + \epsilon_{i,t} \quad (4)$$

$$HQD_{i,t} = \alpha_0 + \alpha_1 ESG_{i,t} + \alpha_2 Green_{i,t} + \alpha_j \sum_j Controls_{i,t} + \sum Industry + \sum Year + \epsilon_{i,t} \quad (5)$$

In the above two models, coefficient α_1 is the direct effect of the independent variable ESG information disclosure on the dependent variable high-quality development of enterprises after controlling the influence of the intermediary variable green technology innovation. $\beta_1\alpha_2$ in equation (4) and (5) reflects indirect effects. Mediating effect equals indirect effect. $\sum_j Controls_{i,t}$ includes all control variables.

4.3 Data Sources

The research object for this paper is China A-share listed companies from 2013 to 2022. ESG information disclosure data are selected from Bloomberg and *Huazheng* ESG rating from the Wind database. The high-quality development of enterprises is measured by the LP method, and the financial data mainly comes from CSMAR. The data on the variables of enterprises' green technology innovation comes from the China Research Data Service Platform (CNRDS). This article eliminates companies marked ST and PT as well as special industry samples such as finance, real estate, and insurance, and winsorized all continuous variables at the 1% and 99% percentiles. After data cleaning, the final sample contains 7455 observations.

5. Results

5.1. Descriptive Statistics

Table 2 reports descriptive statistics for the main variables. The mean, minimum, and maximum values indicate that there are variations in the degree of high-quality development and ESG information disclosure among different enterprises. Among the three dimensions of ESG information disclosure, environmental information disclosure has the lowest score while the highest score is governance information disclosure. The information disclosure of different companies in the three dimensions of ESG is quite different. The data also revealed significant differences in the level of green technology innovation among Chinese listed companies.

Table 2
Descriptive statistical results of variables

Variable	N	Mean	SD	p50	Min	Max
HQD	7455	16.956	1.055	16.895	14.132	19.156
ESG	7455	31.746	9.391	30.017	11.157	58.576
E	7455	11.768	14.306	6.765	0.332	57.415
S	7455	15.458	7.835	13.029	2.570	40.175
G	7455	68.297	12.181	71.794	32.029	89.284
Green	7455	0.659	1.062	0	0	3.892
Asset	7455	23.280	1.240	23.178	20.100	26.220
Leverage	7455	0.454	0.187	0.462	0.053	0.831
ROA	7455	0.055	0.061	0.045	-0.183	0.225
Growth	7455	0.164	0.322	0.113	-0.486	1.767
Flow	7455	0.066	0.064	0.061	-0.128	0.239
Tobin	7455	2.094	1.438	1.575	0.856	7.778
Intang	7455	0.050	0.054	0.035	0	0.306
IDR	7455	37.683	5.555	36.360	33.330	57.140

5.2 Correlation Analysis

The correlation coefficient matrix shown in Table 3 clearly shows that the Pearson correlation coefficients between ESG information disclosure (ESG) and high-quality development (HQD) of enterprises pass the significance test at 1% level and

have a positive correlation. The results initially support the hypothesis that ESG disclosure can promote high-quality corporate performance. All three sub-dimensions of corporate ESG disclosure are also significantly positively correlated with high-quality corporate performance (HQD) at the 1% level. The control variables selected in this article are all correlated with corporate high-quality development (HQD), and most of them have strong correlations. To test whether there is a problem of multicollinearity, this article substitutes the ESG, E, S and G variables into Formula (3) for regression and calculates the variance inflation factor (VIF). After calculation, it is found that the VIFs are 1.5, 1.47, 1.44 and 1.46 respectively, none of which exceeded 10. Therefore, there is no multicollinearity problem among the explanatory variables.

5.3 Regression Result Analysis

To test the research hypothesis proposed in this article, a two-way fixed effects model controlling industry and year is created. The results of the empirical tests are shown in Table 4. The coefficient of the explanatory variable (ESG) in column (1) is 0.008, which is a significantly positive value at the 1% level, indicating that good ESG information disclosure can make significant progress in the quality development of companies and hypothesis 1 is verified. Column (2) shows that the regression coefficient of the corporate environmental disclosure variable (E) is significantly positive at the 1% confidence level. Hypothesis 1a is tested. From the regression results in column (3), it can be seen that the regression coefficient of the corporate social disclosure variable (S) is significantly positive at the 1% confidence level, indicating that the better the corporate disclosure social information is, the stronger its positive influence on the high-quality development of the company and hypothesis 2c is confirmed. From the regression results in column (4), the regression coefficient of the corporate governance information variable (G) is significantly positive at the 5% confidence level, indicating that corporate governance information disclosure promotes high-quality corporate development. Hypothesis 1c is verified. In comparison, the coefficient and significance of corporate governance are not as high as those of environmental disclosure and social disclosure. This may be because Chinese companies are more concerned about environmental and social responsibility (Ge et al., 2022). Enterprises establish a good image of environmental and social responsibility by purifying air emissions, researching and innovating new energy sources, establishing good community and customer relations, diversifying the structure of employees. However, there is a lack of focus on corporate governance such as boards, audits and oversight. Another possible reason is that companies pay more attention to external stakeholders, such as government, suppliers, customers, investors(Al Amosh et al., 2023). According to Chinese conditions, there is a third possible reason. China corporate governance model is characterized by a mixed model with both administrative and economic governance characteristics(Zhao, 2022). This increases the political cost of business, especially for state-owned enterprises, which will result in inefficient investment(Chen et al., 2011) and can be detrimental to the growth of corporate value (Xie et al., 2022).

