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Review

ESG Standards in China: Bibliometric Analysis, Development Status Research, and Future Research Directions

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Abstract: Environmental, social, and governance (ESG) standards have received widespread attention in the quest for sustainable development. However, a comprehensive understanding of the current status of ESG standards, particularly in the context of China, remains a scientific gap. This study bridges this gap by adopting a bibliometric analysis to comprehensively analyze the current status of ESG standards. Based on an analysis of 213 articles involving ESG standards in the Web of Science Core Collection database from 2015 to 2024, this study identified the global distribution of ESG standards organizations, research hotspots, trends, and cutting-edge status of ESG standards research. It was found that the research on ESG standards shows a growing trend: the research hotspots mainly focus on the areas of performance, rating, investment, and sustainability. Crucially, this study offers novel insights into the current development status of ESG standards in China, emphasizing the significant roles of the government's promotion of ESG standard formulation and regulation, corporate voluntary compliance, and academic research and communication. Future research directions on ESG standards are proposed and imply that the implementation of ESG standards in China should be beneficial to sustainable development.

Keywords: ESG; ESG standards; CiteSpace; bibliometric analysis; ESG disclosure

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1. Introduction

Environmental, social, and governance (ESG), an emerging concept that combines social harmony, environmental management, and economic development, is essential for advancing sustainable development and promoting harmonious relations between people and the environment [1,2]. ESG incorporates its three elemental factors into operational processes and corporate management, in the same vein as the corporate social responsibility (CSR) advocated in the past. Companies that fulfill their ESG responsibilities can create a positive social image [3]. In the contemporary context of corporate governance and financial decision-making, ESG has increasingly emerged as a crucial set of factors that influences the pursuit of environmental sustainability [4–8]. At the investment level, ESG investments incorporate ESG factors in their assessments, research, and strategies. ESG disclosure, ESG ratings, and ESG investments constitute the ESG system. ESG disclosure is the basis for conducting ESG ratings and ESG investments. ESG disclosure refers to the disclosure of relevant information by enterprises under disclosure requirements, which has a positive and significant impact on financial performance [9]. ESG rating refers to the evaluation of ESG information disclosed by a company by rating agencies. ESG rating agencies assess firms' ESG performance and provide comprehensive rating data as investment

references based on their unique data collection capacity and measurement system [10]. ESG investment refers to investors conducting risk assessments and investment activities based on the ESG evaluation of the enterprise, which is an important way for the enterprise to achieve sustainable development [11]. ESG disclosure, ESG rating, and ESG investment work together to form an integrated ESG operation mechanism.

The "E" dimension of ESG focuses on ecological impacts [12], including climate change, environmental protection and biodiversity, water resource use, energy consumption, the purchase and use of raw materials, discharge of pollutants, toughness of the environment, green operations, and environment-related opportunities. The "S" dimension of ESG includes equality and compliance employment, staff development, occupational safety and health, community development, land rights and first nations, cultural heritage, information security and privacy protection, development and training, and R&D and innovation. The "G" dimension of ESG includes the code of ethics and conduct, the participation of interested parties, sustainable development strategy, industry development, supply chain management, customer responsibility, risk management, pay performance, accounting policy, and anti-unfair competition measures.

The rise of ESG cannot be separated from the support of standardization. Building scientifically reliable ESG standards is of great significance for promoting ESG practices. ESG, as a core component of the sustainable development framework, is based on stakeholder theory [13–16], resource-based theory [17,18], sustainable development theory [19], institutional theory [20,21], legitimacy theory [22,23], and agency theory [24,25]. These theories provide solid theoretical support for the development and implementation of ESG standards, emphasizing that companies must balance their responsibilities in environmental, social, and governance aspects while pursuing economic benefits [26]. The global concept of sustainable development is becoming increasingly popular, leading stakeholders to pay more attention to environmental protection, social responsibility, and corporate governance [27]. Under the wave of the strong rise of ESG, the development of ESG cannot be separated from the support of standardization. ESG standards are used to evaluate a company's sustainability, as well as the effectiveness and ethical standards of its internal management [28]. The construction of scientific and reliable ESG standards is of great significance.

In terms of ESG practices, investors and consumers are more inclined to choose companies that adhere to ESG standards [29]. ESG standards are beneficial for enhancing corporate performance [30]. DasGupta and Roy posited that adopting strong ESG standards can help improve the level of ESG performance in enterprises [31]. This view underscores the strategic importance of ESG standards in driving business success, which can ultimately result in long-term benefits, including enhanced brand reputation, reduced financial risks, and heightened investor confidence, further validating the positive correlation between ESG standards and long-term corporate benefits. As investors and consumers become increasingly more environmentally and socially conscious, adherence to strong ESG standards can be a competitive advantage, enhancing a company's reputation and bolstering its market position. Steblianskaia et al. proved that the ESG concept has a positive impact on corporate performance indicators and their costs [32]. Incorporating ESG standards into corporate strategies and practices is not only in compliance with regulations but is also a strategic imperative. Shen et al. proposed that developing ESG standards in China would provide reliable guidance for regulatory agencies and provide a clear roadmap for ESG practices in China [33]. This perspective enriches the theoretical basis for the application of ESG standards in developing countries, emphasizing the key role of standardization in promoting ESG practices. Coluccia et al. mentioned that attaching great importance to ESG standards can help companies improve their ability to withstand external shocks, including natural disasters, epidemics, or regulatory changes. They proposed that in the absence of compliance with ESG standards, companies urgently need to collaborate with the industry to establish a stable and long-term regulatory framework to improve governance mechanisms [34].

In terms of the reduction of greenhouse gas emissions, as carbon dioxide is the most important gas among greenhouse gases, countries are committed to reducing carbon emissions [35,36]. ESG has a significant impact in promoting the reduction of carbon emissions [37]. China is facing the goal of peaking CO_2 emissions before 2030 and achieving carbon neutrality before 2060. China may strengthen policy support and industry compliance requirements [38]. Industry organizations and standard-setting bodies may also establish stricter ESG standards to promote the sustainable development of companies [39]. Truant et al. emphasized that ESG standards are crucial for high-tech companies and highly innovative industries with significant energy consumption levels, which are conducive to carbon reduction activities [40]. This viewpoint highlights the crucial role of ESG standards in promoting green transformation in high-emission industries, providing a theoretical basis for industrial green upgrading. It shows the pivotal role that ESG standards play in facilitating the green transition of industries characterized by high greenhouse gas emissions. To better reduce carbon emissions, Li and Xu proposed the need to promote ESG practices through standardized means, emphasizing the development of unified ESG information disclosure standards and the construction of a transparent and comprehensive ESG rating system. This shows the promoting effect of ESG standards on reducing carbon emissions [41].

In terms of ESG rating, ESG ratings can promote the improvement of a company's internal governance capabilities [42]. Cesarone et al. revealed that the current mainstream rating agencies implement different indicator systems, scoring, and quantitative methodologies [43]. Due to the lack of unified ESG rating standards and methods, different rating agencies may have different focuses and evaluation criteria when evaluating a company's ESG performance, resulting in significant differences in evaluation results. This leads to the phenomenon of different rating agencies issuing different rating reports for the same enterprise [44–46]. Khan et al. harshly pointed out that the evaluation process of rating agencies lacks transparency, making it difficult to understand their evaluation methods and data sources, which affects the accuracy and reliability of rating results and makes it difficult to judge the quality of ESG ratings [47]. Given the widespread application of ESG ratings globally and their importance in assessing corporate value, it is necessary to explore and establish a set of ESG evaluation standards that ensure fairness and accuracy [48]. Wang et al. proposed that regulatory agencies should establish unified ESG disclosure standards as soon as possible and promote the construction of ESG rating systems so that they can solve the problem of uneven ESG report quality [49]. It can be confirmed that unified ESG standards are beneficial for regulating the accuracy of ESG ratings.

