Proceedings of the 8th International Conference on Economic Management and Green Development
DOI: 10.54254/2754-1169/116/20242395

Relationship Between ESG and Corporate Innovation Investment

- Based by A-share Listed Companies

Duanrong Xiao[1,a,*]

[1]*College of Financial, Jiangxi Normal University, Nanchang, China*
a. 202126804061@jxnu.edu.cn
**Corresponding author*

Abstract: ESG criteria are pivotal factors in assessing corporate performance, influencing not only a company's social reputation and investor trust but also its innovation investment decisions. Recognizing the crucial role of innovation in enterprise growth and its linkage to ESG factors, This essay examines the association between company innovation investments and ESG levels objectively. Utilizing China's A-shares as the research sample, an empirical analysis is conducted through a linear regression model. The findings conclusively reveal a notable correlation between ESG performance and the level of enterprise innovation investments. Specifically, companies with stronger ESG performance tend to invest more heavily in R&D and innovation. Conversely, enterprises with higher levels of R&D and innovation often exhibit superior ESG standards. This study underscores the mutual reinforcement between ESG practices and corporate innovation, emphasizing the importance of integrating ESG considerations into business strategies for sustainable growth and innovation.

Keywords: ESG, Enterprise innovation investments, China's A-shares

1. Introduction

The idea of ESG has gained traction in the context of sustainable development and global economic integration. As an important standard to measure the comprehensive performance of enterprises, ESG performance is not only related to the social reputation and investor confidence of enterprises but also closely related to the decision-making of enterprise innovation investment. Meanwhile, innovation is the core driving force of enterprise development, but innovation investment often requires huge resources and funds. When formulating innovation strategies, enterprises need to comprehensively consider a variety of factors, including ESG performance. Therefore, studying how ESG performance affects corporate innovation input has important theoretical significance and practical value for deepening the understanding of corporate innovation behavior and sustainable development. As the main body of China's capital market, A-share listed companies are significantly representative of their ESG performance and innovation investment.

At present, most of the literature takes developed countries as research samples for research, but the research on ESG rating in China, a developing country, has just started and has not reached a

DOI: 10.54254/2754-1169/116/20242395

consensus [1]. Most scholars believe that ESG performance has a positive impact on corporate value and can improve corporate performance. Li et al. mention that the application of ESG assists businesses in shifting their focus from "profit maximization" to "sustainable development," which is a prerequisite for achieving green and sustainable development [2]. In addition, some scholars stressed that the better the ESG performance, the more active the company is in terms of green innovation [3]. Due to the fact that ESG performance sharply increased the number of green patents issued by businesses, suggests that ESG enhanced corporate green innovation [4]. However, some scholars also said that ESG performance will not have a great impact on the innovation level of enterprises [5-6].

When compared to the previously published literature, this paper's primary contribution is to close the knowledge gap about the present state of ESG performance on the innovation investments made by businesses in developing nations.; At the same time, the current ESG level and innovation R&D investment level of Chinese enterprises are searched to clarify the effect mechanism of ESG performance on enterprise innovation R&D investment. In addition, it provides a relevant theoretical basis and future development suggestions for Chinese companies to strengthen ESG performance and innovation R&D investment.

Consequently, the study seeks to analyze and uncover the internal mechanism of the relationship between corporate innovation investment and ESG performance through empirical research on A-share listed businesses.

2. Method

2.1. Data Source and Sample Selection

Owing to the limitations of ESG level and enterprise-related data, the study samples used in this work are the A-share listed businesses in Shanghai and Shenzhen in 2022. This article eliminates certain industries with few observed values, the "special treatment" businesses, and the relatively unique banking and insurance sectors in order to guarantee the accuracy of the data. The Wind and CSMAR databases provide the original data for listed companies. The ESG rating data of China Securities is the source of ESG performance statistics

2.2. Model Building

2.2.1. Empirical Model

In order to study the impact of enterprise innovation inputs on ESG performance, the following models are constructed:

$$\text{Innova}_i = \beta_0 + \beta_1 ESG_i + \beta_2 control_i + \varepsilon \quad (1)$$

Among them, ESG is the ESG level of the enterprise, which is expressed by the rating data of China Securities; control is the control variable in the model, which includes enterprise size, enterprise leverage coefficient, equity multiplier, capital intensity and the number of shares held by the chairman.