5.4. Robustness Test

5.4.1 Alternative Measurement for ESG

Based on the regression analysis, this article conducted a robustness test, first by replacing the measurement method of the independent variables. The *Huazheng* ESG rating is used as a proxy variable for corporate ESG information disclosure. Table 5 reports the regression results after changing the explanatory variable measurement method. A corporation's high-quality development level is improved by corporate ESG information disclosure, according to the regression coefficient of corporate ESG information disclosure (ESG-HZ), which is 0.01 and significantly positive at the 1% level. The regression coefficient of corporate environmental disclosure (E - HZ) is 0.015 and is significantly positive at the 1% level. The regression coefficient of corporate social disclosure (S-HZ) is 0.005 and is significantly positive at the 5% level. The regression coefficient of corporate governance disclosure (G-HZ) is 0.005 and is significantly positive at the 10% level. The findings demonstrate that the high-quality development of companies is supported by the disclosure of corporate environmental, social, and governance information. The conclusion of this paper is still valid after changing the explained variables.

5.4.2 Alternative Measurement for High-Quality Development of Enterprises

This article changes the measurement method of high-quality development of enterprises. OP method (Olley and Pakes, 1992) is used to measure the high-quality development of firms. Table 6 reports the regression results after changing the explained variables. Corporate ESG information disclosure has a regression coefficient of 0.006 and is significantly positive at the 1% level, suggesting that it encourages the development of corporations with high standards. Regarding the three dimensions, the corporate environmental disclosure regression coefficient is 0.004 and is significantly positive at the 1% level, while the corporate social disclosure regression coefficient is 0.006 and is also significantly positive at the 1% level. These results suggest that the disclosure of corporate environmental and social information promotes the high-quality development of corporations. But according to the OP method, there is no connection between corporate governance disclosure and high-quality corporate development. The reason may be that in the actual economic operation, the investment amount of some companies in the year is less than or equal to zero, and such sample values are invalid under the OP method (Huo & Wang, 2015). This leads to a decrease in the estimation accuracy and has a certain impact on the regression results. In summary, after changing the measurement method of the explained variables, except for the results of corporate governance disclosure, other results remain robust.

Table 3
Correlation coefficient matrix

	HQD	ESG	E	S	G	Green	Asset	Leverage	ROA	Growth	Flow	Tobin	Intang	IDR
HQD	1													
ESG	0.428***	1												
E	0.376***	0.877***	1											
S	0.311***	0.743***	0.689***	1										
G	0.307***	0.756***	0.402***	0.303***	1									
Green	0.291***	0.226***	0.227***	0.202***	0.125***	1								
Asset	0.804***	0.481***	0.414***	0.337***	0.365***	0.290***	1							
Leverage	0.498***	0.117***	0.109***	0.060***	0.079***	0.171***	0.510***	1						
ROA	0.021*	0.048***	0.056***	0.059***	0.007	-0.01	-0.106***	-0.441***	1					
Growth	0.083***	0.060***	0.054***	0.030***	0.052***	0.003	0.005	-0.01	0.315***	1				
Flow	0.064***	0.114***	0.103***	0.084***	0.079***	0.005	-0.005	-0.242***	0.542***	0.095***	1			
Tobin	-0.312***	-0.070***	-0.071***	-0.045***	-0.043***	-0.080***	-0.421***	-0.423***	0.443***	0.163***	0.246***	1		
Intang	-0.026**	0.020*	0.023**	0.026**	0.004	-0.042***	0.075***	0.056***	-0.075***	-0.016	0.039***	-0.082***	1	
IDR	0.099***	0.087***	0.062***	0.061***	0.086***	0.025**	0.093***	0.023*	0.023**	-0.016	0.029**	0.032***	-0.036***	1

The table reports Pearson's correlation coefficients.

Note: (*** p < 0.01 **p < 0.05 * p < 0.1)

Table 4
Panel fixed effect regression results

	(1) HQD	(2) HQD	(3) HQD	(4) HQD
ESG	0.008*** (8.21)			
E		0.004*** (7.21)		
S			0.006*** (7.26)	
G				0.002** (2.52)
Asset	0.607*** (82.82)	0.615*** (86.72)	0.618*** (89.24)	0.627*** (89.90)
Leverage	1.026*** (22.43)	1.017*** (22.22)	1.031*** (22.48)	1.008*** (21.97)
ROA	2.292*** (15.47)	2.287*** (15.42)	2.287*** (15.42)	2.308*** (15.51)
Growth	0.101*** (4.95)	0.101*** (4.93)	0.103*** (5.01)	0.103*** (5.02)
Flow	1.006*** (8.67)	1.020*** (8.79)	1.035*** (8.91)	1.034*** (8.88)
Tobin	-0.019*** (-3.45)	-0.018*** (-3.23)	-0.018*** (-3.22)	-0.017*** (-3.07)
Intang	-0.908*** (-7.41)	-0.907*** (-7.40)	-0.913*** (-7.45)	-0.893*** (-7.27)
IDR	0.002* (1.84)	0.002** (1.99)	0.002** (1.96)	0.002** (1.98)
cons	1.913*** (12.21)	1.933*** (12.12)	1.789*** (11.61)	1.546*** (10.21)
N	7455	7455	7455	7455
r2	0.758	0.758	0.758	0.756
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes

t statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Table 5
Alternative measurement for ESG

