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THE IMPACT OF MANDATORY DISCLOSURE OF ESG INFORMATION ON THE VALUE OF STOCKS: A BIBLIOMETRIC ANALYSIS

O impacto da divulgação obrigatória de informações ESG no valor das ações: Uma análise bibliométrica

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ABSTRACT

The growing interest in the topic of sustainability has stimulated the enactment of legislation that makes it mandatory for companies to disclose sustainable practices. However, empirical articles on this topic present contradictory results in terms of share valuation. Therefore, this study aims to understand the evolution of academic production on this issue. To this end, a bibliometric analysis of academic literature is carried out using the WoS and Scopus databases. It is executed using R and Biblioshiny software. Furthermore, the main bibliographic laws are checked - Lotka, Bradford and Zipf. The final sample consists of 244 articles. The results obtained contribute to academia by deepening the analysis of research that relates sustainability to the financial performance of companies, especially in the context of mandatory disclosure and market value. Furthermore, they assist governments and regulators in improving public policies related to the disclosure of sustainability information.
Keywords: ESG, Sustainable practices, Mandatory disclosure, Stock market, Bibliometric analysis

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O IMPACTO DA DIVULGAÇÃO OBRIGATÓRIA DE INFORMAÇÕES ESG NO VALOR DAS AÇÕES: UMA ANÁLISE BIBLIOMÉTRICA

The impact of mandatory disclosure of ESG information on the value of stocks: A bibliometric analysis

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RESUMO

O interesse crescente sobre o tema de sustentabilidade estimulou a promulgação de legislações que tornam obrigatória a divulgação de práticas sustentáveis pelas empresas. Entretanto, artigos empíricos sobre esse tema apresentam resultados contraditórios em termos de valorização das ações. Assim sendo, este estudo tem por objetivo compreender a evolução da produção acadêmica sobre essa questão. Para tanto, realiza-se uma análise bibliométrica da literatura acadêmica a partir das bases de dados WoS e Scopus. Sua execução se dá por meio dos *softwares* R e Biblioshiny. Além disso, são verificadas as principais leis bibliográficas - Lotka, Bradford e Zipf. A amostra final é composta por 244 artigos. Os resultados obtidos contribuem à academia ao aprofundar a análise de pesquisas que relacionam a sustentabilidade com o desempenho financeiro das empresas, especialmente no contexto da obrigatoriedade da divulgação e do valor de mercado. Além disso, eles auxiliam governos e reguladores no aprimoramento de políticas públicas relacionadas à divulgação de informações de sustentabilidade.
Palavras-chave: ESG, Práticas sustentáveis, Divulgação mandatória, Mercado de ações, Análise bibliométrica

INTRODUCTION

The term environmental, social and governance (ESG) refers to sustainability issues in organizations. It was first used by the World Bank - in partnership with the United Nations (UN) and financial institutions from nine countries (World Bank, 2004). Although ESG scores have non-financial metrics, it has become increasingly common to relate sustainability to the financial performance of companies. The term triple bottom line, created by the British author John Elkington (Elkington, 1997), already associated environmental and social issues with business financial performance.

In the Brazilian stock market, the national Security Exchange Commission (SEC) launched the Sustainable Finance Policy on January 23, 2023, consolidating guidelines on the topic and defining a development plan for the capital market (SEC, 2023a). Previously, SEC had already expressed itself through resolution no. 59/2021, making the publication of ESG information mandatory and uniform from January 2, 2023 (SEC, 2021). In practice, the SEC adopted the comply or explain policy, pressuring listed companies to implement or justify - in their Reference Forms (RF) - their eventual non-adoption. This requirement applies to information related to the fiscal year ending on December 31, 2022, according to SEC resolution no. 80/2022 (SEC, 2022).

Following the guidelines of its sustainable finance policy and the recommendation of the International Organization of Securities Commissions (IOSCO), the SEC published resolution no. 193/2023 on October 20, 2023. Brazil becomes the first country to adopt the sustainability-related financial information report issued by the International Sustainability Standards Board (ISSB) (SEC, 2023b). According to the resolution, publicly traded companies can voluntarily disclose the sustainability report from January 1, 2024, and mandatorily from January 1, 2026. The ISSB issued its first standards on June 26, 2023, with IFRS Standard 1 (S1) addressing general requirements for the disclosure of sustainability-related financial information, while IFRS Standard 2 (S2) discusses climate-related disclosures (IFRS, 2023).

Regarding international capital markets, over the past decades, more regulators have been guiding companies to publish their sustainability practices. The European Union, for example, made the disclosure of non-financial information mandatory from 2017 for companies with more than 500 employees (European Union, 2014). In the case of the United States, ESG practice publications are voluntary. However, in 2021, Congress required the SEC to define standards and metrics for the mandatory annual disclosure of ESG information (North American Congress, 2021). Although the market considers the adoption of sustainable practices by companies positive, the literature presents (dis)advantages regarding their mandatory or voluntary disclosure.

Mandatory publication benefits society by promoting consistency and comparability of information, encouraging the adoption of a standardization in ESG disclosure. Additionally, makes it easier for stakeholders to monitor companies' operational improvements (Bushman & Smith, 2001; Stubbs & Higgins, 2018; Adams & Abhayawansa, 2021). On the other hand, mandatory publications can incur additional costs for companies throughout the required disclosure process (Friedman, 2007; Grewal *et al.*, 2019). Companies that voluntarily publish their sustainable actions promote their reputation among stakeholders and reduce external conflicts. However, most voluntary publications are not auditable due to the lack of standard information, which undermines their reliability (Christensen *et al.*, 2021).

Thus, given the existing controversy on this topic, the research problem of this study consists of answering the following questions: (1) What is the evolution of academic production on this topic?; (2) What are the collaboration patterns among the main authors, institutions, and countries in the analyzed sample?; (3) Which articles, authors, and journals have the greatest impact on the research topic? and (4) What are the main connections between the documents in the sample? These questions will be answered through a bibliometric analysis on the topic. This methodology involves two main types of techniques - performance analysis and scientific mapping.

Through these techniques, it is possible to evaluate the productivity and impact of articles, as well as the relationships of knowledge clusters. Thus, among the theoretical contributions of this bibliometric research are: i. objective (e.g., frequency) and relative (e.g., h-index, etc.) productivity of authors, journals, institutions, and knowledge clusters; ii. determination of the impact of studies through the number of local and global citations; iii. discovery of relationship clusters; iv. identification of constructs or concepts of interest and v. tracking of evolutionary aspects to understand where the topic is heading (Aria & Cuccurullo, 2017; Donthu *et al.*, 2021, Mukherjee *et al.*, 2022; Ozturk *et al.*, 2024).

The final sample consists of 244 articles published between 1945 and October 11, 2024, obtained from the Web of Science (WoS) and Scopus databases. The adoption of the bibliometric analysis methodology requires the use of specialized software - R and Biblioshiny. Additionally, the main bibliometric laws - Lotka (1926), Bradford (1934), and Zipf (1949) - are verified.

Other bibliometric analyses have already been conducted on topics related to this research. Tsang *et al.* (2023) present the main motivational aspects and consequences associated with the voluntary disclosure of ESG information. Khan (2022) and Wan *et al*. (2023) highlighted the relationship between the characteristics of companies that adopt ESG practices and their financial performance. However, this study distinguishes itself from others by presenting the evolution of these researches after the publication of the S1 and S2 standards (IFRS, 2023), analyzing their sociometric indicators, as well as the main bibliometric laws on the stock market's reaction to the mandatory disclosure of ESG information.