In terms of ESG investment, ESG investment is a strategy that incorporates environmental responsibility, social responsibility, and corporate governance factors into investment decisions, which can improve investment risks and bring benefits to investors [50,51]. Biasin et al. proposed that incorporating ESG into real estate investment strategies can mitigate climate risks and emphasized that investors are increasingly valuing the benefits of investments that meet ESG standards [52]. Cebrián et al. proposed that adaptive investment strategies should conform to evolving ESG standards and investor preferences [53]. This reflects the importance of ESG standards in investment decision-making [54,55]. Seifert et al. pointed out that due to the lack of clear ESG definitions, financial advisors face difficulties in providing ESG investment advice to clients [56]. They were concerned about the inability to accurately assess the true value of ESG investments, or about the lack of authority in the ESG standards they rely on, which could affect customer trust. It can be seen that unified ESG standards can correctly evaluate green assets, thereby increasing investors' enthusiasm for ESG investment.

ESG, as a hot topic of sustainable development, has been extensively studied by many scholars. Wan et al. used bibliometric analysis to study the development trends of ESG performance [1]. Trotta et al. conducted a comprehensive exploration of the current research status of the intersection between fintech innovation and ESG from the angle of bibliometrics and put forward future research directions for ESG and fintech innovation [57].

Khaw et al. used bibliometric analysis and a systematic literature review to investigate the factors affecting ESG performance, effectively identifying key themes that influence ESG performance research [12]. Khan et al. explored the role of corporate governance in ESG disclosure and the importance of ESG disclosure through bibliometric analysis and meta-analysis [58]. Wahyuningrum et al. used bibliometric methods to study the themes of environmental sustainability disclosure in Asian countries, including environmental disclosure, sustainable accounting and finance, corporate characteristics, sustainable development governance and reporting, and sustainable development performance [59]. Legendre et al. used bibliometric analysis to elucidate the development trajectory of ESG in the hotel and tourism industry, explained the true meaning of ESG compared to corporate social responsibility, and proposed the development direction of ESG practices in the hotel and tourism industry [60]. Galletta et al. conducted research on ESG practices in the banking industry based on bibliometric analysis [61].

Academics have studied ESG performance, ESG disclosure, and ESG practices in great detail, however, there is a lack of research on ESG standards. ESG standards are an important area for ESG research. Constructing ESG standards is an effective practice to implement ESG rules promoting sustainable development.

The objective of this study is to conduct a comprehensive review based on bibliometric analysis to identify the hotspots, trends, and cutting-edge status of ESG standards. CiteSpace, a visualization program, is used for the analysis of annual publications, country distribution, keyword co-occurrence, keyword clustering, and keyword emergence for articles related to ESG standards in the Web of Science database. By conducting a bibliometric analysis of the literature related to ESG standards, a comprehensive overview of the current research progress of ESG standards is provided, which is beneficial for researchers to fully understand the current status, hotspots, and future development directions of ESG standards, filling the gap in this research field. In addition, this study introduces the development of ESG standards in China, enabling researchers to gain a deeper understanding of ESG standards in China.

This study aims to provide a comprehensive analysis of the current state of ESG standards in China, utilizing CiteSpace (v6.3.R1) for data visualization. Based on the data analysis, we identified the key trends of ESG standards in China, interpreted the implications of these trends within China's regulatory landscape, and proposed future research directions and policy recommendations for ESG standards. Our analysis highlighted significant developments, such as the rapid increase in ESG-related regulations between 2022 and 2024, the emphasis on CSR initiatives, and sector-specific advancements in industries like steel and energy. These findings provide a foundation for understanding the current state and future direction of the development of ESG standards in China.

The remainder of this article is structured as follows. Section 2 introduces the research methodology, including data collection and methodology, and detailed research results are presented in Section 3. Section 4 introduces the development of ESG standards in China. Based on the research results presented in Section 3, combined with the current development status of ESG standards and existing challenges of ESG standards in China, Section 5 presents the future research directions of ESG standards, providing reference for scholars' future research. Section 6 presents the conclusion.

2. Research Methodology

2.1. Database Collection

Web of Science (WOS) is a reputable and widely recognized database that comprises SCI, SSCI, and A&HCI citation databases as well as prestigious journals. Additionally, it is the most widely used database for visualization software such as CiteSpace, VOSviewer (v1.6.20), and HistCite (v12.03.17) [62]. Given that Web of Science has the most selective journal coverage [63], for this study, the Web of Science core collection was selected as the data source.

In this study, we employed the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) method to ensure the transparency, completeness, and reproducibility of the research. We followed the basic framework of PRISMA, starting from clarifying the research question, through a systematic literature search, strict screening criteria, data extraction, and result analysis, and finally arrived at the research conclusion. Through the four procedures of identification, screening, eligibility, and inclusion, PRISMA assists the authors in finding the appropriate literature to carry out the bibliometric analysis [64]. Figure 1 shows the overall strategy for bibliometric analysis in this study.

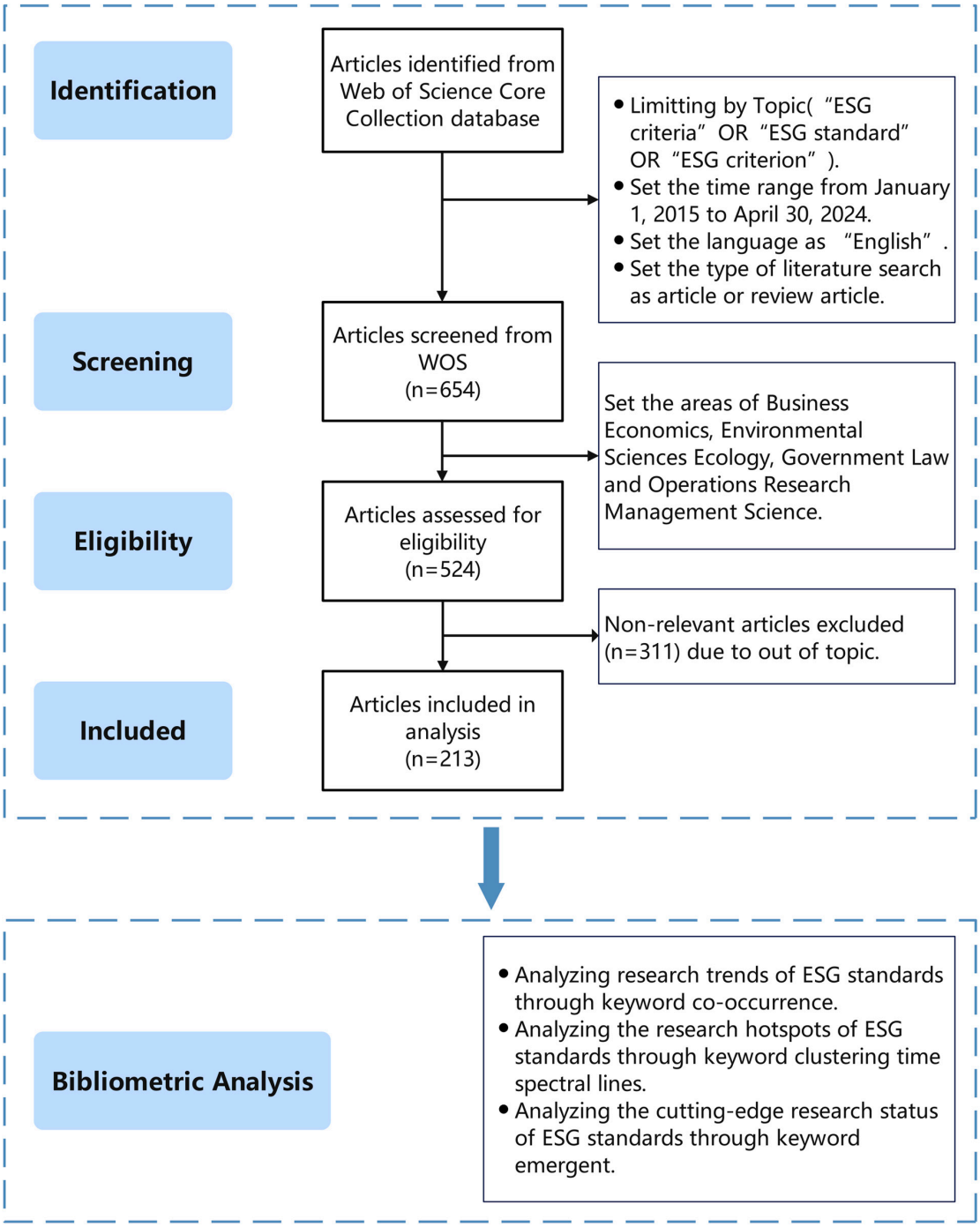

Figure 1. The overall strategy of bibliometrics (note: developed by the authors).