	(1) A	(2) B	(3) C	(4) D
ESG-HZ	0.010*** (2.92)			
E-HZ		0.015*** (5.16)		
S-HZ			0.005** (2.22)	
G-HZ				0.005* (1.87)
Asset	0.638*** (177.38)	0.637*** (177.39)	0.640*** (180.85)	0.640*** (179.65)
Leverage	0.977*** (40.54)	0.965*** (40.22)	0.968*** (40.37)	0.980*** (39.87)
ROA	2.345*** (31.64)	2.369*** (32.36)	2.359*** (32.00)	2.356*** (31.75)
Growth	0.131*** (11.71)	0.132*** (11.79)	0.130*** (11.58)	0.131*** (11.68)
Flow	0.694*** (11.35)	0.687*** (11.24)	0.695*** (11.36)	0.693*** (11.33)
Tobin	-0.012*** (-3.62)	-0.011*** (-3.49)	-0.012*** (-3.70)	-0.012*** (-3.70)
Intang	-1.106*** (-14.35)	-1.112*** (-14.42)	-1.108*** (-14.38)	-1.106*** (-14.35)
IDR	-0.001 (-1.25)	-0.001 (-0.97)	-0.001 (-1.02)	-0.001 (-1.27)
cons	1.532*** (19.46)	1.574*** (19.85)	1.519*** (19.31)	1.520*** (19.32)
N	23271	23271	23271	23271
r2	0.770	0.770	0.770	0.770
Industry	Yes	Yes	Yes	Yes
year	Yes	Yes	Yes	Yes

t statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01

Table 6
Alternative measurement for high-Quality development of enterprises

	(1) A	(2) B	(3) C	(4) D
ESG	0.006*** (6.54)			
E		0.004*** (6.89)		
S			0.006*** (6.36)	
G				-0.000 (-0.02)
Asset	0.401*** (53.27)	0.405*** (55.62)	0.409*** (57.53)	0.422*** (58.93)
Leverage	0.826*** (17.57)	0.820*** (17.47)	0.833*** (17.67)	0.808*** (17.14)
ROA	1.996*** (13.11)	1.990*** (13.07)	1.991*** (13.07)	2.005*** (13.13)
Growth	0.183*** (8.70)	0.183*** (8.67)	0.184*** (8.74)	0.185*** (8.75)
Flow	0.455*** (3.82)	0.463*** (3.88)	0.478*** (4.01)	0.487*** (4.07)
Tobin	-0.0167*** (-2.95)	-0.0160*** (-2.82)	-0.0158*** (-2.79)	-0.0146** (-2.57)
Intang	-1.248*** (-9.92)	-1.250*** (-9.94)	-1.254*** (-9.97)	-1.238*** (-9.81)
IDR	0.000984 (0.87)	0.00110 (0.97)	0.00109 (0.96)	0.00122 (1.07)
cons	5.098*** (31.66)	5.174*** (31.62)	5.015*** (31.69)	4.811*** (30.93)
N	7455	7455	7455	7455
r2	0.620	0.620	0.620	0.618
Industry	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes

t statistics in parentheses
* p<0.1, ** p<0.05, *** p<0.01

5.4.3 Endogeneity Problems Alleviation

Baseline regression results may suffer from endogeneity problems. Therefore, this paper uses instrumental variable methods to alleviate the endogeneity problem. After referring to the research of some scholars, this article constructs two instrumental variables. The first instrumental variable is the industry ESG average after excluding the individual company's own ESG (Arian et al., 2022; Bhatia & Marwaha, 2022; Gholami et al., 2022). The symbol of this variable is *demean*. And the second instrumental variable is the level of institutional ownership (Aluchna et al., 2022; Lavin & Montecinos-Pearce, 2021; Velte, 2020) and the symbol is *Coz*.

Because the number of instrumental variables is greater than the number of endogenous independent variables, to improve the robustness and accuracy of the model, this article uses the IV-GMM regression method for estimation. Columns (2) and (3) of Table7 show the results that use the instrumental variable method to deal with the endogeneity problem in the benchmark model. At the 1% significance level, the estimated coefficients of the two instrumental variables on the endogenous variables pass the test and are both positive. That means that the greater the values of *demean* and *Coz*, the better the corporate ESG information disclosure. The F statistic is 2764.762, which is much larger than the weak ID test critical values, indicating that weak instrumental variables do not exist. The two instrumental variables are exogenous, as indicated by the p value of 0.6281 in the Hansen J statistic.

From the perspective of the coefficient direction, ESG information disclosure significantly positively affects the high-quality development of enterprises when compared to the regression results of the benchmark model (column (1)). The estimated coefficient rises from 0.008 to 0.009 when viewed from the standpoint of coefficient size, suggesting that endogenous issues cause the Panel fixed effect regression to underestimate the marginal impact of ESG information disclosure on the high-quality development of companies.

Table 7
The 2sls IV-GMM regression method results

	（1）	（2）	（3）
	Panel fixed effect regression	First-stage	2-Step GMM estimation
Variables	HQD	ESG	HQD
ESG	0.008***		0.009***
	(8.21)		(8.1)
demean		0.883***	
		(64.16)	
Coz3		3.846***	
		(3.51)	
Asset	0.607***	2.115***	0.542***
	(82.82)	(10.65)	(31.32)
Leverage	1.026***	-4.47***	0.484***
	(22.43)	(-5.74)	(7.54)
ROA	2.292***	0.057	1.528***
	(15.47)	(0.04)	(13.02)
Growth	0.101***	-0.251	0.172***
	(4.95)	(-1.32)	(10.94)
Flow	1.006***	0.678	0.784***
	(8.67)	(0.58)	(9.99)
Tobin	-0.0191***	0.348***	0.00131
	(-3.45)	(5.66)	(0.36)
Intang	-0.908***	4.977*	-0.362*
	(-7.41)	(1.85)	(-1.66)
IDR	0.00203*	0.038**	0.00137
	(1.84)	(2.48)	(1.44)
N	7455	7402	7402
r2	0.758	0.676	0.626
F		2764.76	
Hansen J			P= 0.628
Industry	Yes	Yes	Yes
year	Yes	Yes	Yes

t statistics in parentheses
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5.5 Mechanism Analysis of Green Technology Innovation

This article chooses to refer to (Baron & Kenny, 1986)'s causal steps approach and Wen and Ye (2014)'s mediation effect test method to verify the mediation mechanism of green technology innovation between ESG information disclosure and high-quality development of enterprises. To improve statistical power, the Sobel test and Bootstrap test (drawing bootstrap samples 1000 times) will also be involved in the study. Table 8 reflects the results.