This study contributes to academia by deepening the analysis of research that relates sustainability to the financial performance of companies, especially in the context of mandatory disclosure and market value. The extensive literature review, covering the main theories and standards that support the topic, allows for a better understanding for new research. Companies and investors benefit from these results by deepening their understanding of the impact of regulation on promoting transparency and the development of ESG in companies. Additionally, the results of this study assist governments and regulators in improving public policies related to the disclosure of sustainability information.

1 THEORETICAL FRAMEWORK

Studies conducted to analyze the impact of mandatory or voluntary disclosure of ESG information on the value of companies' stocks mentioned several finance theories that point to positive and negative relationships. Despite existing controversies, it is possible to highlight five important theories in the study of ESG practices disclosure: i. stakeholders, ii. legitimacy, iii. agency, iv. informational asymmetry, and v. signaling (Park *et al.*, 2023; Tsang *et al.*, 2023).

The stakeholder theory expands the objective of companies beyond the needs of shareholders, encompassing the generation of benefits to other groups (in)directly impacted by the business - e.g., customers, suppliers, employees, government, communities, and civil societies (Freeman, 1984). The ability of organizations to relate to interested parties is a determining factor in value creation. Thus, the disclosure of non-financial information is a practice that increases transparency with stakeholders by communicating the actions the company has taken to meet the demands of the three ESG pillars (Khan, 2022; Tsang *et al.*, 2023).

The legitimacy theory perspective is that organizations must continuously seek to align with the values and norms accepted by society, ratifying the reason for their existence (Dowling & Pfeffer, 1975). Social perception is influenced by a variety of factors, including personal experiences, information they receive about the organization, and the image creation process. Therefore, the use of ESG practices disclosure works on the organization's functionality. This ultimately impacts social perception and the legitimization of the relationship between the organization and society (Khan, 2022; Park *et al.*, 2023).

The agency theory, on the other hand, assumes that companies are managed through a set of contracts. Among them is the specific one that safeguards the relationship between the principal (owner) and the agent (manager). In practice, managers may act to maximize their own interests, compromising the owners' objectives. This gives rise to the agency conflict (Jensen & Meckling, 1976). Among the agency costs to mitigate this conflict is the disclosure of (non)financial reports that minimize informational asymmetry between both parties (Agoraki *et al.*, 2023; Tsang *et al.*, 2023).

Informational asymmetry occurs when one party has more information than the other in a transaction. This fact promotes the realization of lower-quality deals, causing market inefficiency (Akerlof, 1978). The disclosure of ESG practices reduces informational asymmetry between companies and stakeholders. However, it still exists when information is not presented with the necessary quality and detail - even in markets where its disclosure is mandatory. In countries where its disclosure is voluntary, companies do so in search of increasing the value and liquidity of their stocks, as well as reducing their cost of capital (Tsang *et al.*, 2023; Zhang *et al.*, 2023).

In addition to mitigating informational asymmetry, the disclosure of sustainable practices is a positive signal to the market about the company's commitment to its long-term continuity. According to Spence (1973), signaling theory assumes that one party must provide relevant information so that the other party can interpret this signal. It is expected that understanding this signal will enable decision-making by investors and add value to the company that discloses its ESG practices. Thus, the mandatory disclosure of ESG practices, for example, allows investors to compare information, and their decisions also send signals to companies, reinforcing the implementation of this policy (López-Santamaría *et al.*, 2021; Agoraki *et al.*, 2023; Tsang *et al.*, 2023).

The factors that determine the disclosure of information by companies vary according to the type of organization, the context in which it operates, and its specific needs. Disclosure is a multidimensional concept that integrates various attributes (Beattie *et al.*, 2004). Information disclosure can be classified into two types: voluntary and mandatory. In voluntary disclosure, internal factors are more relevant, characterized by the choice of information to be disclosed, when, and with what budget. In mandatory disclosure, control lies with the country's capital market regulatory body, and the company must comply with the standard (Park *et al.*, 2023; Xue *et al.*, 2023).

There are developed countries where the disclosure of sustainable practices is mandatory, such as the already mentioned European Union, as well as the United Kingdom and Switzerland. In the United Kingdom, an amendment to the Companies Act (2006) made the disclosure of climate-related information mandatory (Government of United Kingdom, 2022). Switzerland, like the United Kingdom, also published an ordinance requiring companies to disclose information about actions with climate impact (The Federal Council of Swiss, 2022).

On the contrary, there are developed countries - such as Australia, Canada, and the already mentioned United States - where the publication of ESG reports is optional, and legislators are studying standards for their uniformity. Canada implemented the Canadian Sustainability Standards Board (CSSB), which has been developing actions since 2023 to advance the adoption and standardization of sustainability practices disclosure (Financial Reporting & Assurance Standards Canada, 2023). Similarly to Canada, Australia has initiatives to make the disclosure of ESG practices mandatory and standardized (Australia Accounting Standards Board, 2023).

In developing countries, both scenarios are also present. The disclosure of corporate sustainable practices can be mandatory or voluntary. Brazil, as mentioned, adopts the "comply or explain" policy through SEC Resolution no. 59/2021. India introduced the requirement for ESG reports as early as 2012. Its version of the ESG report was called the Business Responsibility Report (BRR). At the time, it was determined by the Securities and Exchange Board of India (SEBI) that the 100 largest listed companies in India - by market capitalization - should present their BRR. In 2021, the BRR evolved into the Business Responsibility and Sustainability Report (BRSR). Now, the 1000 largest companies are required to submit it to SEBI (SEBI, 2021; EY, 2023).

Malaysia also made the disclosure of ESG practices mandatory from 2016 (BMS, 2015). It does so through the Sustainability Reporting Guide (SRG) - issued by its stock exchange - which includes ESG information on the list of company requirements. The SRG also provides guidance on how to incorporate sustainability into organizations and helps identify, assess, and manage relevant economic, environmental, and social risks and opportunities.

On the other hand, developing countries such as China, Mexico, and Russia maintain the voluntary disclosure of ESG practices while legislators debate new regulations for companies. The China Securities Regulatory Commission (CSRC) initiated a project with the country's stock exchanges to make the disclosure of sustainability reports by listed companies mandatory and standardized in 2026 (Shanghai Stock Exchange, 2024). The Mexican Stock Exchange (BMV) encourages companies to publish ESG practice reports to show their efforts on the topic. However, this is not a mandatory action (BMV, 2022). In the case of Russia, the Central Bank of the Russian Federation also encourages companies to adopt and disclose sustainability practices. However, this is not mandatory (Bank of Russia, 2024).

The impact of mandatory or voluntary disclosure of sustainable practices on the value of companies is still controversial in the capital market. In countries where disclosure is mandatory - with standardized norms by the government and regulatory bodies - the effects on the capital market are more positive. The first consequence of mandatory disclosure is the change in companies' behavior, increasing their awareness of sustainable practices. The second effect observed is the improvement of companies' informational environment, reducing asymmetry with stakeholders. A third relevant aspect is that the disclosed information leads to better pricing of companies' value by investors (Do & Vo, 2023; Zhang *et al.*, 2023).