The research term for this study was determined to be Topic = ("ESG criteria" OR "ESG standard" OR "ESG criterion"). The search time range was from 1 January 2015 to 30 April 2024. The search language was set as "English", and the literature type was limited to articles and review articles. A total of 654 relevant articles were obtained. The articles used for bibliometrics in this study covered only the fields of business economics, environmental sciences ecology, government law, and operations research management science. Through further screening, 524 articles were obtained.

The remaining 524 articles were manually reviewed and assessed for eligibility. Due to the lack of research specifically focused on ESG standards, any article that mentioned ESG standards was included in the list for literature visualization analysis in this study. Subsequently, only 213 articles met the inclusion criteria for this study. This study analyzed keyword co-occurrence, keyword clustering, and keyword emergence using CiteSpace visualization software to identify the hotspots, trends, and cutting-edge status of research involving ESG standards. While CiteSpace was employed for visualizing keyword co-occurrence and trends in ESG standards research, our contribution extends to the meticulous selection and validation of data sources to better fit the context of China's ESG landscape, ensuring more relevant and accurate results. This process involved domain-specific adjustments and expert consultations to enhance the analysis's depth and relevance.

2.2. Methodology

Many visualization software options are available for bibliometric analysis. Each visualization program has different advantages and disadvantages [65]. For instance, the operation of VOSviewer is straightforward. Its interface is clear and easy to use. However, its clustering function can only divide the range by color and cannot extract clustering information. HistCite is easy to use for citation analysis and can quickly draw the development trajectory of a research field. However, its graph is black and white, which increases the difficulty of graph analysis. At the same time, it has limitations in co-occurrence analysis. SATI can perform co-occurrence analysis, cluster analysis, etc., but cannot analyze the evolution of the research field over time. RefViz's interface is simple and easy to operate, and it can group research into folders based on the content and relevance. However, the function of research frontier analysis is weak.

CiteSpace is a software developed based on the Java programming language specifically for bibliometric analysis [66]. CiteSpace mainly analyzes the keywords, research institutions, research time, and other information of the studied literature, and visualizes the literature through pathfinding network algorithm theory and co-citation analysis. CiteSpace addresses the shortcomings of the above visualization software. It can be used to perform keyword co-occurrence analysis, cluster analysis, temporal composition analysis, and emergent word analysis. It also has strong operability and can customize the font size, node size, cluster fill color, etc., making the visualization effect better. In addition, it can be sliced over time to display the trends, hotspots, and cutting-edge developments in the research field over a certain period. ESG is a rapidly emerging concept, and its development is constantly changing. The use of CiteSpace visualization software for bibliometric analysis aligns well with the rapid development of ESG.

The combination of bibliometrics and visualization software can be used to effectively summarize research progress and directions within specific disciplines. Therefore, this study used CiteSpace (6.3.R1(64-bit), https://citespace.podia.com/, accessed on 21 July 2024) as the visualization analysis software for bibliometric analysis. Based on 213 relevant articles retrieved from the WOS database, the main topic mining and visualization analysis was carried out on keyword co-occurrence, the keyword clustering time spectrum, and keyword emergence words.

The steps for visual analysis using CiteSpace in this study are as follows: (1) import 213 articles retrieved from the WOS database and perform deduplication processing; (2) choose the period from January 2015 to April 2024, and set "1 Year Per Slice"; (3) set the term source as "Title", "Abstract", "Author Keywords", and "Keywords Plus"; (4) choose

the node types of the country to obtain the collaboration visualization networks; (5) choose the node types of keywords and obtain keyword co-occurrence networks that can help in understanding the evolution of the ESG standards research, the current research hotspots, and potential turning points; (6) set the pruning as "Pathfinder", "Pruning sliced networks", and "Pruning the merged network", and set the visualization as "Cluster View-Static" and "Show Merged Network".

3. Results

3.1. Analysis of Annual Publications

In academic research, the number of publications not only reflects the degree of attention scholars on a certain discipline but also becomes an important quantitative indicator to evaluate the research activity and development trend of the field in a specific period. The annual publications about ESG standards are shown in Figure 2.

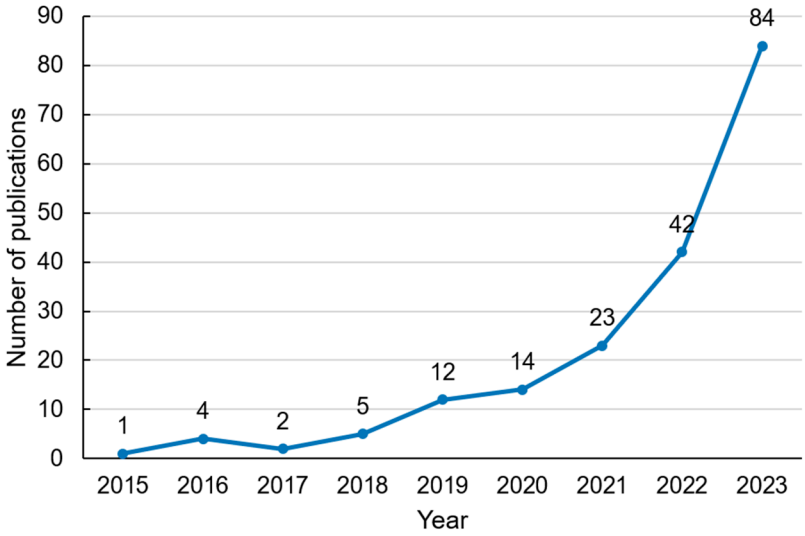

Figure 2. Annual publication statistics (note: developed by the authors).

There is a general growing tendency in the annual publishing volume of articles related to ESG standards, which can be categorized into two stages. The first stage is the primary development stage (between 2015 and 2018), when ESG, as a relatively new field, has been less studied by scholars. Therefore, at this stage, the number of articles related to ESG standards published is relatively small (less than 10). The second stage is the rapid development stage (between 2019 and 2023). With the rapid development of sustainability, ESG concepts have received a lot of attention, and the market is increasingly valuing companies' ESG practices [67].

The publication of articles related to ESG standards has grown rapidly, reaching 84 in 2023, an increase of 600% compared to the same period in 2019, indicating the strength of the research efforts. It should be noted that due to only searching the literature from January to April 2024, the data for 2024 are relatively low. The inclusion of only four months' worth of data from 2024 would not provide a sufficiently representative sample for a full-year analysis. Given the seasonality and potential fluctuations in research publications, it is important to have complete years of data to accurately depict annual trends. Therefore, when analyzing the annual publication volume, the number for 2024 is not included.

3.2. Analysis of Country Distribution

We mainly analyzed the author's home country to identify the geographical distribution of research contributions related to ESG standards. This analysis aims to uncover which countries have been most active in publishing research on ESG standards. The 213 articles retrieved in this study covered research from 99 countries. Figure 3 displays

the top 10 countries by total number of articles. China has published the most articles (30) on ESG standards, followed by Italy (26 articles) and the United States (26 articles). ESG practice in China is currently in a rapid development stage, which has driven academic institutions to research ESG standards. Mandatory ESG disclosures in the United States and Italy serve as an incentive for scholars to explore ESG standards, thereby offering crucial support and aid in achieving sustainable development goals. For research involving ESG standards, there are close connections between countries. A national collaboration network with 60 nodes and 53 links is shown in Figure 4, reflecting the collaborative connections between countries in conducting research related to ESG standards. China collaborates closely with countries such as Brazil and the United States, and there is extensive research collaboration among England, Australia, and Italy. It indicates that effective collaboration among countries is conducive to promoting research on ESG standards and promoting the international standardization of ESG standards. The development of universal ESG standards towards international standardization is a trend. Collaboration between countries can better promote ESG practices and achieve sustainable development.