Columns (1) and (2) examine the green technology innovation mechanism between ESG disclosure and high-quality corporate development. In column (1), the ESG disclosure coefficient is significantly positive. That means companies with strong ESG practices are more likely to innovate in green technologies. This may be because good ESG practices often involve advances in technology, especially those that can reduce a company's environmental damage or enhance its social responsibility (El Hazbi & Mounir, 2023). The influence coefficients of green technology innovation and ESG information disclosure on HQD are significantly positive in column (2). The coefficient of the Sobel test is positive and significant at 1% level. In the Bootstrap test, the P value of indirect effect $\beta_1\alpha_2$was less than 0.01 and the 95% confidence interval did not contain 0, indicating the existence of intermediary effect and hypothesis 2 is supported.

Column (3) and (4) examines the mechanism of green technology innovation between corporate environmental disclosure (E) and corporate high-quality development (HQD). The results show that the intermediary effect exists and hypothesis 2a is supported. Column (5) and (6) reflect that information disclosure of corporate social responsibilities is helpful for companies to absorb innovative resources, gain investment willingness, enhance teamwork efficiency, and promote high-quality corporate development. The hypothesis 2b is supported.

Column (7) and (8) examine the mechanism of green technology innovation between corporate governance disclosure (G) and high-quality corporate development (HQD). The Bootstrap test shows that the P value of the indirect effect is 0.107, and the 95% confidence interval includes 0, indicating that the indirect effect is not significant. It indicates that green technology innovation does not have a mediating effect between corporate governance disclosure and high-quality development of companies. The hypothesis 3c is not established. The reason may be that the internal organizational models of China listed companies are relatively complex, and the level of corporate governance cannot improve total factor productivity by improving the organizational innovation of enterprises.

Table 8

The mediation mechanism of green technology innovation

	（1）	（2）	（3）	（4）	（5）	（6）	（7）	（8）
	Green	HQD	Green	HQD	Green	HQD	Green	HQD
ESG	0.0149***	0.00716***						
	(8.40)	(7.48)						
E			0.00772***	0.00343***				
			(7.90)	(6.51)				
S					0.0158***	0.00562***		
					(9.76)	(6.40)		
G							0.00264*	0.00191**
							(1.76)	(2.36)
Green		0.0464***		0.0472***		0.0464***		0.0506***
		(7.44)		(7.57)		(7.42)		(8.13)
Asset	0.210***	0.597***	0.223***	0.604***	0.224***	0.608***	0.252***	0.614***
	(15.48)	(80.50)	(16.95)	(83.95)	(17.45)	(86.30)	(19.46)	(86.29)
Leverage	0.648***	0.996***	0.631***	0.987***	0.673***	1.000***	0.610***	0.977***
	(7.63)	(21.77)	(7.44)	(21.57)	(7.94)	(21.79)	(7.17)	(21.31)
ROA	0.556**	2.266***	0.546**	2.262***	0.539**	2.262***	0.584**	2.278***
	(2.02)	(15.35)	(1.99)	(15.30)	(1.97)	(15.31)	(2.11)	(15.38)
Growth	-0.119***	0.107***	-0.120***	0.107***	-0.117***	0.108***	-0.115***	0.109***
	(-3.13)	(5.24)	(-3.15)	(5.22)	(-3.09)	(5.29)	(-3.02)	(5.32)
Flow	-0.209	1.016***	-0.186	1.029***	-0.161	1.042***	-0.150	1.042***
	(-0.97)	(8.79)	(-0.86)	(8.90)	(-0.75)	(9.01)	(-0.69)	(8.98)
Tobin	0.008	-0.019***	0.010	-0.018***	0.001	-0.018***	0.012	-0.018***
	(0.80)	(-3.53)	(1.00)	(-3.33)	(0.95)	(-3.32)	(1.20)	(-3.19)
Intang	-0.941***	-0.864***	-0.942***	-0.863***	-0.962***	-0.868***	-0.914***	-0.847***
	(-4.14)	(-7.08)	(-4.15)	(-7.06)	(-4.24)	(-7.10)	(-4.01)	(-6.91)
IDR	-0.003	0.002**	-0.003	0.002**	-0.003	0.002**	-0.003	0.002**
	(-1.47)	(1.97)	(-1.32)	(2.11)	(-1.39)	(2.09)	(-1.28)	(2.10)
cons	-4.859***	2.138***	-4.772***	2.158***	-4.961***	2.019***	-5.545***	1.827***
	(-16.73)	(13.45)	(-16.15)	(13.36)	(-17.41)	(12.89)	(-19.73)	(11.81)
N	7455	7455	7455	7455	7455	7455	7455	7455
r2	0.178	0.760	0.177	0.759	0.181	0.759	0.171	0.758
r2_a	0.175	0.759	0.174	0.758	0.177	0.758	0.167	0.757
Industry	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sobel	0.00069*** (Z= 5.57)		0.00036*** (Z= 5.466)		0.00073*** (Z=5.908)		0.00013* (Z=1.717)	
Bootstrap	0.000		0.000		0.000		0.107	
Bootstrap	(0.00043, 0.00095)		(0.00023,0.00050)		(0.00051,0.00096)		(-0.00003,0.00030)	