2.2.2. Core Explanatory Variables

Concerning the practice of He continuous innovation is taken as an independent research variable, and the innovation input index (R&D funds) and innovation output index (due to the lack of comprehensive access to the new product sales revenue data of listed companies, only the number of patent applications is analyzed here) are used to reflect the sustainability of innovation [6].

DOI: 10.54254/2754-1169/116/20242395

Specifically, the innovation persistence of an enterprise in year t is equal to the sequential growth rate of the total of the number of green patent applications of the enterprise in years t-1 and t compared with the sum of the number of patent applications (or R&D funds) in years t-2 and t-1. This is multiplied by the sum of the number of patent applications or R&D costs in year t-1 and year t.

$$IIP_t = \frac{IIN_t + IIN_{t-1}}{IIN_{t-1} + IIN_{t-2}} \times (IIN_t + IIN_{t-1}) \quad (2)$$

$$OIP_t = \frac{OIN_t + OIN_{t-1}}{OIN_{t-1} + OIN_{t-2}} \times (OIN_t + OIN_{t-1}) \quad (3)$$

Where IIN is the R&D expenditure of enterprises, and OIP is the amount of patent applications of enterprises

2.2.3. Mediating Variable

In this article, the ESG performance of enterprises is reflected by selecting ESG data from China Securities Co., LTD. Combined with the actual situation of the domestic market, the ESG evaluation system builds a three-level index system from top to bottom. Using a combination of traditional and alternative data, the China Securities Index regularly assesses the environmental, social and governance (ESG) standards of listed companies and bond issuers, and accordingly assigns a rating of AAA-C. The higher the ESG rating of Huaseng reflects the higher the ESG performance of the enterprise, otherwise, there are problems in the environment, society, and governance.

2.2.4. Control Variable

Referring to previous studies, firm size (Size), firm leverage coefficient (Lev), equity multiplier (EM1), capital intensity (CAP), and the number of shares held by the chairman(CH) are selected as control variables. These variables can reflect the financial structure, resource capacity and executive incentives of enterprises.

3. Result

3.1. Descriptive Statistics

According to the samples selected in the article, A total of 213 A-share listed companies are selected in this paper, among which the mean value of ESG performance is 4.737 and the variance is 0.751, which indicates that the ESG level of listed companies varies greatly and has a certain room for improvement (Table 1).

Table 1: Descriptive statistics

	ESG	IIP	OIP	Size	Lev	EM1	CAP	CH
N	213	213	213	213	213	213	213	213
Mean	4.737	7.55E+9	70.61306	24.59924	.4950248	2.286632	1.805545	66061850
SD	0.8668	1.264E+10	157.8346	1.079600	.1731310	1.071612	1.179884	129683533
Vari	0.751	1.597E+20	24911.78	1.166	.030	1.148	1.392	1.682E+16
Mini	2.5	2.E+9	.00	22.19192	.0768563	1.096113	.4122727	.00
Max	7.0	1.E+11	1026.393	26.44375	.8956844	9.586300	11.08545	45100800

3.2. Regression Results Analysis

According to Table 2, ESG simultaneously exerts a notable beneficial impact on IIP. With a standard correlation Beta of 0.214 for ESG, it implies that IIP alters by approximately 0.214 units for each unit variation in ESG, considering other factors. Among all the variables, the standard correlation Beta of ESG is relatively high, showing its strong effect on IIP.