Figure 3. Top 10 countries with the highest number of publications (note: developed by the authors).

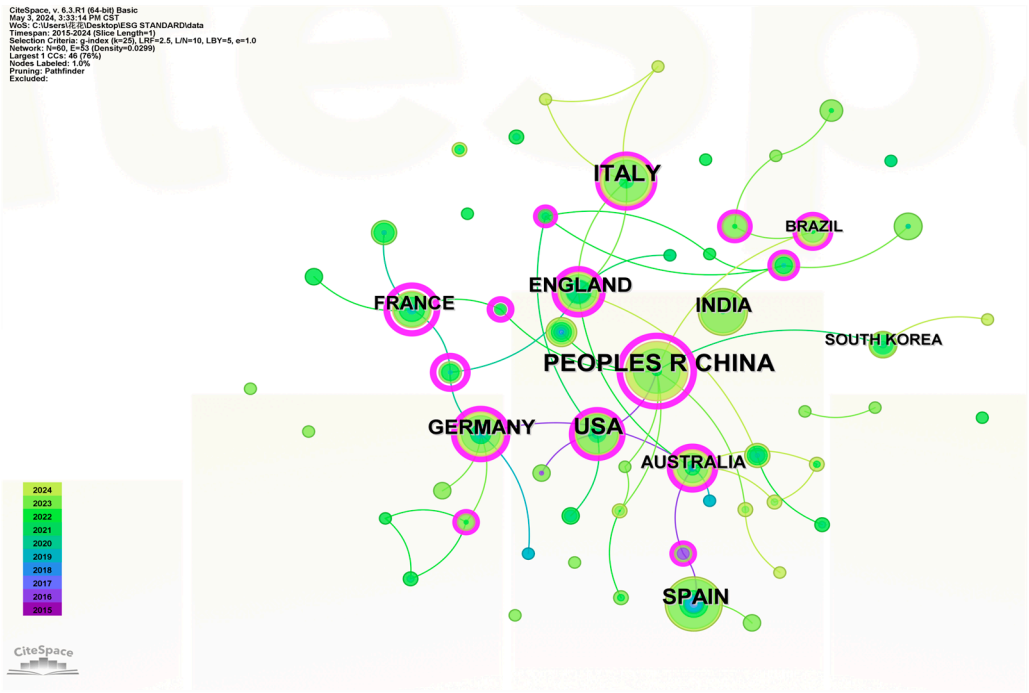

Figure 4. Country distribution network (note: developed by the authors).

3.3. Analysis of Keyword Co-Occurrence

The keyword co-occurrence network reveals the concentration trend of research by analyzing the co-occurrence patterns of keywords in the literature over a certain period. It is possible to identify and comprehend studies and hot topics in the field more successfully by focusing on high-frequency keywords. This study uses the Pathfinder algorithm to crop the overall network and generate a keyword co-occurrence network.

Figure 5 shows the co-occurrence relationship of research keywords related to ESG standards in the WOS database. The keyword co-occurrence network is composed of 258 nodes and 565 links, which has a density of 0.017. From Figure 5, it can be seen that the top 10 keywords with the highest frequency of occurrence are "performance", "corporate social responsibility", "impact", "governance", "risk", "management", "responsibility", "disclosure", "financial performance", and "sustainable development", indicating that these have been relatively popular areas of research involving ESG standards by scholars in the past decade. There is limited research by scholars specifically focusing on ESG standards, mainly mentioning ESG standards in areas such as ESG performance [68], corporate social responsibility [69], ESG disclosure [70], financial performance [71], and sustainable development [26].

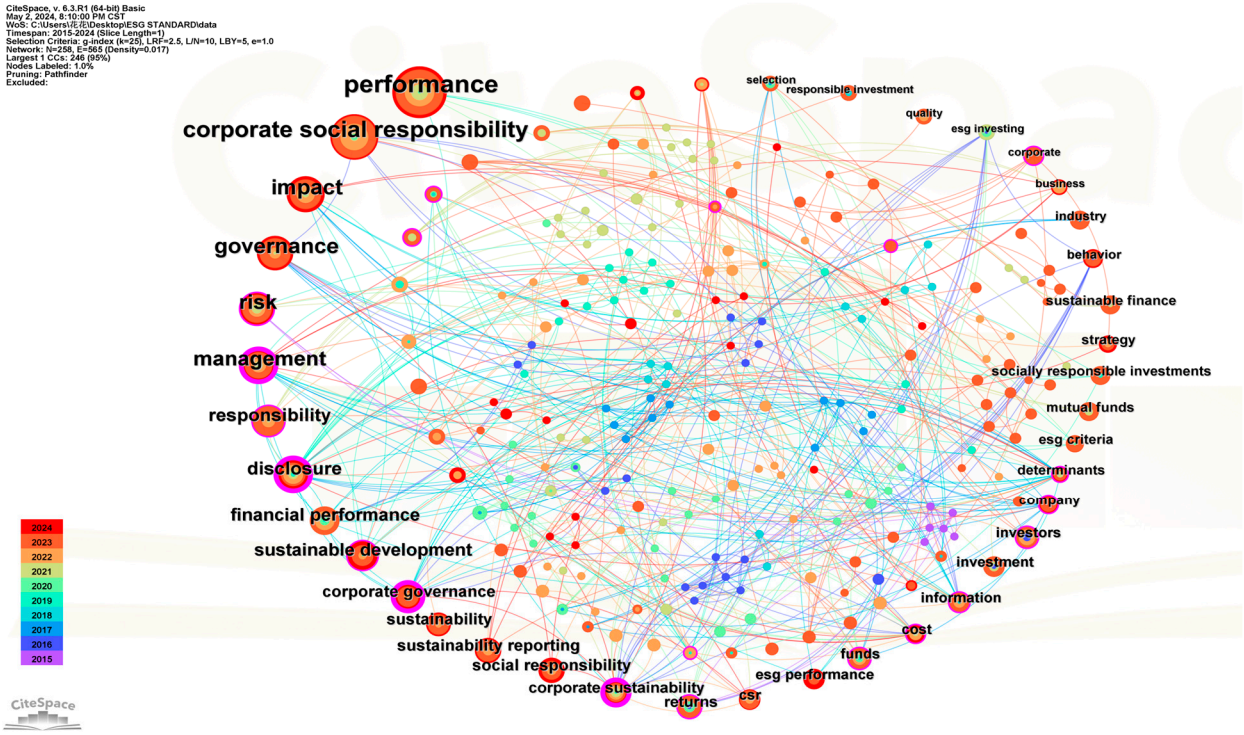

Figure 5. Keyword co-occurrence network (note: developed by the authors).

In addition, in this study, a statistical analysis of keywords with high citation frequency and strong intermediary centrality was performed. Table 1 shows the frequency of high-frequency keywords and their mediating centrality. The keyword "performance" is cited the most frequently (52), indicating that scholars' research on ESG standards is focused on performance. The keyword "management" has the highest centrality (0.55), indicating that there are more studies involving management in ESG standards. In addition, the keywords "disclosure" (0.5), "corporate governance" (0.44), and "corporate sustainability" (0.44) have relatively high centrality. Undoubtedly, ESG disclosure, corporate governance, and corporate sustainability are hot topics in ESG standards research.

Table 1. Top 20 co-occurring keywords (note: developed by the authors).