t statistics in parentheses

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6. Discussion

The ESG concept embodies the values of sustainable development and is increasingly recognized by people. This article primarily examines the relationship between ESG information disclosure and high-quality enterprise development in the context of China's economic transformation to a high-quality state, as well as the mechanisms influencing this relationship from the standpoint of green technology innovation. The research samples are A-share non-financial listed companies from 2013 to 2022 in China. Research results show that corporate ESG information disclosure can significantly promote high-quality corporate development. The results of this article are consistent with the research of Ge et al. (2022), Lian (2023), Miralles-Quirós et al. (2018) on the role of enterprise ESG information disclosure in promoting high-quality corporate development. This conclusion still holds true after replacing the corporate ESG information disclosure database and the measurement method of corporate high-quality development respectively. In order to further alleviate the endogeneity problem, this paper uses the instrumental variable method for regression testing. The conclusions obtained are still robust. This article examines the effects of the three ESG dimensions on high-quality corporate development and concludes that information disclosure of environment social responsibility and corporate governance all significantly contribute to the development of high-quality businesses. By contrast, social and environmental information disclosure has a greater impact on the high-quality development of businesses than corporate governance. This could be as a result of the increased focus that Chinese businesses place on external stakeholders, social and environmental contributions, and the impact of administrative governance models on internal corporate governance.

In the mechanism analysis, this article uses the causal steps approach, Sobel test and Bootstrap test to analyse the intermediary mechanism of green technology innovation between ESG information disclosure and high-quality development of corporations. The results show that companies with strong ESG practices are more likely to carry out green technology innovation. By encouraging the development of green technologies, ESG information disclosure helps businesses achieve high-quality development. This outcome aligns with earlier studies by Ge et al. (2022), Homayoun et al. (2023) and Shen et al. (2022).

The research limitations and future lines of research of this article are as follows. Firstly, high-quality development of enterprises is a relatively abstract concept. In this study, total factor productivity determined by the LP method was used to assess the level of high-quality development of corporations. The main justification for this is that the paper argues that raising total factor productivity is crucial for the growth of high-quality businesses, and it supports this claim with references from other scholars. However, high-quality corporate development may also need to consider other factors. More appropriate measures will be explored in future research. Secondly, there may be many mechanisms by which ESG information disclosure affects the high-quality development of corporations. This article only analyses one mechanism of green technology innovation. Other influencing mechanisms will be further explored in future research. Thirdly, the research sample of this article is China listed companies, so the applicability of the research conclusions is limited. In the future, the sample scope will be expanded in order to provide more theoretical and empirical evidence for related research.

7. Conclusion

This article empirically tests the relationship between ESG disclosure and high-quality corporate development and the mediating mechanism of green technology innovation using research samples of China A-share non-financial listed companies from 2013 to 2022. The results show that ESG disclosure has a significant positive impact on the development of corporate high-quality. In other words, ESG disclosure will promote high-quality development of firms. Among the three ESG dimensions, environmental disclosure and social disclosure play a more important role in promoting the development of high-quality companies. Additionally, there is a partial mediating role that green technology innovation plays between ESG information disclosure and high-quality enterprise development. Among them, information disclosure on the environmental and social dimensions of ESG can improve the quality of corporate development through corporate green technology innovation. According to the findings of this article, there are some suggestions for governments, investors and enterprises. Governments should encourage companies to disclose ESG information. Investors can refer to ESG information to make more effective investment decisions. Companies ought to integrate the ESG concept into their operations and management procedures, endeavour in the areas of environmental conservation, social responsibility, corporate governance, and green technology innovation, and contribute to the high-quality enterprise development and the advancement of sustainable economic growth.

References

Al Amosh, H., Khatib, S. F. A., & Ananzeh, H. (2023). Environmental, social and governance impact on financial performance: Evidence from the Levant countries. *Corporate Governance: The International Journal of Business in Society*, *23*(3), 493–513. https://doi.org/10.1108/CG-03-2022-0105

Aouadi, A., & Marsat, S. (2018). Do ESG Controversies Matter for Firm Value? Evidence from International Data. *Journal of Business Ethics*, *151*(4), 1027–1047. https://doi.org/10.1007/s10551-016-3213-8

Arian, A. G., Sands, J., & Shams, S. (2022). *The Impact of Corporate ESG Performance Disclosure across Australian Industries* (SSRN Scholarly Paper 4279073). https://papers.ssrn.com/abstract=4279073

Atan, R., Alam, Md. M., Said, J., & Zamri, M. (2018). The impacts of environmental, social, and governance factors on firm performance: Panel study of Malaysian companies. *Management of Environmental Quality: An International Journal*, *29*(2), 182–194. https://doi.org/10.1108/MEQ-03-2017-0033

Balachandran, B., & Faff, R. (2015). Corporate governance, firm value and risk: Past, present, and future. *Pacific-Basin Finance Journal*, *35*, 1–12. https://doi.org/10.1016/j.pacfin.2015.07.002

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, *51*, 1173–1182. https://doi.org/10.1037/0022-3514.51.6.1173

Bhatia, S., & Marwaha, D. (2022). The Influence of Board Factors and Gender Diversity on the ESG Disclosure Score: A Study on Indian Companies. *Global Business Review*, *23*(6), 1544–1557. https://doi.org/10.1177/09721509221132067