On the other hand, some authors observe a negative effect of mandatory ESG report publication on companies' value. Wang *et al.* (2023) point out that - immediately - companies need to incur new expenses to generate and disclose information about their sustainability practices, in compliance with the country's standards. Chen *et al.* (2018) argue that these expenses can be high, generating more costs than benefits. Consequently, there is a negative effect on the financial result and value of companies that need to adapt to the new rules. Additionally, mandatory disclosure can increase agency conflicts between managers and owners. Executives start prioritizing the disclosure of sustainability information to the detriment of others that may be more relevant to some shareholders.

Regarding the voluntary communication of sustainable practices, Baloria *et al.* (2018) suggest that companies that choose this option reduce informational asymmetry. This decision is motivated by managers' interest in obtaining benefits from mitigating risks associated with companies' operational activities. Incentives for companies that voluntarily disclose their sustainability practices include reducing capital costs, improving their image, increasing liquidity, and company value. Conversely, Xue *et al.* (2023) find that voluntary disclosure of sustainability information incurs additional costs for the company compared to its competitors. This fact reduces the profitability of those that choose this option.

2 METHODOLOGIES

The objective of this study is to examine the stock market's reaction to the mandatory disclosure of ESG information through a bibliometric analysis. This methodology seeks to quantify and evaluate scientific production in a specific area of study by analyzing publication, citation, and collaboration patterns among authors, journals, and institutions.

Bibliometric analysis techniques offer an objective way to identify knowledge clusters and research gaps, which can enrich and expand existing theoretical understanding (Donthu *et al.*, 2021, Mukherjee *et al.*, 2022; Ozturk *et al.*, 2024). Its implementation considers the following steps:

Step 1 - Choice of database. Articles are obtained from the following databases: i. Web of Science (WoS) - belonging to Clarivate Analytics. WoS contains records of scientific articles published in high-impact journals, classified through the Journal Citation Reports (JCR) index; and (ii) Scopus - Elsevier's academic article database. Scopus measures the relevance of academic journals through the Citescore index.

Step 2 - Definition of initial research parameters. To limit the scope of the study, a keyword search is conducted. Subsequently, filters from the WoS and Scopus databases related to language, document type, area, category, and period are applied - see Table 1.

Table 1 - Evolution of the final sample (Source: Prepared by the authors)

Signal	Description	Number of articles	
		WoS	**Scopus**
(+)	**Initial sample.** Search in the article title, abstract, keyword fields, considering the following sets of keywords: "(ESG OR Sustainab* OR CSR)" AND "(Disclosur* OR Report*)" AND "(Mandator* OR Obligator*)" AND "(Stock* OR Share*)"	246	271
(-)	Languages other than "English"	-6	-7
(-)	Document types other than "article" and "review article"	-13	-43
(-)	Research areas other than: WoS: "business economics", "environmental science ecology", "science technology other topics", "social sciences and other topics" . Scopus: "business management and accounting", "economics, econometrics and finance", "social sciences", "environmental sciences", "multidisciplinary"	-35	-19
(-)	Categories other than: WoS: "business finance", "environmental studies", "environmental sciences", "management", "green sustainable science technology", "business", "economics", "multidisciplinary sciences" Scopus: this database does not have the category filter option	-5	-
(=)	**Subtotal**	187	202
(-)	Exclusion of duplicate articles in the WoS and Scopus databases	-145	
(=)	**Final sample**	244	

Step 3 - Unification of databases and exclusion of duplicate articles. After downloading the files from the WoS and Scopus databases, they are unified and duplicate articles are excluded. Both actions are performed using R software.

Step 4 - Bibliometric analysis. The final sample file is imported into the Biblioshiny software (Aria & Cuccurullo, 2017), from which the analysis of the objective data of the articles - countries, authors, keywords, institutions, etc. - is carried out to prepare and analyze tables and relationship/co-citation maps. Additionally, the analyses are complemented by verifying the main bibliometric laws, namely: i. Zipf's Law (1949) - categorization and estimation of keyword frequency; ii. Bradford's Law (1934) - verification of journals; and iii. Lotka's Law (1926) - identification of researchers with the highest frequency of production on the defined topic.

3 RESULTS AND DISCUSSION

The final sample consists of 244 documents or studies related to the stock market's reaction to the mandatory disclosure of ESG information. Table 2 summarizes its main characteristics.

Table 2 - Summary of the final sample

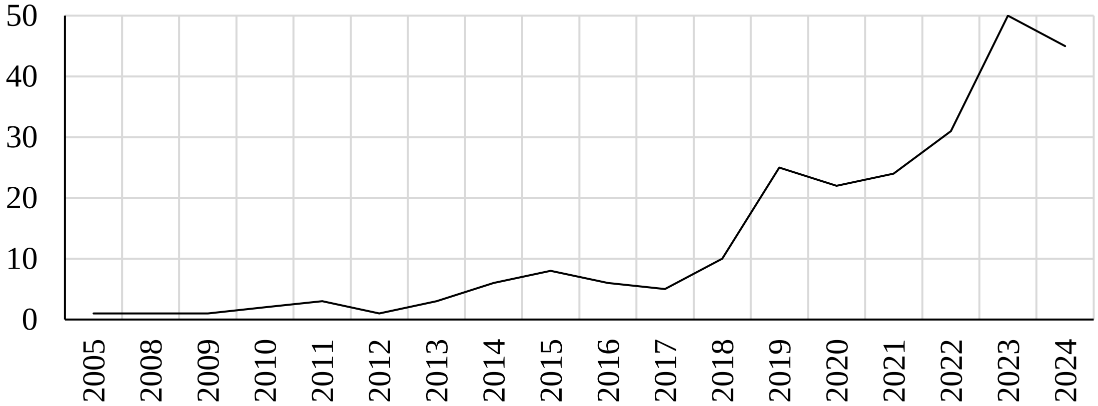
Description	Data
Period	2005-2024
Documents	244
Articles	228
Articles (early access)	10
Review articles	6
Annual growth rate	22.18%
Average citations per document	22.25
Authors	616
Co-authors per document	2.84
Single-author documents	39
Journals	153
Author keywords	849
Keywords plus (databases)	605

Source: Biblioshiny

3.1 Evolution of scientific production

The WoS and Scopus databases have 1945 as the starting year for research. However, the first studies were published only from 2005 onwards. Moreover, it is noteworthy that between 2005 and 2017, there was an annual average of 3.36 documents. Between 2018 and 2022, this average increased to 22.40, reaching 50 studies in 2023 - see Figure 1. One of the reasons for this growth is the mandatory disclosure of non-financial information imposed by the European Union in 2017 (European Union, 2014). Figure 1 highlights this upward trend in interest in this topic, as the year 2024 presents partial results. The sample period ends on October 11, 2024.