Number	Count	Centrality	Year	Keywords
1	52	0.03	2017	performance
2	43	0.05	2016	corporate social responsibility
3	33	0.1	2017	impact
4	29	0.09	2016	governance
5	27	0.11	2015	risk
6	26	0.55	2017	management
7	18	0.13	2021	responsibility
8	17	0.5	2017	disclosure
9	16	0.06	2016	financial performance
10	16	0.14	2019	sustainable development
11	12	0.44	2016	corporate governance
12	12	0.04	2022	sustainability reporting
13	12	0	2022	sustainability
14	11	0.04	2022	social responsibility
15	10	0.44	2016	corporate sustainability
16	10	0.14	2015	returns
17	9	0.04	2021	csr
18	9	0.11	2017	funds
19	9	0	2018	esg performance
20	8	0.2	2016	information

3.4. Analysis of Keyword Clustering

Keyword clustering refers to grouping closely related key vocabulary into clusters, which are used to observe the research clusters formed in the current field. CiteSpace provides modularity values (Q value) and silhouette values (S value) based on network structure and clustering clarity. These two parameters can characterize the effectiveness of clustering. Generally, when the Q value is more than 0.3, the clustering effect is considered to be significant. Clustering is plausible when the S value is more than 0.5; high credibility and persuasiveness of the clustering are indicated when the S value is more than 0.7.

Figure 6 shows the keyword clustering results. The Q value of the keyword clustering graph is 0.7732, and the S value is 0.9041, indicating that the reliability of this clustering model is high. It can effectively make scientific and fair evaluations of research related to ESG standards. The following are the main areas of research related to ESG standards: comment letters (Cluster #0), financial performance (Cluster #1), esg ratings (Cluster #2), esg rating (Cluster #3), sustainable development (Cluster #4), panel data (Cluster #5), esg investing (Cluster #6), tccm framework (Cluster #7), and governance (Cluster #8), sustainable finance (Cluster #9), financial indicators (Cluster #10), sustainable finance and investment (Cluster #11), India (Cluster #12), esg investment (Cluster #13), sustainable strategic management (Cluster #14), and esg score (Cluster #15).

The keyword clustering timeline map can visually display the changes in the research field over time. Figure 7 shows the keyword clustering timeline map. In terms of time, the earliest cluster to appear was #12 (India), indicating that research conducted in India earlier involved ESG standards. However, there are fewer hot keywords in this clustering, with the main keywords being "risk" and "return", indicating that India focuses on research on risks and returns related to ESG standards. After 2016, as the ESG concept gradually spread, Cluster #0 (comment letters), Cluster #1 (financial performance), Cluster #3 (esg rate), Cluster #6 (esg investment), Cluster #9 (sustainable finance), and Cluster #10 (financial indicators) emerged successively. Scholars have begun to interweave research on ESG standards in areas such as financial performance, ESG ratings, ESG investments, sustainable finance, and financial indicators. Cluster #1 (financial performance) has a high frequency of core keywords, including "ESG criteria", indicating that there is more research on ESG standards in the field of financial performance. After 2021, Cluster #7 (TCCM framework) emerged, and some scholars used the TCCM framework to conduct literature reviews related to ESG standards [72]. However, after 2022, Cluster #12 (India) gradually faded out,

indicating that the forefront of ESG research in India no longer includes ESG standards. Since 2023, some clusters have gradually faded out, but Cluster #0 (comment letters), Cluster #1 (financial performance), Cluster #2 (esg ratings), Cluster #4 (sustainable development), Cluster #10 (financial indicators), and Cluster #13 (esg investment) still exist. This indicates that the amount of research carried out in this field is gradually increasing, indicating that it is an important area for ESG standards research today.

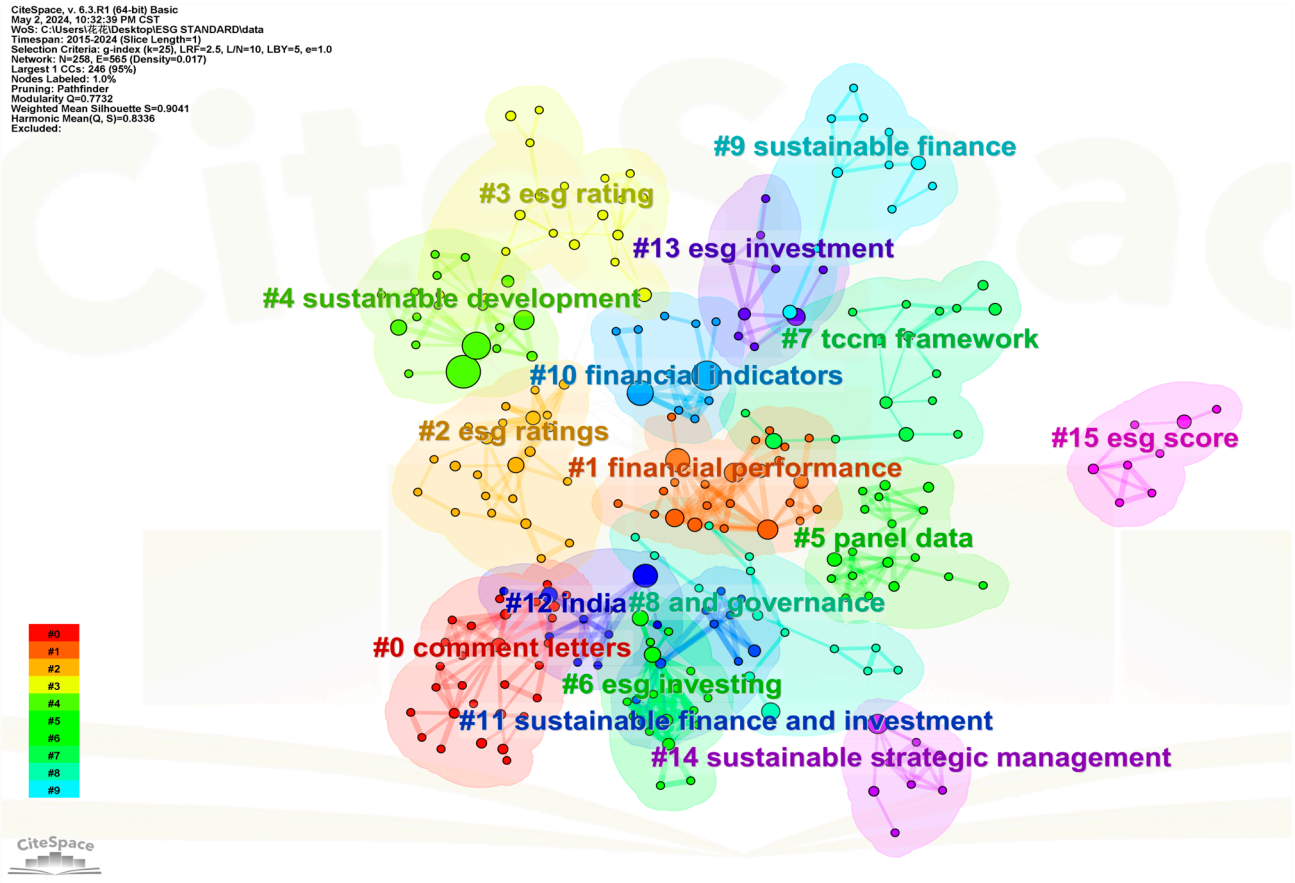

Figure 6. The keyword clustering network (note: developed by the authors).

3.5. Analysis of Keyword Emergence

A significant increase in the frequency of a particular term during a given time frame suggests that the relevant research topic is hot at that specific time. The keyword emergence analysis in CiteSpace reflects the forefront of current research [66]. Figure 8 shows the 12 keywords with the strongest citation bursts, including the year of first appearance, the year of end, and the intensity of the mutation. The red color of the column "2015–2024" in Figure 8 represents the occurrence duration of keyword bursts. It indicates that scholars have different research hotspots related to ESG standards at different periods. According to the keyword emergence graph, the earliest mutated word to appear was "returns", indicating that scholars were the first to study ESG standards in ESG returns. The mutation words with the longest duration of mutation are "disclosure", "esg ratings", "management", and "sustainability", all of which have lasted for two years, indicating that scholars have conducted more research on ESG standards in these fields. In 2019, the keyword "ESG criteria" emerged, indicating the beginning of research on important ESG standards. In 2020, keywords such as "firms", "business", "assurance", and "sustainability" began to emerge, indicating that cutting-edge areas related to ESG standards research include business and sustainability.