Birindelli, G., Ferretti, P., Intonti, M., & Iannuzzi, A. P. (2015). On the drivers of corporate social responsibility in banks: Evidence from an ethical rating model. *Journal of Management & Governance*, *19*(2), 303–340. https://doi.org/10.1007/s10997-013-9262-9

Bloom, N., Eifert, B., Mahajan, A., McKenzie, D., & Roberts, J. (2013). Does Management Matter? Evidence from India *. *The Quarterly Journal of Economics*, *128*(1), 1–51. https://doi.org/10.1093/qje/qjs044

Boeing, P., & Mueller, E. (2016). Measuring patent quality in cross-country comparison. *Economics Letters*, *149*, 145–147. https://doi.org/10.1016/j.econlet.2016.10.039

Bozec, Y., & Bozec, R. (2011). Corporate governance quality and the cost of capital. *International Journal of Corporate Governance*, *2*(3–4), 217–236. https://doi.org/10.1504/IJCG.2011.044376

Chen, S., & Shen, T. (2022). Does ESG Rating Affect Corporate Innovation? *Frontiers in Business, Economics and Management*, *4*(1), 94–99. https://doi.org/10.54097/fbem.v4i1.510

Chen, S., Sun, Z., Tang, S., & Wu, D. (2011). Government intervention and investment efficiency: Evidence from China. *Journal of Corporate Finance*, *17*(2), 259–271. https://doi.org/10.1016/j.jcorpfin.2010.08.004

Dai, D., & Xue, Y. (2022). The Impact of Green Innovation on a Firm's Value from the Perspective of Enterprise Life Cycles. *Sustainability*, *14*(3), Article 3. https://doi.org/10.3390/su14031226

Deng, X., & Cheng, X. (2019). Can ESG Indices Improve the Enterprises' Stock Market Performance?—An Empirical Study from China. *Sustainability*, *11*(17), Article 17. https://doi.org/10.3390/su11174765

Drempetic, S., Klein, C., & Zwergel, B. (2020). The Influence of Firm Size on the ESG Score: Corporate Sustainability Ratings Under Review. *Journal of Business Ethics*, *167*(2), 333–360. https://doi.org/10.1007/s10551-019-04164-1

Driessen, P. H., Hillebrand, B., Kok, R. A. W., & Verhallen, T. M. M. (2013). Green New Product Development: The Pivotal Role of Product Greenness. *IEEE Transactions on Engineering Management*, *60*(2), 315–326. https://doi.org/10.1109/TEM.2013.2246792

Du, K., Cheng, Y., & Yao, X. (2021). Environmental regulation, green technology innovation, and industrial structure upgrading: The road to the green transformation of Chinese cities. *Energy Economics*, *98*, 105247. https://doi.org/10.1016/j.eneco.2021.105247

Duque-Grisales, E., & Aguilera-Caracuel, J. (2021). Environmental, Social and Governance (ESG) Scores and Financial Performance of Multilatinas: Moderating Effects of Geographic International Diversification and Financial Slack. *Journal of Business Ethics*, *168*(2), 315–334. https://doi.org/10.1007/s10551-019-04177-w

El Hazbi, F., & Mounir, Y. (2023). Environmental, social, and governance (ESG) practices and Environmental performance: The mediation role of Technology Innovation. *E3S Web of Conferences*, *412*, 01009. https://doi.org/10.1051/e3sconf/202341201009

El Khoury, R., Nasrallah, N., & Alareeni, B. (2021). ESG and financial performance of banks in the MENAT region: Concavity–convexity patterns. *Journal of Sustainable Finance & Investment*, 1–25. https://doi.org/10.1080/20430795.2021.1929807

Fatemi, A., Glaum, M., & Kaiser, S. (2018). ESG performance and firm value: The moderating role of disclosure. *Global Finance Journal*, *38*, 45–64. https://doi.org/10.1016/j.gfj.2017.03.001

Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, *5*(4), 210–233. https://doi.org/10.1080/20430795.2015.1118917

Ge, G., Xiao, X., Li, Z., & Dai, Q. (2022). Does ESG Performance Promote High-Quality Development of Enterprises in China? The Mediating Role of Innovation Input. *Sustainability*, *14*(7), Article 7. https://doi.org/10.3390/su14073843

Gholami, A., Sands, J., & Rahman, H. U. (2022). Environmental, Social and Governance Disclosure and Value Generation: Is the Financial Industry Different? *Sustainability*, *14*(5), Article 5. https://doi.org/10.3390/su14052647

Harrison, J. S., & Wicks, A. C. (2013). Stakeholder Theory, Value, and Firm Performance. *Business Ethics Quarterly*, *23*(1), 97–124. https://doi.org/10.5840/beq20132314

Hojnik, J., & Ruzzier, M. (2016). The driving forces of process eco-innovation and its impact on performance: Insights from Slovenia. *Journal of Cleaner Production*, *133*, 812–825. https://doi.org/10.1016/j.jclepro.2016.06.002

Homayoun, S., Mashayekhi, B., Jahangard, A., Samavat, M., & Rezaee, Z. (2023). The Controversial Link between CSR and Financial Performance: The Mediating Role of Green Innovation. *Sustainability*, *15*(13), Article 13. https://doi.org/10.3390/su151310650

Hu, A., Yuan, X., Fan, S., & Wang, S. (2023). The Impact and Mechanism of Corporate ESG Construction on the Efficiency of Regional Green Economy: An Empirical Analysis Based on Signal Transmission Theory and Stakeholder Theory. *Sustainability*, *15*(17), Article 17. https://doi.org/10.3390/su151713236