Figure 1 - Evolution of scientific production



Source: Biblioshiny

3.2 Zipf's Law (keywords)

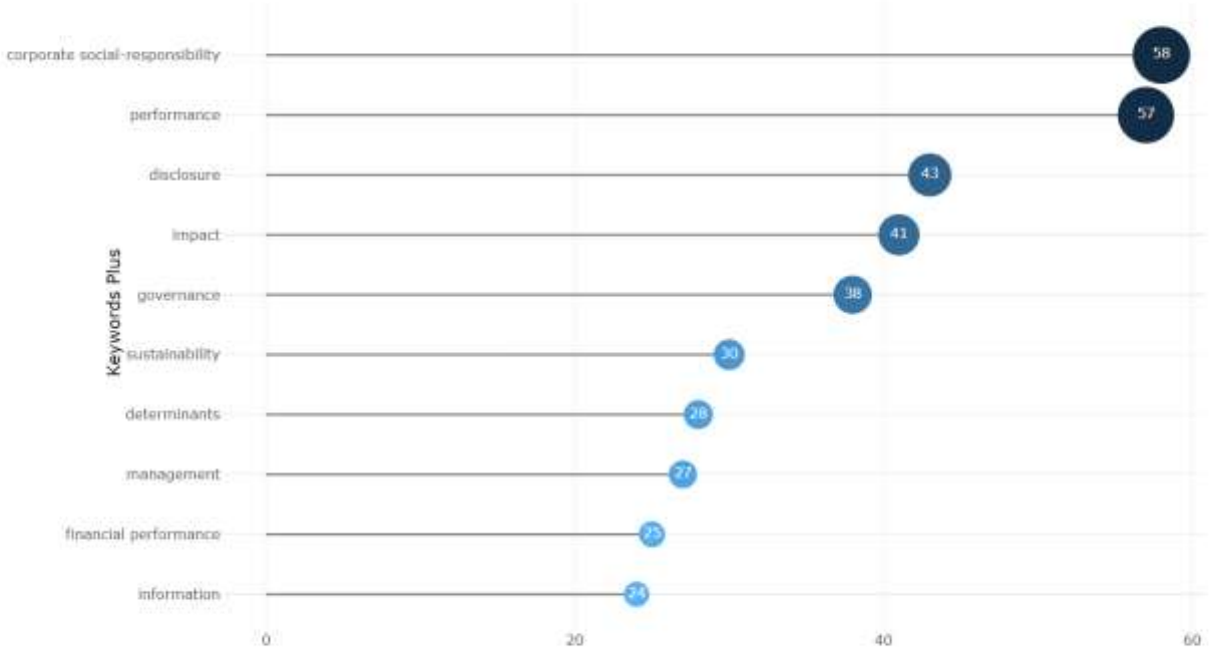
A total of 605 keywords established by the databases in the publications were identified. However, those with the highest frequency are "corporate social responsibility" (CSR), "performance," and "disclosure" - see Figure 2. The term CSR originated with economist Howard Bowen, expressing the importance of business ethics and responsibility towards stakeholders (Bowen, 1953). The definition of CSR has evolved over time, adapting to society's needs. Currently, the environmental dimension has been incorporated, giving rise to the term environmental, social, and governance (ESG).

Figure 2 - Word clouds

Source: Biblioshiny
Note: The size (position) of the word represents its frequency (relevance) throughout the study. Its position also indicates the connection with other nearby words. The closer to the center, the more relevant the word is.

Figure 3 shows that the ten most frequent keywords appeared 371 times in the documents. This represents 24.12% of the total 1,538 occurrences of the 605 keywords established by the databases. These results confirm Zipf's law, according to which there is a tendency to economize on the use of words. Thus, the same word is repeated many times, with the most frequent ones indicating the subject of the document.

Figure 3 - Most frequent words



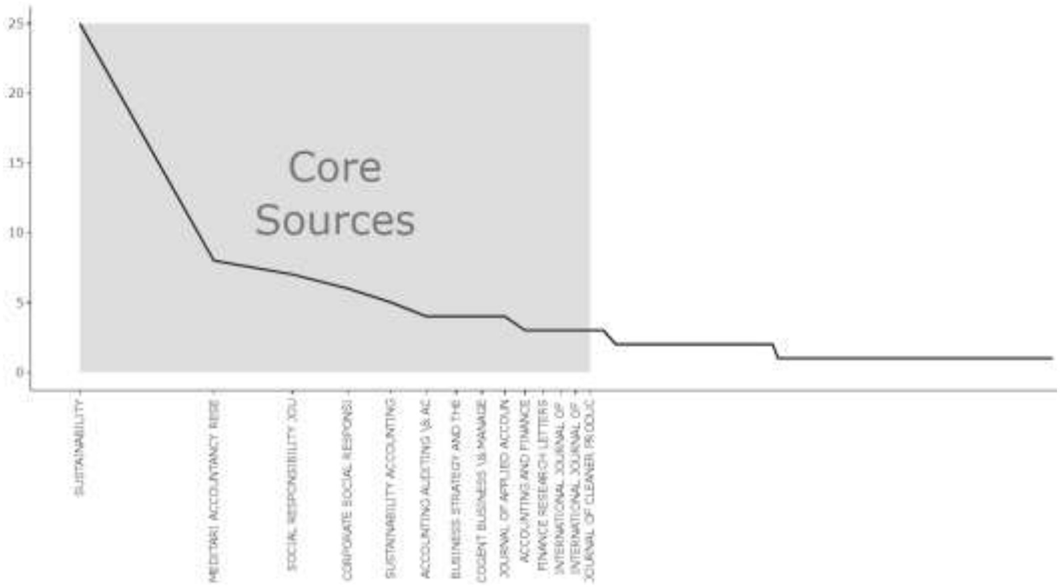
Source: Biblioshiny

3.3 Bradford's Law (journals)

Figure 4 indicates that the journals with the highest number of studies on the research topic are Sustainability, Mediatri Accountancy Research, and Social Responsibility Journal. Sustainability is a journal focused on the environmental, cultural, economic, and social sustainability of humans. Meditari Accountancy Research aims to promote a better understanding of accounting-related issues, encouraging research on the social impacts of sustainability, CSR, and integrated reporting. Finally, the Social Responsibility Journal seeks to publish research in the areas of CSR, sustainability, and governance.

Another aspect to highlight is that in Zone 1, there are 15 journals that publish between 3 and 25 (Sustainability) documents or 34.8% of the final sample. In Zone 2, there are 21 journals that publish up to 2 documents, representing 17.2%. Finally, in Zone 3, there are 117 journals that publish only one study, totaling 48% of the final sample documents. These results confirm Bradford's law. According to it, the descending classification of journals by the number of articles on a specific subject allows the identification of those that are more dedicated to a specific topic. In other words, Bradford (1934) demonstrates that few journals concentrate the largest number of publications on a given subject.