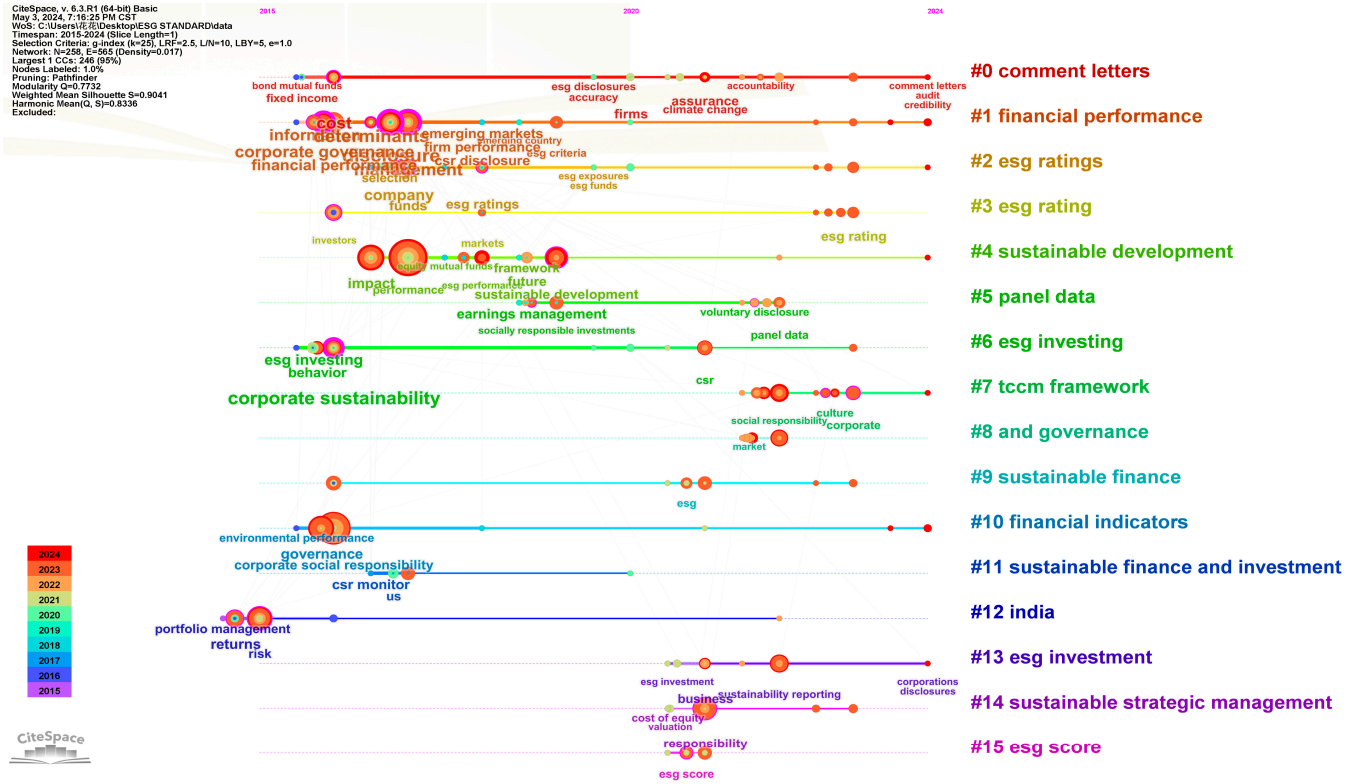

Figure 7. The keyword clustering timeline map (note: developed by the authors).

Figure 8. Top 12 keywords with the strongest citation bursts (note: developed by the authors).

4. Development of ESG Standards in China

4.1. Status of ESG Standards in China

As of April 2024, China has issued a total of 58 standards [73–130] in the field of ESG, with 1 local standard and 57 group standards. This indicates that social groups and associations have played a significant role in promoting the standardization and development of ESG in China. Table 2 illustrates the ESG standards in China as of April 2024, which were collected by the authors based on publicly available website materials. The issuing organizations mainly include local government agencies, industry associations, development promotion associations, and foundations. The standards cover a wide range of industries, such as steel, electronic information, and pharmaceutical companies, reflecting the broad and diversified nature of the ESG standardization process in China. In terms of the content of the standards, they encompass guidelines for the preparation of ESG reports and information disclosure, as well as specific evaluation and management systems for different industries. The targeted and specialized standard-setting helps industries

integrate and implement ESG principles more effectively, thereby promoting sustainable development and social responsibility practices of enterprises. The release of ESG-related standards in China is primarily concentrated between 2022 and 2024, indicating a rapidly increasing emphasis on CSR and sustainable development during this period. This trend underscores the urgency and growing recognition of ESG principles in China's regulatory and corporate sectors.

Existing ESG standards in China cover ESG disclosure, ESG evaluation, and ESG investment, with a primary focus on ESG disclosure. For ESG disclosure, T/SXQL 1-2024 *Guidelines for Environmental, Social, and Governance (ESG) Disclosure of State-Owned Enterprises in Shaanxi Province* provides a basic framework tailored to the specific circumstances of state-owned enterprises (SOEs) in Shaanxi Province. T/CAGDE 230-2023 *ESG—specification for Sustainable Finance Information Disclosure* outlines the principles, requirements, content, form, frequency, and supervision of corporate sustainable finance (ESG) disclosure. Additionally, T/CASMES 285-2024 *Guidelines for Small and Medium-Sized Enterprises ESG Information Disclosures* offers comprehensive guidelines for SMEs on ESG disclosure, covering principles, content, organizational safeguards, report preparation, verification, issuance, responsibility, supervision, and continuous improvement. In terms of ESG evaluation, T/SDZBZZ 004-2022 *Guidelines for Disclosure of Enterprise ESG Sustainable Development Reporting and Auditing Evaluation System Part 2: Audit Evaluation System*, released on 29 September 2021, stipulates the basic requirements, principles, basis, methodology, process, and indicators for ESG audits and evaluations conducted by enterprises. T/IPIF 0015-2022 *ESG Evaluation Guide for Enterprises* provides an ESG evaluation system for enterprises, detailing principles, contents, methods of evaluation, procedures, and grade setting. Regarding ESG investment, T/CAGDE 227-2023 *Technical Specification for Evaluation of ESG Corporate Social Responsibility Investment* specifies the principles, process, content requirements, and supervision for the disclosure of corporate social responsibility investment (ESG). Lastly, T/CAGDE 230-2023 *ESG—specification for Sustainable Finance Information Disclosure* reaffirms the principles, requirements, content, form, frequency, and supervision for corporate sustainable finance (ESG) disclosure. The findings suggest significant developments in areas such as the steel industry and the energy sector, reflecting an evolving landscape that demands continued research and adaptation. These trends provide a foundation for the projections and recommendations discussed in the following sections.

4.2. Existing Challenges of ESG Standards in China

First, China has not yet established a comprehensive ESG standard system. While various bodies such as government departments, industry associations, research institutes, and third-party assessment organizations formulate China's ESG group standards, the absence of a unified national standard and a clear leading authority has resulted in an imperfect coordination mechanism. The three major areas of environment, society, and governance encompass numerous specific indicators. Different groups, influenced by varying interests and philosophies, select and weigh these indicators differently, leading to inconsistency in the ESG disclosure indicator system and evaluation and rating methodologies. The lack of consistency and stability in ESG rating results makes it challenging to accurately reflect enterprises' real impact on the environment and society, as well as their actual governance performance.

Second, the number and variety of ESG standards in China are limited. Despite the rapid development of ESG, the current number of ESG standards is insufficient to support sustainable development. Existing standards mainly cover industries such as steel, construction materials, financial services, petrochemicals, energy, logistics, and pharmaceuticals, leaving significant gaps in other industries. For example, there is a lack of ESG standards in critical and emerging industries such as education, transportation (including air, land, and marine transport), technology, and agriculture. Additionally, current ESG standards focus primarily on disclosure index systems and evaluation methods, lacking standardized guidelines and management for ESG investment, ESG rating agencies and practitioners, industry-specific ESG standards, and ESG information management.

Table 2. Publication of ESG standards in China as of April 2024 (note: developed by the authors).

