

Mapping the evolution of ESG in the insurance sector: An empirical bibliometric analysis of conceptual structures and regulatory-driven research dynamics

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Abstract. This study examines how the concept of sustainability, expressed through ESG (Environmental, Social and Governance) principles, is reflected in academic research focused on the insurance sector. The study is based on a bibliometric analysis of 88 articles published between 2011 and 2024, using the Web of Science database and VOSviewer software. The results highlight a notable increase in academic interest after 2020, closely aligned with recent European sustainability regulations (CSRD, ESRS, EU Taxonomy, Solvency II, Omnibus I). The analysis identifies four main research directions: social responsibility, financial performance, corporate governance and risk management. The findings demonstrate that ESG has become a key analytical framework for understanding structural transformations in insurance, being increasingly used in assessing performance, regulatory compliance and long-term value. The study provides an empirical perspective on the mutual influence between academic research and public policies and highlights the need for interdisciplinary approaches to support the transition to a more sustainable financial system.

Keywords: *ESG, insurance, bibliometric analysis, VOSviewer, governance, sustainability, risk, regulation*

Introduction

Existing studies analyze ESG in finance broadly but rarely isolate how insurance specific regulator transformations have influenced scholarly domain. This study contributes to the specialized literature by mapping and analyzing the conceptual networks surrounding the theme of ESG in the insurance industry, an endeavor that can also be understood as *tracing the development of ESG insurance* that is, following the process of formation and consolidation of this interdisciplinary research field. In the context of the climate crisis, increasing social expectations, and stricter governance standards, insurance companies stand at the intersection of risk and responsibility: they not only manage risks but also act as pivotal agents in the transition towards sustainability. The integration of ESG (Environmental, Social, and Governance) principles into insurance is no longer a symbolic or rhetorical commitment, but a strategic imperative requiring the reassessment of investment policies, underwriting processes, and

disclosure practices. Yet, the conceptualization and consolidation of the “ESG insurance” field remain relatively recent and marked by fragmentation, reflecting the ongoing institutional transformations across the European regulatory landscape.

The consolidation of sustainability and ESG principles within the insurance sector is deeply rooted in both the international and European regulatory evolution. Globally, the 1987 Brundtland Report [1] and the 2015 United Nations 2030 Agenda for Sustainable Development [2] provided the normative foundation for integrating economic growth, social equity, and environmental protection into a unified development model. The Sustainable Development Goals (SDGs) [3], particularly Goals 8 (Decent Work and Economic Growth) [4], 12 (Responsible Consumption and Production) [5], and 13 (Climate Action) [6], directly link sustainable finance and risk management to systemic resilience and long-term value creation objectives in which the insurance sector plays a central role.

At the European level, this vision gradually materialized through a series of strategic and legislative milestones. The first legal foundation emerged with the Treaty of Rome (1957), which introduced the Common Agricultural Policy (CAP) under *Part Two – Bases of the Community, Title II – Agriculture, Articles 38–47* [7], establishing the principle of collective responsibility for resource management and economic stability an early precursor to modern sustainability governance. Over time, this foundation evolved toward a comprehensive sustainability agenda, culminating in the Common Agricultural Policy Strategic Plan Regulation (EU) 2021/2115 [8], which integrated environmental performance, eco-schemes, and rural development into a unified policy framework. These developments converged with the European Green Deal [9], launched in December 2019 (*COM(2019) 640 final*), the Union’s strategic roadmap for achieving climate neutrality by 2050 and embedding sustainability across all economic sectors.

The Green Deal triggered a cascade of legislative instruments that collectively redefined the governance of sustainability. Among them, the Corporate Sustainability Reporting Directive (Directive (EU) 2022/2464 – CSRD) [10] expanded corporate reporting obligations and introduced the European Sustainability Reporting Standards (ESRS), legally adopted through Delegated Regulation (EU) 2023/2772 [11], to ensure transparency, comparability, and accountability in sustainability disclosures. The Taxonomy Regulation (EU) 2020/852 [12] established a unified classification for sustainable economic activities, reducing the risk of greenwashing and fostering coherence between financial and environmental objectives. In the insurance field, Delegated Regulation (EU) 2021/1256 [13] amended the *Solvency II* framework to incorporate sustainability risks into governance and risk management processes, reinforced by EIOPA’s 2024 guidelines on the prudential treatment of sustainability risks [14][15]. More recently, the Omnibus I package (COM/2025/80 final) [16][17] simplified and harmonized ESG reporting and due diligence requirements, aiming to alleviate administrative burdens while strengthening cross-sectoral consistency.