Figure 4 - Bradford's Law

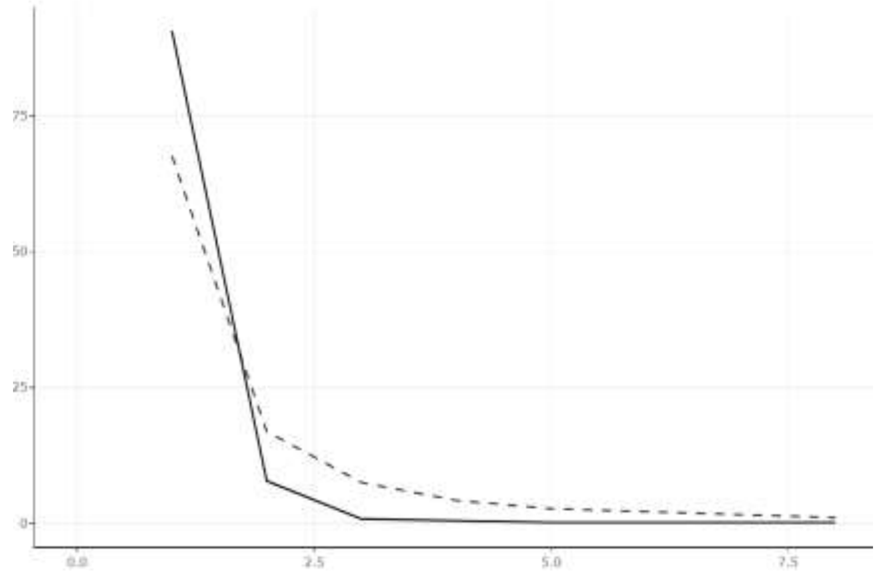


Source: Biblioshiny

3.4 Lotka's Law (authors)

Regarding the analysis of authors and their productions, Lotka's Law (1926) deals with the productivity of researchers. It states that a small number of authors are responsible for a large number of articles on a specific topic. Figure 5 presents the number and percentage of documents published by the authors in the final sample. It is noted that there is a smaller percentage of authors who publish a larger number of articles, confirming Lotka's Law (1926). In the final sample, 58 (9.42%) of the 616 authors are responsible for publishing 22 studies related to the research topic, and 558 (90.58%) published a single document, confirming Lotka's law.

Figure 5 - Lotka's Law



Source: Biblioshiny
Note: The solid line represents the observed result of the sample. The dashed line represents the function of Lotka's Law, which establishes the inverse relationship between the number of authors and the number of documents written.

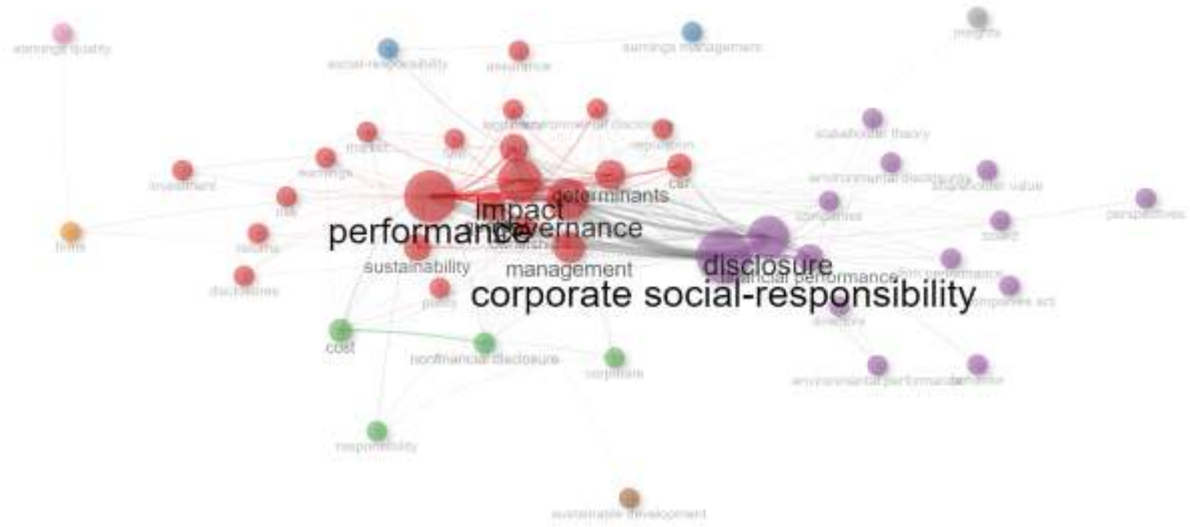
3.5 Sociometric indicators

Regarding sociometric indicators, or those based on social network analysis (SNA), it is equally relevant to understanding the information flow of the actors that make up the scientific collaboration networks through their interactions and existing partnerships. Its objective is to perceive the structural connections of the vertices of these actors' social networks (e.g., keywords, authors, institutions, countries, etc.) (Ribeiro, 2024).

Figure 6 presents the co-occurrence map of the main keywords established by the databases. It contains eight clusters, with the two main ones represented by the colors purple and red. In the case of the purple cluster, there are 14 keywords associated with the term corporate social responsibility - e.g., disclosure, financial performance, environmental, directors, board, etc. In this cluster, the stakeholder theory is also highlighted, directly linked to the CSR concept. This points to the authors' research interest in verifying whether the disclosure of CSR actions affects companies' financial performance.

The red cluster has 22 keywords and shows a strong connection with the term corporate social responsibility. It associates the words "performance" and "impact" with "governance," "sustainability," and "determinants." The legitimacy theory is also present in this cluster. This indicates the authors' concern in considering the premises of this theory to support the relationships between CSR and companies' financial performance.

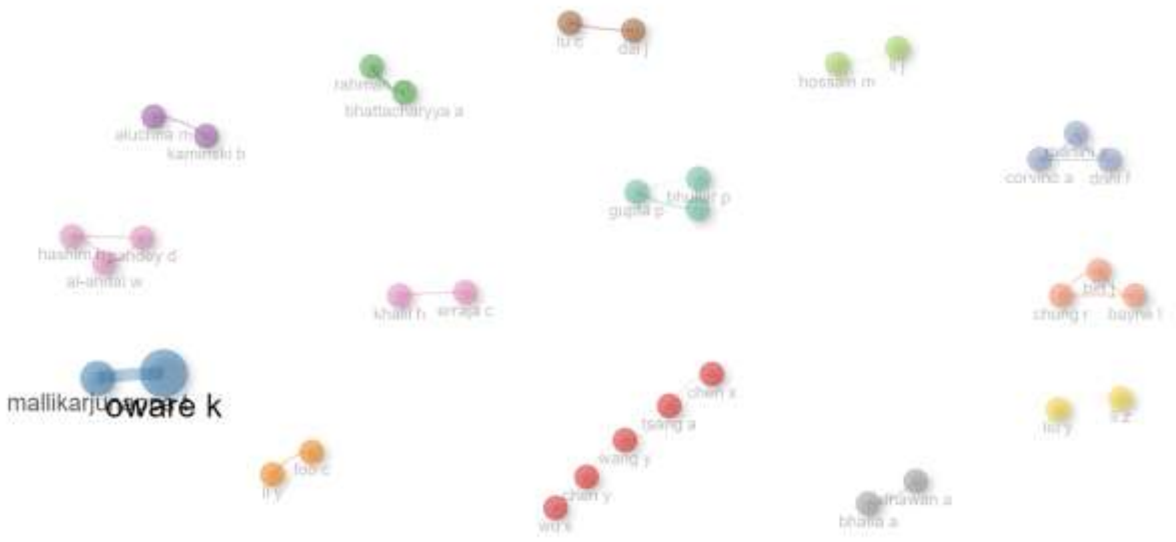
Figure 6 - Co-occurrence map of main keywords



Source: Biblioshiny
Note: The diameter of each node represents the relevance of the respective term. The density of a line represents the intensity of the connection between the nodes linked by it. Finally, each color represents a thematic cluster of related terms.