Huo, W., & Wang, M. (2015). Comparative Test and Correction of 'Productivity

Paradox' in Chinese export Enterprises. *Science of Finance and Economics* (09),120-131.https://kns.cnki.net/kcms/detail/detail.aspx?FileName=CJKX201509013&DbName=CJFQ2015

Ishak, I., Jamaludin, R., & Abu, N. H. (2017). Green Technology Concept and Implementataion: A Brief Review of Current Development. *Advanced Science Letters*, *23*(9), 8558–8561. https://doi.org/10.1166/asl.2017.9928

Jaffe, A. B., & de Rassenfosse, G. (2017). Patent citation data in social science research: Overview and best practices. *Journal of the Association for Information Science and Technology*, *68*(6), 1360–1374. https://doi.org/10.1002/asi.23731

Judd, C. M., & Kenny, D. A. (1981). Process Analysis: Estimating Mediation in Treatment Evaluations. *Evaluation Review*, *5*(5), 602–619. https://doi.org/10.1177/0193841X8100500502

Kong, G., Wang, S., & Wang, Y. (2022). Fostering firm productivity through green finance: Evidence from a quasi-natural experiment in China. *Economic Modelling*, *115*, 105979. https://doi.org/10.1016/j.econmod.2022.105979

Lee, C.-C., Zhong, Q., Wen, H., & Song, Q. (2023). Blessing or curse: How does sustainable development policy affect total factor productivity of energy-intensive enterprises? *Socio-Economic Planning Sciences*, *89*, 101709. https://doi.org/10.1016/j.seps.2023.101709

Lee, D. D., Faff, R. W., & Langfield-Smith, K. (2009). Revisiting the Vexing Question: Does Superior Corporate Social Performance Lead to Improved Financial Performance? *Australian Journal of Management*, *34*(1), 21–49. https://doi.org/10.1177/0312896209034001O3

Lee, L.-C., Lau, W.-Y., & Yip, T.-M. (2023). Do Environmental, Social and Corporate Governance Practices Enhance Malaysian Public-Listed Companies Performance? *Institutions and Economies*, 5–32. https://doi.org/10.22452/IJIE.vol15no3.1

Levinsohn, J., & Petrin, A. (2003). Estimating Production Functions Using Inputs to Control for Unobservables. *The Review of Economic Studies*, *70*(2), 317–341. https://doi.org/10.1111/1467-937X.00246

Lian, X. (2023). Digital Finance and Total Factor Productivity: Evidence from China. In J. Yen, M. Z. Abedin, & W. A. S. B. Wan Ngah (Eds.), *Proceedings of the 2nd International Academic Conference on Blockchain, Information Technology and Smart Finance (ICBIS 2023)* (Vol. 14, pp. 857–864). Atlantis Press International BV. https://doi.org/10.2991/978-94-6463-198-2_88

Liu, X., & Zhang, C. (2017). Corporate governance, social responsibility information disclosure, and enterprise value in China. *Journal of Cleaner Production*, *142*, 1075–1084. https://doi.org/10.1016/j.jclepro.2016.09.102

Liu, Y., Chen, Y., Ren, Y., & Jin, B. (2021). Impact mechanism of corporate social responsibility on sustainable technological innovation performance from the perspective of corporate social capital. *Journal of Cleaner Production*, *308*, 127345. https://doi.org/10.1016/j.jclepro.2021.127345

Luo, Y., Wu, H., Ying, S. X., & Peng, Q. (2022). Do company visits by institutional investors mitigate managerial myopia in R&D investment? Evidence from China. *Global Finance Journal*, *51*, 100694. https://doi.org/10.1016/j.gfj.2021.100694

McWilliams, A., Siegel, D. S., & Wright, P. M. (2006). Corporate Social Responsibility: Strategic Implications*. *Journal of Management Studies*, *43*(1), 1–18. https://doi.org/10.1111/j.1467-6486.2006.00580.x

Miralles-Quirós, M. M., Miralles-Quirós, J. L., & Valente Gonçalves, L. M. (2018). The Value Relevance of Environmental, Social, and Governance Performance: The Brazilian Case. *Sustainability*, *10*(3), Article 3. https://doi.org/10.3390/su10030574

Molden, L. H., & Clausen, T. H. (2021). Playing 3D chess, or how firms can thrive under complexity: The mediating role of innovation capabilities in the use of innovation input. *Journal of Business Research*, *125*, 1–13. https://doi.org/10.1016/j.jbusres.2020.11.049

Ng, T.-H., Lye, C.-T., Chan, K.-H., Lim, Y.-Z., & Lim, Y.-S. (2020). Sustainability in Asia: The Roles of Financial Development in Environmental, Social and Governance (ESG) Performance. *Social Indicators Research*, *150*(1), 17–44. https://doi.org/10.1007/s11205-020-02288-w

Nguyen, T. H. H., Elmagrhi, M. H., Ntim, C. G., & Wu, Y. (2021). Environmental performance, sustainability, governance and financial performance: Evidence from heavily polluting industries in China. *Business Strategy and the Environment*, *30*(5), 2313–2331. https://doi.org/10.1002/bse.2748

Nollet, J., Filis, G., & Mitrokostas, E. (2016). Corporate social responsibility and financial performance: A non-linear and disaggregated approach. *Economic Modelling*, *52*, 400–407. https://doi.org/10.1016/j.econmod.2015.09.019

Olley, G. S., & Pakes, A. (1992). *The Dynamics of Productivity in the Telecommunications Equipment Industry* (w3977). National Bureau of Economic Research. https://doi.org/10.3386/w3977

