

# Research on the Correlation between ESG Performance and Corporate Innovation Capability from the Perspective of CiteSpace

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## Abstract

This article uses CiteSpace software to analyze the correlation between ESG (environmental, social, and governance) performance and corporate innovation capabilities. A knowledge graph of ESG and corporate innovation research was constructed through coword analysis and timeline view analysis of the Web of Science core collection literature from 2010–2023. Research has shown that good ESG performance is a positive compensatory effect on innovation capability and that improvements in ESG performance contribute to the development of innovation activities in companies. This article provides a new perspective on how ESGs promote corporate innovation.

## Keywords

CiteSpace, enterprise innovation, ESG

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## 1. Introduction

### 1.1 Research Background

In 2006, the United Nations Principles for Responsible Investment identified environmental protection, social responsibility and corporate governance as the key indicators for assessing sustainable development and thus formally proposed the concept of ESG and established guidelines for socially responsible investment (Shen & Jiang, 2024). ESG stems from the evolution of socially responsible investment. As environmental issues and corporate governance issues become increasingly severe, affecting the long-term stable development of enterprises, investors have begun to regard these two aspects as key considerations in corporate investment decisions, which has promoted high-quality and rapid economic development (Xu & Qin, 2024). In September 2020, the Chinese government proposed the development goal of “carbon neutrality by 2060” at the United Nations General Assembly, and the ESG operation practices of enterprises received widespread attention. The rapid development of corporate ESG operation practices has also aroused widespread concern and in-depth discussion from the theoretical community.

### 1.2 Research Purpose

This paper investigates in depth the correlation between ESG performance and enterprise innovation capability, analyzes the possible factors affecting this correlation, and explores how to promote corporate innovation by improving ESG performance. The interaction between ESG performance and enterprise

innovation capability is determined, the key variables affecting this association are identified and evaluated, and an ESG practice-based enterprise innovation promotion strategy is proposed.

### 1.3 Research Significance

This study enriches the research on the correlation between ESG performance and enterprise innovation capability, expands research methods and perspectives by using scientific bibliometric tools such as CiteSpace, and provides a new theoretical basis for understanding how ESG performance affects enterprise innovation capability. This study promotes the development of interdisciplinary research, which combines the theories and methods of management, environmental science, sociology and other disciplines. It provides companies with management strategies to improve ESG performance and innovation capability, guides investors in making more effective investment decisions on the basis of ESG performance, and provides policy-makers with references to promote corporate innovation and socially sustainable development through policy guidance. Multiple stakeholders, such as enterprises, investors and the government, should be promoted to better understand and use the ESG concept to promote enterprise innovation and achieve socioeconomic development.

## 2. Theoretical Analysis and Research Assumptions

Corporate innovation is seen as a key driving force for the enhancement of market competitiveness, the creation of added value and the acquisition of excess profits, as well as the only way to achieve the goal of long-term sustainable development. In recent years, the integration of the ESG (environment, society and governance) concept has injected new vitality into corporate innovation activities, which has not only strengthened the sense of corporate social responsibility but also promoted the dual growth of social value and corporate profits.

Traditional neoclassical economics theory often neglects the positive impact of ESG factors on enterprise value. However, from the perspective of stakeholder theory, through the implementation of ESG practices, enterprises can effectively balance and meet the expectations of various stakeholders. This includes not only shareholders but also employees, customers, suppliers, the community and even society as a whole. Active environmental protection actions, the assumption of social responsibility and a transparent corporate governance mechanism can significantly enhance the trust and support of all stakeholders for the enterprise and create a favorable external environment for the development of innovation activities (Chen, 2024). Through ESG information disclosure, companies can effectively alleviate the problem of information asymmetry and improve transparency, thereby reducing financing costs and providing stable and sufficient funding support for innovation projects. Good ESG performance can send positive signals to investors, owners and employees; increase the tolerance for the failure of innovation projects; stimulate the enthusiasm of employees for innovation; improve work efficiency; and jointly promote the pace of enterprise innovation. ESG practices help create a positive image of the enterprise, enhance the brand loyalty of consumers, promote product sales, and provide a continuous market demand driving force for enterprise innovation (Yang, 2023).

According to the above analysis, good ESG performance significantly promotes corporate innovation.