Figure 7 presents the groups of authors who published documents collaboratively. The main collaboration on this research topic is between the authors Kofi Mintah Oware and Thathaiah Mallikarjunappa. Of the eight studies in the sample published by Oware, five were co-authored by Mallikarjunappa, with a sample of Indian companies. The largest collaborative group involves five authors: Xiaoqi Chen, Albert Tsang, Yujie Wang, Yi-Chun Chen, and Sou-Shan Wu. Of the ten documents in the sample published by these authors, four had the collaboration of two or more authors from this group. All studies address the disclosure of CSR or ESG information, using samples of companies located in China, Taiwan, and the United States.

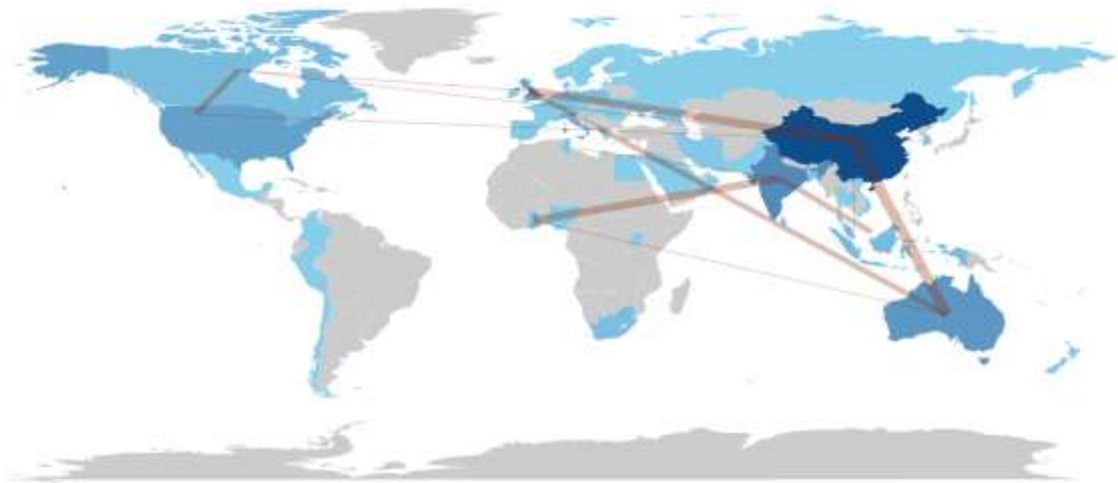
Figure 7 - Collaboration among authors



Source: Biblioshiny
Note: Each node represents an author, and its diameter is associated with collaborative relevance. The density of a line represents the frequency of collaboration between authors. Finally, each color represents a collaboration group (clusters).

Figure 8 presents a collaboration network among countries in the publication of documents. Of the 20 countries that collaborated with each other, the main ones are China (24), India (13), Australia (9), and the United Kingdom (9), totaling 64.0% of the studies. The main pairs are China-Australia (6), China-United Kingdom (4), India-Ghana (4), Australia-United Kingdom (3), India-Malaysia (3), and United States-Canada (3). South America and Africa are the regions with the lowest levels of collaboration.

Figure 8 - Collaboration map among countries



Source: Biblioshiny

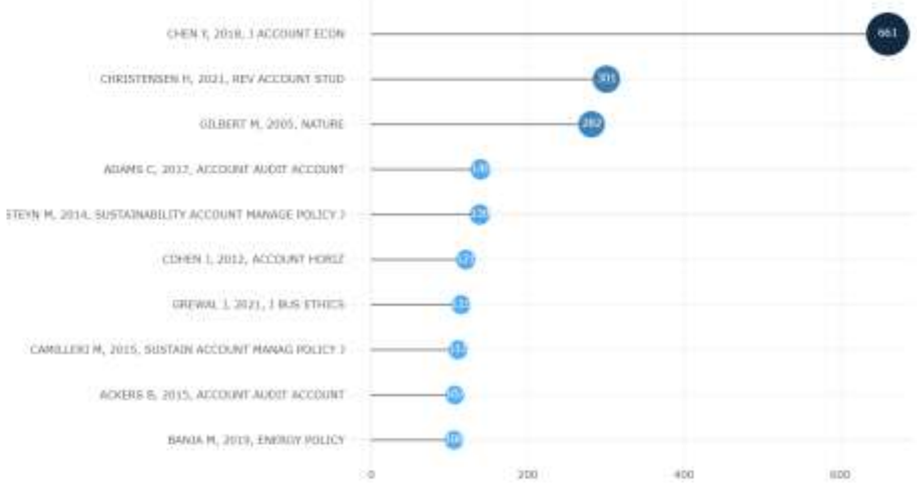
Note: The intensity of the color represents the level of collaboration of the country. The density of a line represents the frequency of collaboration between countries.

3.6 Most cited articles

Finally, Figure 9 presents the ten most frequently cited documents by other researchers, considering the set of studies from the databases. The top two represent 46.18% of these citations. The first, which appears on the list with 661 citations, is "*The effect of mandatory CSR disclosure on firm profitability and social externalities: Evidence from China*" (Chen *et al.*, 2018). It analyzes whether the mandatory disclosure of sustainability information impacts the profitability of Chinese companies. Additionally, the research examines the implications of this requirement for society, such as changes in people's behavior.

The second most cited document appears 301 times, being "*Mandatory CSR and sustainability reporting: Economic analysis and literature review*" (Christensen *et al.*, 2021). The study proposes a comparative analysis of the economic impacts that mandatory sustainability reports can generate in US companies. The research addresses the stages of defining the sustainability report, the effects on the capital market, and the implementation by companies. In both studies, the number of citations highlights the researchers' interest in analyzing and seeking behavioral patterns in the capital market after the mandatory disclosure of sustainability information.

Figure 9 - Most globally cited articles



Source: Biblioshiny

Note: The intensity of the color represents the frequency of citations the article received worldwide, including the sample.

CONCLUSION

The topic of sustainability has been of continuous interest to markets, governments, and society in general. Examples of this global disposition include: i. the UN's definition of a global agenda of sustainable development goals (SDGs) for 2030; ii. the IFRS S1 and S2 rules established by the ISSB; iii. SEC Resolution no. 80/2022, among other guidelines in favor of sustainable practices. It is also noteworthy that among them are those that aim at the mandatory disclosure of ESG information. However, empirical studies on this topic present non-consensual results regarding stock valuation. The existing controversy is that the implementation of sustainable practices cannot disregard the financial sustainability of companies.

Therefore, this study aims to understand the evolution of academic production on this topic, seeking to answer this and other related questions. To this end, a bibliometric analysis of academic literature between 1945 and October 11, 2024, is carried out using the WoS and Scopus databases. It is executed using R and Biblioshiny software. Furthermore, the laws of Lotka (1926), Bradford (1934), and Zipf (1949) are verified. The final sample consists of 244 articles.

The study results provide the following answer to question (1) - What is the evolution of academic production on this topic? The first studies were published only from 2005 onwards, with an exponential growth of documents from 2018 onwards. This effect coincides with the period following the UN's disclosure of the SDGs agenda for 2030. Regarding question (2) - What are the collaboration patterns among the main authors, institutions, and countries in the analyzed sample? - sociometric indicators highlight the formation of clusters of researchers linked to institutions in China, India, Australia, the United Kingdom, the United States, and Canada. This demonstrates the global scope and interdependence of this topic.