Padilla-Lozano, C. P., & Collazzo, P. (2021). Corporate social responsibility, green innovation and competitiveness – causality in manufacturing. *Competitiveness Review: An International Business Journal*, *32*(7), 21–39. https://doi.org/10.1108/CR-12-2020-0160

Pavelin, S., & Porter, L. A. (2008). The Corporate Social Performance Content of Innovation in the U.K. *Journal of Business Ethics*, *80*(4), 711–725. https://doi.org/10.1007/s10551-007-9464-7

Riillo, C. A. F. (2017). Beyond the question "Does it pay to be green?": How much green? And when? *Journal of Cleaner Production*, *141*, 626–640. https://doi.org/10.1016/j.jclepro.2016.09.039

Shen, Y., Zheng, H., Cai, H., Chen, X., Liu, Y., Ma, S., & Zhao, X. (2022). ESG Performance, R&D Innovation and High Quality Development of Corporate: A Perspective Based on Firm Performance. *Industrial Engineering and Innovation Management*, *5*(6), 23–34. https://doi.org/10.23977/ieim.2022.050604

Sun, G., Guo, C., Ye, J., Ji, C., Xu, N., & Li, H. (2022). How ESG Contribute to the High-Quality Development of State-Owned Enterprise in China: A Multi-Stage fsQCA Method. *Sustainability*, *14*(23), Article 23. https://doi.org/10.3390/su142315993

Tan, Y., & Zhu, Z. (2022). The effect of ESG rating events on corporate green innovation in China: The mediating role of financial constraints and managers' environmental awareness. *Technology in Society*, *68*, 101906. https://doi.org/10.1016/j.techsoc.2022.101906

Velte, P. (2017). Does ESG performance have an impact on financial performance? Evidence from Germany. *Journal of Global Responsibility*, *8*(2), 169–178. https://doi.org/10.1108/JGR-11-2016-0029

Waheed, A., & Zhang, Q. (2022). Effect of CSR and Ethical Practices on Sustainable Competitive Performance: A Case of Emerging Markets from Stakeholder Theory Perspective. *Journal of Business Ethics*, *175*(4), 837–855. https://doi.org/10.1007/s10551-020-04679-y

Wang, H., Zhang, G., Hu, W., Cao, D., Li, J., Xu, S., Xu, D., & Chen, Z. (2020). Artificial intelligence based approach to improve the frequency control in hybrid power system. *Energy Reports*, *6*, 174–181. https://doi.org/10.1016/j.egyr.2020.11.097

Wen, Z., & Ye, B. (2014). Analyses of Mediating Effects: The Development of Methods and Models. *Advances in Psychological Science*, *22*(5), 731. https://doi.org/10.3724/SP.J.1042.2014.00731

Xiang, T. C., Talib, Z. M., & Johar, M. G. M. (2023). An analysis of sustainable change management for quality 4.0: Evidence from hybrid project management adoption in the Malaysian FinTech context. *Journal of Project Management*, *8*(4), 253–272. https://doi.org/10.5267/j.jpm.2023.6.001

Xiao, Z., Peng, H., & Pan, Z. (2022). Innovation, external technological environment and the total factor productivity of enterprises. *Accounting & Finance*, *62*(1), 3–29. https://doi.org/10.1111/acfi.12779

Xie, S., Lin, B., & Li, J. (2022). Political Control, Corporate Governance and Firm Value: The Case of China. *Journal of Corporate Finance*, *72*, 102161. https://doi.org/10.1016/j.jcorpfin.2022.102161

Xie, X., Huo, J., & Zou, H. (2019). Green process innovation, green product innovation, and corporate financial performance: A content analysis method. *Journal of Business Research*, *101*, 697–706. https://doi.org/10.1016/j.jbusres.2019.01.010

Xu, A., Zhu, Y., & Wang, W. (2023). Micro green technology innovation effects of green finance pilot policy—From the perspectives of action points and green value. *Journal of Business Research*, *159*, 113724. https://doi.org/10.1016/j.jbusres.2023.113724

Xu, J., Liu, F., & Shang, Y. (2021). R&D investment, ESG performance and green innovation performance: Evidence from China. *Kybernetes*, *50*(3), 737–756. https://doi.org/10.1108/K-12-2019-0793

Yankovskaya, V., Gerasimova, E. B., Osipov, V. S., & Lobova, S. V. (2022). Environmental CSR From the Standpoint of Stakeholder Theory: Rethinking in the Era of Artificial Intelligence. *Frontiers in Environmental Science*, *10*. https://doi.org/10.3389/fenvs.2022.953996

Zhang, C., & Jin, S. (2022). What Drives Sustainable Development of Enterprises? Focusing on ESG Management and Green Technology Innovation. *Sustainability*, *14*(18), Article 18. https://doi.org/10.3390/su141811695

Zhang, R., & Fu, W. (2023). Multiple large shareholders and corporate environmental performance. *Finance Research Letters*, *51*, 103487. https://doi.org/10.1016/j.frl.2022.103487

Zhao, J. (2022). Corporate governance in China. In *Derivative Actions and Corporate Governance in China* (pp. 53–102). Edward Elgar Publishing. https://www.elgaronline.com/monochap/book/9781784719111/book-part-9781784719111-10.xml

Zhao, T., Xiao, X., & Dai, Q. (2021). Transportation Infrastructure Construction and High-Quality Development of Enterprises: Evidence from the Quasi-Natural Experiment of High-Speed Railway Opening in China. *Sustainability*, *13*(23), Article 23. https://doi.org/10.3390/su132313316