DOI: 10.54254/2754-1169/116/20242395

Table 2: Coefficients for IIP

	Ustd.B	Coef.Std.Error	Std.Coef.Beta	t	Sig.	Tolerance	VIF
Constant	-1.268E+11	2.030E+10	-	-6.252	.000	-	-
ESG	3.114E+9	895363758	.214	3.478	.001	.973	1.027
Size	4.799E+9	872719813	.410	5.499	.000	.660	1.514
Lev	4.429E+9	8.833E+9	.061	.501	.006	.251	3.989
EM1	-4.989E+8	1.329E+9	-.042	-.375	.007	.289	3.462
CAP	386682284	671465014	.036	.576	.056	.934	1.071
CH	-1.333	5.946	-.014	-.224	.823	.986	1.014

In addition, the t-value of ESG is 3.478, far exceeding the commonly used significance level threshold (such as 1.96 or 2.58), and the significance level is 0.001, indicating that the impact of ESG on IIP is very significant.

Table 3 shows that ESG has a notable beneficial effect on OIP. This means that the improvement of the ESG score helps to increase OIP, and the standardized coefficient Beta value of ESG is 0.170, which means that the existing impact is significant. In addition, the t-value of ESG is 32.656 and the significance level is 0.001, indicating that ESG is an important influencing factor.

Table 3: Coefficients for OIP

	Ustd.B	Coef.Std.Error	Std.Coef.Beta	t	Sig.	Tolerance	VIF
Constant	-1330.204	262.041	-	-5.076	.000	-	-
ESG	30.784	11.591	.170	2.656	.009	.972	1.029
Size	49.195	11.275	.340	4.363	.000	.658	1.519
Lev	101.274	114.100	.112	.888	.003	.250	3.994
EM1	-14.094	17.162	-.097	-.821	.049	.289	3.465
CAP	15.514	8.658	.117	1.793	.074	.934	1.070
CH	-4.41E-8	.000	-.037	-.575	.566	.986	1.014

3.3. Robustness Test

In order to enhance the reliability of the argument, this paper replaces the evaluation data samples of the core independent variables to ensure the accuracy of the regression analysis results. In this paper, the ESG rating data of Shangdao Rong Green in 2022 is replaced by the ESG rating data of Huaseng as the explanatory variable, and the CH in the control variable is modified to the TobinQ value. The research results show (Table 4) that ESGn with ESG rating data of Shangdaorong Green as the independent variable will have a positive and significant impact on IIP, and the sig level is not more than 0.05; The beta coefficient of standard drawing for ESGn, which uses Shangdao Rong Green's ESG rating data as the independent variable, is 0.456, suggesting that ESGn likewise has a strong positive influence on OIP. Furthermore, ESGn has a moderately large positive impact on OIP.

Table 4: Coefficients for IIP

	Ustd.B	Coef.Std.Error	Std.Coef.Beta	t	Sig.	Tolerance	VIF
Constant	-4.074E+11	1.432E+11		-2.844	.008		
ESG	4.926E+10	1.858E+10	.522	2.651	.012	.566	1.768
Size	198681623	2.864E+9	.014	.069	.009	.547	1.829
Lev	3.879E+10	2.619E+10	.316	1.481	.001	.481	2.079
TobinQ	-5.039E+8	4.802E+9	-.021	-.105	.009	.563	1.777
CAP	2.616E+9	1.315E+9	.323	1.989	.050	.831	1.203
EM1	-14.094	17.162	-.097	-.821	.049	.289	3.465

DOI: 10.54254/2754-1169/116/20242395

Since only the ESG rating of Shangdao Rong Green is disclosed rather than the specific score, this paper studies the rating data after assigning values (that is, A+ is defined as 10 and decreases by this integer). This paper uses the multiple linear regression model to verify the robustness of the research results, and the regression results are shown in Table 5.