Regarding question (3) - Which articles, authors, and journals have the greatest impact on the research topic? - it is found that the most cited article is "The effect of mandatory CSR disclosure on firm profitability and social externalities: Evidence from China" (Chen *et al.*, 2018). It investigates the effect of mandatory disclosure of sustainability information on the financial performance of Chinese companies. Its results also point to changes in society's behavior concerning sustainable concerns. The journal with the largest number of documents is Sustainability, which published 25 (10.2%) of the 244 studies in the final sample.

Regarding question (4) - What are the main connections between the documents in the sample? - there is a strong connection between the keyword clusters "corporate social responsibility" with "performance" and "impact." This points to the authors' research interest in verifying whether the disclosure of CSR actions impacts companies' financial performance. As for the main bibliometric laws, all of them were confirmed. Regarding Zipf's law, of the 605 identified keywords, the most frequent ones were "CSR," "performance," and "disclosure," indicating the main topic of the documents. Regarding Bradford's law, a single journal published 25 articles (Sustainability), demonstrating that few journals concentrate the largest number of publications on a given subject. Finally, Lotka's law indicates that 58 (9.42%) of the 616 authors are responsible for publishing 22 studies related to the research topic, and 558 (90.58%) published a single document.

This research contributes to academia by investigating studies that link sustainability to companies' financial performance, particularly in a scenario of mandatory implementation and disclosure to the market. The literature analysis, including the main theories and standards that support the topic, facilitates understanding for future studies. These results benefit companies and investors by deepening their understanding of the effect of regulation on promoting transparency and advancing ESG in organizations. Additionally, the findings of this research contribute to governments and regulatory authorities in improving public policies related to the dissemination of sustainability information.

Regarding the limitations of this research, the identification of documents was restricted to the WoS and Scopus databases, as these are the most used for this type of study. As for the agenda for future studies, it is suggested to evolve the adopted methodology to a meta-analysis, to enable an analysis of the types of relationships between (in)dependent variables of econometric models on the topic, as well as to reveal relationships not studied in existing studies.

REFERENCES

Adams, C.A., & Abhayawansa, S. (2022). Connecting the Covid-19 pandemic, environmental, social and governance (ESG) investing and calls for "harmonization" of sustainability reporting. *Critical Perspectives on Accounting, 82*, 102309. https://doi.org/10.1016/j.cpa.2021.102309

Agoraki, M. E. K., Giaka, M., Konstantios, D., & Patsika, V. (2023). Firms' sustainability, financial performance, and regulatory dynamics: Evidence from European firms. *Journal of International Money and Finance*, *131*, 102785. https://doi.org/10.1016/j.jimonfin.2022.102785

Akerlof, G.A. (1978). *The market for "lemons": Quality uncertainty and the market mechanism*. In Uncertainty in economics (pp. 235-251). Academic Press. https://doi.org/10.1016/B978-0-12-214850-7.50022-X

Aria, M., & Cuccurullo, C. (2017). Bibliometrix: An R-tool for comprehensive science mapping analysis. *Journal of Informetrics, 11*(4), 959-975. https://doi.org/10.1016/j.joi.2017.08.007

Australia Accounting Standards Board (AASB). (2023). *Sustainability Reporting Exposure Draft*. https://aasb.gov.au/news/exposure-draft-ed-sr1-australian-sustainability-reporting-standards-disclosure-of-climate-related-financial-information/

Baloria, V. P., Klassen, K. J., & Wiedman, C. I. (2018). Shareholder activism and voluntary disclosure initiation: The case of political spending. *Contemporary Accounting Research*, *36*(2), 904-933. https://doi.org/10.1111/1911-3846.12457

Beattie, V., McInnes, B., & Fearnley, S. (2004). A methodology for analysing and evaluating narratives in annual reports: A comprehensive descriptive profile and metrics for disclosure quality attributes. *Accounting Forum, 28*(3), 205-236. https://doi.org/10.1016/j.accfor.2004.07.001

Bolsa Mexicana de Valores (BMV). (2022). *Annual Integrated Report*. https://www.bmv.com.mx/docs-pub/informeAnual/AnnualReport_2022.pdf

Bowen, H. R. (1953). *Social responsibilities of the businessman*. Harper& Row.

Bradford, S.C. (1934). Sources of information on scientific subjects. *Engineering: An Illustrated Weekly Journal*, *137*, 85-86. https://doi.org/10.1177/016555158501000407

Bursa Malaysia Securities Berhad (BMS). (2015). *Sustainability Reporting Guide.* https://www.bursamalaysia.com/sites/5bb54be15f36ca0af339077a/content_entry5ce3b5005b711a1764454c1a/5ce3c83239fba2627b286508/files/bursa_malaysia_sustainability_reporting_guide-final.pdf?1570701456

Bushman, R. M., & Smith, A. J. (2001). Financial accounting information and corporate Governance. *Journal of Accounting and Economics, 32*(1-3), 237-333. https://doi.org/10.1016/S0165-4101(01)00027-1

Central Bank of the Russian Federation (Bank of Russia). (2024). *Corporate Affairs Department*. https://www.cbr.ru/eng/about_br/bankstructute/dko/

Chen, Y. C., Hung, M., & Wang, Y. (2018). The effect of mandatory CSR disclosure on firm profitability and social externalities: Evidence from China. *Journal of Accounting and Economics*, *65*(1), 169-190. https://doi.org/10.1016/j.jacceco.2017.11.009

Christensen, H. B., Hail, L., & Leuz, C. (2021). Mandatory CSR and sustainability reporting: Economic analysis and literature review. *Review of Accounting Studies, 26*(3), 1176-1248. https://doi.org/10.1007/s11142-021-09609-5

Chueke, G. V., & Amatucci, M. (2022). Métodos de sistematização de literatura em estudos científicos: Bibliometría, meta-analise e revisão sistemática. *Internext, 17*(2), 284-292. https://doi.org/10.18568/internext.v17i2.704

Securities and Exchange Commission (SEC). (2021). Resolution no. 59. Annex C. Item 1.9. *Reference form content.* https://www.gov.br/cvm

Securities and Exchange Commission (SEC). (2022). Resolution no. 80. Annex C. Item 1.9. *Reference form content.* https://www.gov.br/cvm

Securities and Exchange Commission (SEC). (2023a). Ordinance CVM/PTE no. 10/2023. *Sustainable finance policy.* https://www.gov.br/cvm

Securities and Exchange Commission (SEC). (2023b). Resolution no. 193. *Development and disclosure of the financial information report related to sustainability, based on the international standard issued by the International Sustainability Standards Board - ISSB.* https://www.gov.br/cvm

Companies Act (2006). *UK public general acts*. https://www.legislation.gov.uk/ukpga/2006/46/contents

Do, T. K., & Vo, X. V. (2023). Is mandatory sustainability disclosure associated with default risk? Evidence from emerging markets. *Finance Research Letters*, *55*, 103818. https://doi.org/10.1016/j.frl.2023.103818

Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research, 133*, 285-296. https://doi.org/10.1016/j.jbusres.2021.04.07

Dowling, J., & Pfeffer, J. (1975). Organizational legitimacy: Social values and organizational behavior. *Pacific Sociological Review*, *18*(1), 122-136. https://doi.org/10.2307/1388226

Elkington, J (1997). *Cannibals with forks: The triple bottom line of 21st century business*. Oxford: Capstone.