No.	Standard Number	Standard Name	Date
1	T/CHA 037-2023	ESG management systems for lodging enterprise-requirements	2024/3/29
2	T/SFIE 001-2024	Guidelines for the Preparation of Corporate Environmental, Social and Governance Reports	2024/3/19
3	T/CASMES 285-2024	Guidelines for small and medium-sized enterprises ESG information disclosures	2024/2/22
4	T/CIET 376-2024	Guide to building an enterprise ESG management system	2024/2/22
5	T/SXQL 1-2024	Guidelines for Environmental, Social, and Governance (ESG) Disclosure of State-Owned Enterprises in Shaanxi Province	2024/2/20
6	T/CAAA 120-2023	Guide for animal husbandry enterprise ESG information disclosure	2024/1/30
7	T/CNSCPA 003-2024	ESG management system of nuclear enterprises-requirements with guidance for use	2024/1/18
8	T/CNSCPA 002-2024	Evaluation guidance on ESG of nuclear enterprises	2024/1/18
9	T/CNSCPA 001-2024	Guidance on ESG information disclosure for nuclear enterprises	2024/1/18
10	T/CSTF 000001-2023	Certified ESG Analyst (Sustainability Analyst) Professional Competence Evaluation Specifications	2024/1/18
11	T/CASMES 282-2023	Solar PV industry chain enterprise environmental, social and governance (ESG) Part 2 evaluation requirements	2024/1/11
12	T/CASMES 279-2023	Solar PV industry chain enterprise environmental, social and governance (ESG) Part 1 information disclosure	2024/1/11
13	T/CERDS 5-2023	Enterprise ESG management system	2023/12/29
14	T/CFIS 0008-2023	ESG assessment guidelines for internet enterprises	2023/12/27
15	T/CAPI 001-2023	Enterprise ESG due diligence service specifications	2023/12/18
16	T/CIET 313-2023	Guidelines for corporate carbon peak and carbon neutrality based on ESG evaluation	2023/12/11
17	T/CSEIA 1002-2023	ESG Disclosure Guide for Energy Companies	2023/12/7
18	T/CSEIA 1001-2023	ESG Evaluation Guide for Energy Companies	2023/12/7
19	T/CSTA 0031.2-2023	Steel Enterprise Environmental, Social and Governance (ESG) Part 2 Evaluation Requirements	2023/12/4
20	T/CSTA 0031.1-2023	Environmental, Social and Governance (ESG) of Iron and Steel Enterprises Part 1 Information Disclosure	2023/12/4
21	T/CSR 0002-2023	Self-discipline guidance on ESG investment management in the Guangdong-Hong Kong-Macao Greater Bay Area	2023/11/30
22	T/CHA 038-2023	Evaluation guidelines for lodging industry ESG	2023/11/29
23	T/GDESG 01-2023	Evaluation of Professional Skills of ESG Practitioners	2023/11/24
24	T/CCPITCSC 134-2023	Environmental, Social and Governance (ESG) management system–Requirements	2023/11/20
25	T/CAGDE 230-2023	ESG-specification for sustainable finance information disclosure	2023/10/20
26	T/CAGDE 229-2023	ESG-specification for corporate supply chain information disclosure	2023/10/20
27	T/CAGDE 228-2023	ESG-technical specification for corporate compliance governance systems	2023/10/20
28	T/CAGDE 227-2023	ESG-technical specification for corporate social responsibility investment evaluation	2023/10/20
29	T/CAGDE 226-2023	ESG-technical specification for corporate climate change financial information disclosure	2023/10/20
30	T/CECC 022-2023	Guidance on drafting environmental, social and corporate governance (ESG) reports for information and communication enterprises	2023/9/22
31	T/SHPPA 022-2023	Guidelines for ESG information disclosure of pharmaceutical enterprises	2023/8/25
32	DB43/T 2656-2023	Guidelines for peak carbon dioxide emissions and carbon neutrality of enterprises based on ESG evaluation	2023/8/22
33	T/APEP 1030-2023	ESG Information Disclosure Rules	2023/8/8
34	T/ZCX 006-2023	Specifications for professional ability evaluation of Environmental, Social and Governance (ESG)	2023/7/19
35	T/ZCX 005-2023	Specifications of Corporate Environmental, Social and Governance Rating	2023/7/19

Table 2. *Cont.*

No.	Standard Number	Standard Name	Date
36	T/CSTE 0357-2023	ESG reporting guidelines for financial leasing enterprises	2023/7/14
37	T/SHWL 000005-2023	ESG evaluation guide for logistics enterprises	2023/7/3
38	T/AIAC 006-2023	ESG information disclosure standards for energy companies	2023/5/28
39	T/AIAC 005-2023	ESG evaluation criteria for energy companies	2023/5/28
40	T/SSEA 266.2-2023	Steel Enterprise Environmental, Social and Governance (ESG) Part 2 Evaluation Requirements	2023/3/20
41	T/SSEA 266.1-2023	Environmental, Social and Governance (ESG) of Iron and Steel Enterprises Part 1 Information Disclosure	2023/3/20
42	T/CSTM 00978-2023	ESG reporting guidelines for building materials enterprises	2023/3/17
43	T/CERDS 4-2022	Guidance on enterprise ESG reporting	2022/11/26
44	T/CERDS 3-2022	Enterprise ESG evaluation system	2022/11/16
45	T/SDZBZZ 004-2022	Guidelines for disclosure of enterprise ESG sustainable development reporting and auditing evaluation system of enterprise ESG Part 2: audit evaluation system	2022/12/24
46	T/SDZBZZ 003-2022	Guidelines for disclosure of enterprise ESG sustainable development reporting and auditing evaluation system of enterprise ESG Part 1: Reporting disclosure guidelines	2022/12/24
47	T/CAQP 028-2022	Specifications for enterprises ESG assessment service providers	2022/12/12
48	T/CAQ 10118-2022	Evaluation guidelines for enterprise ESG	2022/11/20
49	T/CAQ 10117-2022	ESG management systems for enterprise—Requirements	2022/11/20
50	T/ZJFS 007-2022	Guidelines for ESG credit process management in the banking industry	2022/11/4
51	T/CI 072-2022	ESG evaluation technical guideline for listed company	2022/9/26
52	T/IPIF 0015-2022	ESG evaluation guide for enterprises	2022/9/2
53	T/CERDS 2-2022	Guidance for enterprise ESG disclosure	2022/4/16
54	T/CAQP 027-2022	General requirements for disclosure of enterprises ESG information	2022/6/25
55	TCAQP 026-2022	General requirements for enterprises ESG assessment	2022/6/25
56	T/SZCSR 001-2022	Corporate ESG—Evaluation specifications	2022/5/12
57	T/CGDF 00011-2021	ESG Assessment Guidelines	2021/9/29
58	T/CCIIA 0003-2020	Guidelines for the ESG evaluation of listed companies in China's petroleum and chemical industry	2020/11/18

Third, ESG standards in China lack global harmonization. Current ESG standards are formulated based on national conditions and do not align with global standards such as the Global Reporting Initiative (GRI), the Sustainability Accounting Standards Board (SASB), and the Task Force on Climate-related Financial Disclosures (TCFD). This discrepancy increases disclosure costs and operational complexity for multinational corporations (MNCs). For other investors and consumers, the lack of harmonization complicates globally consistent ESG disclosure and ratings, reducing the transparency and credibility of ESG standards.

5. Future Research Directions

Building on the current state of ESG standards in China, as detailed in the previous chapters, this section provides projections and recommendations for future developments.

First, it is essential to establish an ESG Standards Research Group. This group should focus on conducting specialized standardization research for ESG. Key discussions should include the specific form of ESG management, such as whether to form an ESG-integrated management organization in the form of a coordination group (CG), strategy group (SG), technical committee (TC), or advisory group (AG). Additionally, the group should consider uniting ESG stakeholders, including the Ministry of Ecology and Environment of the People's Republic of China, the Ministry of Industry and Information Technology of the People's Republic of China, the National Development and Reform Commission, the People's Bank of China, the State-owned Assets Supervision and Administration Commission of the State Council, the China Securities Regulatory Commission, China's ESG-related standardization technical committees, and other relevant parties. Furthermore, it should explore whether to reference the organizational structure and responsibilities of the ESG Coordinating Committee of ISO (ISO/ESG CC) to divide working groups for carrying out ESG strategy research, standard project management, and standard promotion.