## 3. Research Design

### 3.1 Sample Selection and Data Sources

To ensure the accuracy and reliability of the study, the data of Chinese A-share listed companies from 2009-2022 were carefully selected as the initial research sample, and a series of rigorous data processing measures were adopted.

After strict screening and processing, a total of 36673 high-quality sample observations were obtained, laying a solid data foundation for subsequent analysis.

## 3.2 Variable Definition

### 3.2.1 Explained Variables

The assessment of enterprise innovation (Patent) usually includes two levels: innovation investment and innovation outcomes. In terms of innovation investment, R&D expenditure is usually used as a measurement standard. In terms of innovation output, it is usually evaluated by the total number of patent applications of the enterprise. Given that enterprise innovation activities are often associated with high risks, long cycle times and greater uncertainties, considering the possible efficiency loss in the transformation of R&D investment into innovation outcomes (He, 2023). The number of patent applications plus one is taken, and the natural logarithm is taken to quantify the innovation level of the enterprise.

### 3.2.2 Explanatory Variables

Corporate ESG performance (ESG) is a comprehensive assessment of a company through the three dimensions of the environment, society and governance. In China, the ESG evaluation systems include Wind, SynTao Green Finance, Huazheng, China Securities, etc., and there are significant differences between these systems in terms of the evaluation criteria (Zhou, 2023). The Huazheng ESG evaluation system is based on the characteristics of the Chinese market, and a three-level indicator system has been constructed from top to bottom. It is favored for its wide coverage and strong timeliness. Therefore, this study chose the Huazheng ESG rating as a measure of corporate ESG performance. Surrogate indicator. To facilitate empirical research, this study assigns 1 to 9 points on each of the nine ESG ratings (from C to AAA).

### 3.2.3 Moderation Variables

Enterprise digital transformation (Digit) involves the use of contemporary technology and communication means in the production, operation and management activities of an enterprise to optimize the allocation of resources, improve operational efficiency, and change the way in which value is provided to consumers. To assess the degree of enterprise digital transformation, this study used the text analysis method to count the total number of occurrences of the five keywords “artificial intelligence technology”, “big data technology”, “cloud computing technology”, “block chain technology” and “digital technology application” in the company’s annual reports. and then add one to the sum of the times and take the natural logarithm to quantify the degree of digital transformation of the enterprise.

## 4. Empirical Analysis

### 4.1 Descriptive Statistics

On the basis of descriptive statistics, we can gain in-depth insight into the performance characteristics of the sample companies in the three dimensions of innovation, ESG performance and digital transformation. The average value of the innovation level of the sample companies is 1.547, reflecting the low overall innovation level, but the maximum value of 6.219 and standard deviation of 1.603 indicate that there are enterprises with strong innovation strength, and the innovation performance among enterprises varies significantly, which reveals the polarization in the innovation field of Chinese enterprises.

The average score of the ESG performance of the sample companies is 4.107, and the median is 4, which is generally lower than the middle level. This means that the ESG practices of most companies are still in their infancy. The wide gap between the minimum value of 1 and the maximum value of 7, as well as the standard deviation of 1.059, exposes the imbalance in the ESG performance of companies and emphasizes that the depth and breadth of the promotion and implementation of the ESG concept still need to be improved.

The average value of the sample enterprises in terms of digital transformation (Digit) was 1.351, the minimum value was 0, the maximum value was 5.298, and the standard deviation was 1.395. The data revealed that these enterprises significantly differed in their level of digital transformation, and the overall level was 1.395. The low level reflects that there is a significant gap in the degree of implementation and effect of digital transformation among enterprises.

The differences in the financial indicators of the sample companies further confirmed the diversity of the companies’ operating conditions and strategies, which may affect their investment and performance in

innovation, ESG practices and digital transformation. The differences in financial indicators not only reflect the economic health of the enterprise but also may be important factors in the innovation capability and ESG performance of the enterprise.