Ernst & Young (EY). (2023). *Business Responsibility and Sustainability Reporting (BRSR): The evolution of sustainability reporting in India.* https://assets.ey.com/content/dam/ey-sites/ey-com/en_in/topics/climate-change/2023/ey-business-responsibility-and-sustainability-reporting.pdf

European Union (EU). (2022). Directive 2014/95/EU of the European parliament and of the council. *Amending directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and group*. https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014L0095

Forliano, C., De Bernardi, P., & Yahiaoui, D. (2021). Entrepreneurial universities: A bibliometric analysis within the business and management domains. *Technological Forecasting and Social Change*, *165*, 1-16. https://doi.org/10.1016/j.techfore.2020.120522

Freeman, R.E. (1984). Strategic management: A stakeholder approach. *Cambridge University Press*.

Financial Reporting & Assurance Standards Canada (FRAS Canada). (2023). *Canadian Sustainability Standards Board (CSSB)*. https://www.frascanada.ca/en/cssb/about

Friedman, M. (2007). *The social responsibility of business is to increase its profits* (pp. 173-178). Springer Berlin Heidelberg.

Government of United Kingdon (2022). *Mandatory climate-related financial disclosures by publicly quoted companies, large private companies and LLPs*. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1056085/mandatory-climate-related-financial-disclosures-publicly-quoted-private-cos-llps.pdf

Grewal, J., Riedl, E. J., & Serafeim, G. (2019). Market reaction to mandatory nonfinancial disclosure. *Management Science, 65*(7), 3061-3084. https://doi.org/10.1287/mnsc.2018.3099

International Accounting Standards Board (IFRS) (2023). *ISSB issues inaugural global sustainability disclosure standards*. https://www.ifrs.org/news-and-events/news/2023/06/issb-issues-ifrs-s1-ifrs-s2/

Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3*(4), 305-360. https://doi.org/10.1016/0304-405X(76)90026-X

Khan, M. A. (2022). ESG disclosure and firm performance: A bibliometric and meta-analysis. *Research in International Business and Finance*, *61,* 101668. https://doi.org/10.1016/j.ribaf.2022.101668

López-Santamaría, M., Amaya, N., Hinestroza, M. P. G., & Cuero, Y. A. (2021). Sustainability disclosure practices as seen through the lens of the signaling theory: A study of companies listed on the Colombian Stock Exchange. *Journal of Cleaner Production*, *317,* 128416. https://doi.org/10.1016/j.jclepro.2021.128416

Lotka, A.J. (1926). The frequency distribution of scientific productivity. *Journal of the Washington Academy of Sciences*, *16*(12), 317-323. https://www.jstor.org/stable/24529203

Mukherjee, D., Lim, W. M., Kumar, S., & Donthu, N. (2022). Guidelines for advancing theory and practice through bibliometric research. *Journal of Business Research, 148*, 101-115. https://doi.org/10.1016/j.jbusres.2022.04.042

North American Congress. (2021). H.R.1187 - Corporate governance improvement and investor protection act. *ESG disclosure simplification act of 2021*. https://www.congress.gov/bill/117th-congress/house-bill/1187/text

Ozturk, O., Kocaman, R., & Kanbach, D. K. (2024). How to design bibliometric research: An overview and a framework proposal. *Review of Managerial Science*, 1-29. https://doi.org/10.1007/s11846-024-00738-0

Paul, J., Lim, W. M., O'Cass, A., Hao, A. W., & Bresciani, S. (2021). Scientific procedures and rationales for systematic literature reviews (SPAR-4-SLR). *International Journal of Consumer Studies, 45*(4), O1-O16. https://doi.org/10.1111/ijcs.12695

Park, J. D., Nishitani, K., Kokubu, K., Freedman, M., & Weng, Y. (2023). Revisiting sustainability disclosure theories: Evidence from corporate climate change disclosure in the United States and Japan. *Journal of Cleaner Production*, *382*, 135203. https://doi.org/10.1016/j.jclepro.2022.135203

Ribeiro, H.C.M. (2024). Bibliometrics and sociometrics: Overview and trends in Brazil. *Perspectives in Management & Knowledge*, *14*(2), 135-164, https://dx.doi.org/10.22478/ufpb.2236-417X.2024v14n2.69341

Securities and Exchange Board of India (SEBI). (2021). Regulation no. 34. Annual Report. *Business Responsibility and Sustainability Report*. https://www.sebi.gov.in/sebi_data/commondocs/may-2021/Business%20responsibility%20and%20sustainability%20reporting%20by%20listed%20entitiesAnnexure1_p.PDF

Shanghai Stock Exchange (SSE). (2024). *Guidelines No. 14. Self-Regulation of Listed Companies - Sustainability Report (Trial) (Draft for Comments)*. https://english.sse.com.cn/news/newsrelease/c/c_20240222_10751120.shtml

Spence, A.M. (1973). Job market signaling. *Quarterly Journal of Economics, 87*(3), 355-374. https://doi.org/10.2307/1882010

Stubbs, W., & Higgins, C. (2018). Stakeholders' perspectives on the role of regulatory reform in integrated reporting. *Journal of Business Ethics, 147*, 489-508. https://doi.org/10.1007/s10551-015-2954-0

The Federal Council of Swiss (2022). Ordinance on climate disclosures. *Climate disclosures based on the recommendations of the Task Force on Climate-related Financial Disclosures*. https://www.admin.ch/gov/en/start/documentation/media-releases.msg-id-91859.html

Tsang, A., Frost, T., & Cao, H. (2023). Environmental, Social, and Governance (ESG) Disclosure: A literature review. *British Accounting Review*, *55*(1) 101149. https://doi.org/10.1016/j.bar.2022.101149

Wan, G., Dawod, A.Y., Chanaim, S., & Ramasamy, S.S. (2023). Hotspots and trends of environmental, social and governance (ESG) research: A bibliometric analysis. *Data Science and Management, 6*(2), 65-75. https://doi.org/10.1016/j.dsm.2023.03.001

Wang, J., Hu, X., & Zhong, A. (2023). Stock market reaction to mandatory ESG disclosure. *Finance Research Letters*, *53*, 103402. https://doi.org/10.1016/j.frl.2022.103402

World Bank. (2004). *Who cares wins, 2004-08*. IFC advisory services in environmental and social sustainability. https://documents1.worldbank.org/curated/en/ 444801491483640669/pdf/113850-BRI-IFC-Breif-whocares-PUBLIC.pdf.

Xue, S., Wu, H., Ling, Y., & Lu, Y. (2023). Mandatory CSR disclosure and stock liquidity: Evidence from Chinese listed firms. *Finance Research Letters*, *59,* 104817. https://doi.org/10.1016/j.frl.2023.104817

Zhang, Q., Ding, R., Chen, D., & Zhang, X. (2023). The effects of mandatory ESG disclosure on price discovery efficiency around the world. *International Review of Financial Analysis*, *89,* 102811. https://doi.org/10.1016/j.irfa.2023.10281

Zipf, G.K. (1949). *Human behavior and the principle of least effort*: *An introduction to human ecology*. Cambridge, Mass: Addison-Wesley Press.