Table 5: Coefficients for OIP

	Ustd.B	Coef.Std.Error	Std.Coef.Beta	t	Sig.	Tolerance	VIF
Constant	-3313.738	1253.281		-2.644	.013		
ESG	402.583	162.573	.456	2.476	.019	.566	1.768
Size	-8.807	25.060	-.066	-.351	.007	.547	1.829
Lev	606.222	229.184	.528	2.645	.001	.481	2.079
TobinQ	24.446	42.017	.107	.582	.005	.563	1.777
CAP	33.957	11.506	.448	2.951	.006	.831	1.203
EM1	-4.989E+8	1.329E+9	-.042	-.375	.007	.289	3.462

Among them, the regression coefficients of IIP and OIP are both significant at the level of 1-2%, which still indicates that enterprise ESG can positively affect the performance of enterprise innovation and R&D investment.

4. Discussion

Based on the empirical analysis results mentioned, it can indeed be deduced that the elevation of an enterprise's ESG (Environmental, Social, and Governance) level positively correlates with its innovation and R&D investment. In simpler terms, as the ESG level of a company rises, it tends to have a favorable impact on the enterprise's green innovation patents and R&D investment levels. This finding suggests that enterprises that prioritize ESG practices are more likely to invest in innovation and research, thereby contributing to the development of environmentally friendly technologies and overall corporate growth[7-8].

The positive impact of ESG on green innovation patents suggests that companies that prioritize environmental, social, and governance considerations are more likely to engage in research and development activities aimed at creating environmentally friendly technologies[9-10]. This is because such companies often have a stronger commitment to sustainability and are more aware of the need to align their business practices with societal and environmental expectations. As a result, they are more likely to invest in green technologies that can reduce their environmental footprint and contribute to sustainable development.

5. Conclusion

This article finds that innovation R&D spending and green innovation patents have a substantial positive link with ESG level. As a result, the degree of ESG may have a favorable effect on how much money businesses invest in R&D and innovation. This paper's empirical analysis reveals that companies that place a high priority on environmental sustainability are also more likely to support technological and research developments, which in turn helps to drive overall corporate progress and the development of eco-friendly solutions. The positive correlation between ESG and green innovation patents suggests that companies that prioritize these aspects are proactive in their pursuit of sustainable technology development and in coordinating their corporate operations with wider social and environmental objectives. To sum up, businesses that place a high priority on ESG practices support internal innovation and development in addition to environmental sustainability.

References

[1] *Wang, B., & Yang, M. (2022). Research on the impact mechanism of ESG performance on corporate value: Empirical evidence from China's A-share listed companies. Soft Science, 4(6), 78–84. DOI: 10.13956/j.s.1001-8409.2022.06.11.*

[2] *Li, J., et al. (2023). How do ESG affect the spillover of green innovation among peer firms? Mechanism discussion and performance study. Journal of Business Research, 158, 113648.*

[3] *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.*

[4] *Lian, Y., Li, Y., & Cao, H. (2023). How does corporate ESG performance affect sustainable development: A green innovation perspective. Frontiers in Environmental Science. DOI: https://doi.org/10.3389/fenvs.2023.1170582.*

[5] *Atan, R., Alam, M. M., Said, J., et al. (2018). The impacts of environmental, social, and governance factors on firm performance: Panel study of Malaysian companies. Management of Environmental Quality, 29(2), 182–194.*

[6] *Liu H, Lyu C. Can ESG ratings stimulate corporate green innovation? Evidence from China[J]. Sustainability, 2022, 14(19): 12516.*

[7] *He, Y., Zhou, H., & Ding, J. (2017). Studies in Science of Science (12), 1896–1909. DOI: 10.16192/j.cnki.1003-2053.2017.12.017.*

[8] *Tan Y, Zhu Z. The effect of ESG rating events on corporate green innovation in China: The mediating role of financial constraints and managers' environmental awareness[J]. Technology in Society, 2022, 68: 101906.*

[9] *Long H, Feng G F, Gong Q, et al. ESG performance and green innovation: An investigation based on quantile regression[J]. Business Strategy and the Environment, 2023, 32(7): 5102-5118.*

[10] *Wang J, Ma M, Dong T, et al. Do ESG ratings promote corporate green innovation? A quasi-natural experiment based on SynTao Green Finance's ESG ratings[J]. International Review of Financial Analysis, 2023, 87: 102623.*