Second, ESG standards should be managed in an integrated manner. Given the wide range of ESG content, the current ESG-related TCs only focus on specific areas, making it difficult to find a counterpart TC for the project declaration of comprehensive ESG standards. Therefore, it is recommended that the ESG-integrated management organization coordinate the project management of ESG standards in the form of an advisory group (AG) or other suitable structures.

Third, an ESG standard system should be constructed. Through the ESG-integrated management organization, cooperation and communication with various stakeholders should be strengthened, integrating the current relevant standards and policy document requirements. A unified ESG disclosure and management standard with high market recognition should be formulated as soon as possible. Additionally, the development of ESG standards for various industries, as well as standards in key areas such as environmental management, organizational governance, risk management, and human resource management, should be planned to build a comprehensive national-level ESG standard system.

As we look toward the future, it is crucial to identify key areas where further research can enhance the implementation and effectiveness of ESG standards across different industries. Table 3 outlines several potential research directions, categorized by focus areas, key inquiries, and associated keywords. Additionally, Table 3 provides an industry relevance score, indicating the importance of each research direction within specific sectors such as renewable energy, automotive, financial services, and more.

Table 3. Opportunities for further study (note: developed by the authors).

Focus	Future Studies	Inquiries	Keywords	Industry Relevance
Environmental	Research on the assessment of the environmental impact of ESG standards in various industrial sectors, such as renewable energy and manufacturing.	How can ESG standards help reduce the environmental impact in specific industrial sectors?	- Environmental impact assessment - Industrial standardization	Renewable Energy: ★★★★★ Automotive Industry: ★★★★ Manufacturing Industry: ★★★★
	Application and effectiveness of ESG data management and analysis technologies in environmental protection.	How can big data and AI technologies improve the collection and analysis of environment-related ESG metrics?	- Data management - Artificial intelligence - Environmental protection	Technology Sector: ★★★★ Renewable Energy: ★★★★ Manufacturing Industry: ★★★★
Social	Comparative study of the impact of ESG standards on social responsibility across different industries.	Which industries are most affected by ESG standards in terms of social responsibility?	- Social responsibility - Industry comparison	Automotive Industry: ★★★★ Financial Sector: ★★★★ Government Institutions: ★★★★
	Integration of ESG standards with diversity and inclusion policies in corporate governance.	How can ESG standards promote diversity and inclusion within companies?	- Diversity - Inclusion - Corporate governance	Financial Sector: ★★★★ Technology Sector: ★★★★ Government Institutions: ★★★★
Governance	Study on the effectiveness of ESG standards in corporate risk management, especially in the financial industry.	How do ESG standards assist the financial industry in managing systemic risk?	- Risk management - Financial industry	Financial Sector: ★★★★★ Automotive Industry: ★★★★
	Comparative analysis of global ESG standards to explore the feasibility of a unified global standard.	What are the major differences between ESG standards in different countries or regions? How can standards be unified?	- Global standards - Comparative analysis - Standardization	Multinational Corporations: ★★★★★ Government Institutions: ★★★★
	Study on the impact of ESG disclosure on long-term financial performance, focusing on large multinational corporations.	How can companies improve the transparency of ESG disclosures to enhance investor confidence?	- Disclosure - Financial performance - Multinational corporations	Financial Sector: ★★★★ Multinational Corporations: ★★★★★

Note: "★★★★" indicates relatively important. "★★★★★" indicates extremely important.

6. Conclusions

In this study, bibliometric analysis was conducted using CiteSpace to visually analyze articles related to ESG standards, aiming to understand the hotspots, trends, and cutting-edge status of ESG standards research. Through the analysis of the literature publication volume, country distribution, keyword co-occurrence, keyword clustering, and keyword emergence, the following conclusions were drawn.

From the perspective of the literature publication volume, research on ESG standards is growing, indicating an increasing scholarly focus on ESG standards. Due to extensive practice in ESG investment, ESG performance, and ESG rating, ESG standards are widely recognized. In terms of country distribution, China, the United States, and Italy are the main countries for ESG standards research, and these countries and regions play an important role in ESG standards research. Regarding the aspect of keyword co-occurrence and cluster analysis, it was found that research related to ESG standards mainly focuses on performance, rating, investment, sustainable development, corporate social responsibility, and other aspects. This indicates that the importance of ESG standards in the fields of corporate social responsibility and sustainable development is becoming increasingly prominent. Developing ESG standards not only helps enterprises reduce the negative impacts on the environment but also helps them build a good corporate image by promoting care and support for employees, suppliers, communities, and other stakeholders. In addition, it can help enterprises establish an internal management system to achieve long-term stable development. From the perspective of keyword emergence, "sustainability" emerged as the main keyword in the past two years, reflecting the forefront of ESG standards research in this area and providing valuable references for further study.

Based on a bibliometric analysis of articles related to ESG standards, the survey revealed the current development status of ESG standards in China. In China, the quantity and variety of ESG standards are lacking, and the development of an integrated ESG standard system remains incomplete. Furthermore, the current ESG standards in China suffer from a lack of global coordination, thereby undermining the credibility of ESG ratings. The lack of comprehensive ESG standards in China is not conducive to the development of ESG disclosure, ESG rating, and ESG investment in China. For ESG disclosure, the ESG data disclosed by corporations lack comprehensiveness and reliability. Most information disclosed by companies focuses too much on economic indicators and lacks attention to the indicators of environmental, social, and governance, leading to doubts about the quality and authenticity of the disclosed information. For ESG ratings, different rating agencies implement different indicator systems, scoring approaches, and quantitative methodologies. Due to the lack of unified ESG rating standards and methods, different rating agencies may have different focuses and evaluation criteria when evaluating a company's ESG performance, resulting in significant differences in evaluation results. Thus, investors find it difficult to make judgments on the quality and credibility of ESG ratings. For ESG investment, because of the lack of ESG investment standards for the correct evaluation of green assets, coupled with investors' overestimation of the value of green assets, the price of green assets deviates significantly from their true value, affecting investors' enthusiasm and even causing market instability. To better carry out ESG practice, this study provides future research directions for ESG standards in China.

This study is of great significance for the research and development of ESG standards in China. It not only helps the academic community to gain a deeper understanding of ESG standards research, but also provides useful reference and guidance for governments, enterprises, and the international community. It enables the global application of ESG standards and helps enterprises to better balance the interests of environmental, social, and governance in the business process and achieve sustainable development.

The promotion of ESG standards in China is a complex and important task that requires joint efforts from the government, enterprises, academia, and various sectors of society. The government can guide and support enterprises to comply with ESG standards through legislation, policies, and regulatory measures. The government can establish specialized

agencies or committees responsible for formulating and promoting the implementation of ESG standards while strengthening the supervision and evaluation of ESG standards. Enterprises should voluntarily participate in the development and implementation of ESG standards. Enterprises can improve the ESG management level and establish a corporate social responsibility image by establishing an ESG management system and publishing ESG reports. The academic community must carry out in-depth studies on the theory and application of ESG standards, propose relevant policy recommendations and guidance, and promote the application of ESG standards in practice.

Due to time constraints, this study also has some limitations. When bibliometric analysis was conducted, only the WOS database was selected for retrieving the literature. If other data are used for the literature search, the conclusions will be biased. We also did not select journals based on their perceived reputation or impact factor, which may include articles published in fringe journals. This may affect the reliability of the bibliometric analysis. At the same time, in selecting the literature, we have a strong subjective consciousness, which may affect the final bibliometric analysis results. In addition, only the areas of business economics, environmental sciences ecology, government law, and operations research management science were selected for literature screening. There may be studies in other research areas that deal with ESG standards, which may have some impact on the results of research hotspots and cutting-edge research.

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