Table 1: Statistical description

Variable	Sample size	Mean value	Standard deviation	Minimum value	Median	Maximum value
Patent	36,673	1.547	1.603	0.000	1.386	6.219
Patenti	36,673	1.045	1.293	0.000	0.693	5.642
Patentud	36,673	1.132	1.422	0.000	0.000	5.561
ESG	36,673	4.107	1.059	1.000	4.000	7.000
Digit	36,673	1.351	1.395	0.000	1.099	5.298
Age	36,673	2.154	0.816	0.000	2.303	3.401
Cashflow	36,673	0.047	0.070	-0.235	0.045	0.283
Lev	36,673	0.429	0.206	0.035	0.423	0.931
Growth	36,673	0.168	0.422	-0.658	0.105	4.330
ROA	36,673	0.039	0.067	-0.385	0.038	0.250
Top1	36,673	0.340	0.148	0.079	0.318	0.758
Size	36,673	22.207	1.292	19.415	22.022	26.490
Dual	36,673	0.283	0.451	0.000	0.000	1.000
Ind	36,673	0.376	0.053	0.250	0.364	0.600

## 4.2 Regression Result Analysis

The results of the regression analysis show that there is a significant positive association between ESG performance and corporate innovation. This association was confirmed at the 1% significance level, and the regression coefficient was 0.203. This finding strongly supports Hypothesis H1a; that is, the good ESG practices of enterprises significantly promote innovation activities.

Table 2: Regression results

	(1) Patent	(2) Patenti	(3) Patentud	(4) Patent
ESG	0.203 (15.46)	0.160 (14.61)	0.148 (12.78)	0.132 (7.85)
Digit				-0.071 (-1.89)
ESG_Digit				0.047 (5.43)
Cashflow	0.842 (5.46)	0.452 (3.57)	0.850 (6.28)	0.891 (5.82)
Lev	0.170 (1.86)	0.165 (2.17)	0.209 (2.62)	0.173 (1.90)
Growth	-0.111 (-6.42)	-0.079 (-5.56)	-0.103 (-6.63)	-0.114 (-6.58)
ROA	1.176 (5.98)	0.992 (6.06)	0.950 (5.48)	1.155 (5.93)
Top1	-0.094 (-0.76)	-0.157 (-1.51)	0.039 (0.36)	-0.060 (-0.48)
Size	0.217 (10.29)	0.210 (11.55)	0.166 (9.02)	0.199 (9.46)
Dual	-0.009 (-0.27)	-0.005 (-0.17)	-0.006 (-0.20)	-0.021 (-0.62)
Ind	-0.552 (-1.88)	-0.406 (-1.62)	-0.306 (-1.21)	-0.581 (-2.00)
Industry	YES	YES	YES	YES
Year	YES	YES	YES	YES
_cons	-4.644 (-10.26)	-4.658 (-11.80)	-3.753 (-9.52)	-3.989 (-8.85)
N	36673	36673	36673	36673
adj. R2	0.333	0.278	0.320	0.341

By adopting proactive ESG measures, an enterprise can win wide recognition and support from internal and external stakeholders such as the market, consumers, investors and employees. The promotion of sustainable development in terms of environmental protection, social responsibility and corporate governance can also stimulate corporate innovation, thus forming a virtuous interactive circle.

## 5. Conclusions and Suggestions

Against the background of increasingly severe global environmental and social challenges and an increasingly urgent demand for high-quality economic development, the strategy of sustainable development has become a key path for enterprises to seek long-term survival and development. This study focused on the practice cases of A-share listed companies from 2009–2022 and discussed in depth the intrinsic connection between ESG (environment, social and governance) performance and corporate innovation capability. The results clearly indicate that the active implementation of the ESG concept can significantly improve the innovation level of enterprises, and it is also a key driving force for China to accelerate the formation of new productivity and achieve high-quality economic development.

On the basis of the above conclusions, this section proposes a strategy that uses digital technology as a fulcrum to promote the integration of corporate ESG practices and innovation. At present, although Chinese enterprises have made some progress in digital transformation, they still face challenges such as weak willingness for transformation and insufficient technical capabilities. Enterprises should increase their efforts in the introduction and training of talent in the digital technology field to build high-quality teams with innovative thinking and digital skills to provide talent guarantees for digital transformation. The policy support of national and local governments in digital transformation and green and low-carbon development should be fully utilized, R&D investment in digital technology and green innovation should be increased, and the application potential of digital technology in improving ESG performance should be explored.

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## Conflicts of Interest

The authors declare no conflict of interest.

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