Within this evolving context, the interplay between regulation, sustainability, and insurance practice has become a focal point for both academic and policy-oriented research. The progressive institutionalization of ESG principles has influenced how risk, performance, and corporate legitimacy are conceptualized and measured in the insurance domain. Consequently, this paper seeks to investigate how these regulatory shifts are mirrored in academic discourse by examining the bibliometric evolution of ESG-related research in insurance between 2011 and 2024. Specifically, it explores (1) the growth and thematic diversification of publications, (2) the dominant conceptual clusters defining the field, and (3) the extent to which major EU frameworks, including the Green Deal, CSRD, ESRS, EU Taxonomy, Solvency II, and Omnibus I, have shaped the trajectory of scholarly attention.

The purpose of this study is to trace the *bibliometric evolution of the ESG insurance field* using VOSviewer software, identifying emerging conceptual structures, thematic linkages, and research gaps. The analysis is based on data extracted from the Web of Science Core Collection, rigorously filtered for thematic relevance and document type (articles and reviews in English). Beyond mapping the scientific trajectory of ESG insurance, this study provides insights into how institutional regulation, transparency requirements, and market expectations jointly shape

research and practice in sustainable finance and insurance governance. In this sense, ESG insurance research is no longer a descriptive endeavor but an analytical framework for understanding the structural transformation of the European insurance sector amid the global sustainability transition and the implementation of the 2030 Agenda for Sustainable Development.

Literature review

The integration of Environmental, Social, and Governance (ESG) principles into the insurance sector has become a major axis of research in sustainability governance and financial regulation. The literature demonstrates a steady evolution from fragmented descriptive analyses toward increasingly systematic and theory-driven approaches. Three core thematic strands can be identified: (1) the conceptual and empirical evolution of ESG in insurance, (2) the bibliometric and methodological consolidation of ESG research, and (3) the institutional and industrial operationalization of ESG standards in practice and policy.

1. The conceptual and empirical evolution of ESG in insurance has been marked by a gradual transition from normative considerations of corporate ethics to strategic dimensions of performance and accountability. Early studies approached ESG as an extension of corporate social responsibility and environmental risk management. Johannsdottir and Cook (2019) [23] examined systemic risks associated with Arctic oil spills, illustrating insurers' dual motivations, ethical accountability and pragmatic liability control. Pfeifer and Langen (2021) [22] aligned the insurance business with the UN Sustainable Development Goals (SDGs), conceptualizing insurers as both enablers and beneficiaries of sustainability transitions. Wang et al. (2023) [21] later demonstrated that digital transformation enhances ESG performance primarily through transparency and investor trust. These findings indicate that ESG has evolved from a normative ideal into a measurable strategic dimension influencing both performance and reputation. Martí et al. (2024) [18] and Aburto-Barrera and Wagner (2023) [19] extended this discussion through systematic reviews, showing that while environmental aspects dominate, the social and governance dimensions remain underexplored.

2. The methodological and bibliometric consolidation of ESG research represents a second axis of inquiry, reflecting the analytical maturation of the field through bibliometric mapping and quantitative synthesis. Nobanee et al. (2023) [24] identified seven dominant themes in sustainable insurance research, revealing conceptual fragmentation but methodological convergence around visualization and co-citation analysis. These approaches build upon the foundational work of Van Eck and Waltman (2014) [20], whose VOSviewer and CitNetExplorer tools shaped the methodological architecture of knowledge mapping. Chytis et al. (2024) [25] and Khaw et al. (2024) [26] expanded bibliometric investigations to ESG governance-performance linkages, while Ye et al. (2020) [27] confirmed that corporate governance and social responsibility persist as conceptual anchors across sustainability studies. Beyond the insurance sector, Kiflee et al. (2024) [28] and Contreras and Abid (2022) [29] associated ESG with SDG advancement and the social dimension of corporate sustainability, respectively. This cluster of studies highlights the progressive formalization of ESG as a research field supported by advanced bibliometric evidence.

3. The institutional and practical operationalization of ESG constitutes the third thematic trajectory, emphasizing the application of ESG frameworks within governance, regulation, and industry practices. Recent scholarship and industry reports converge in recognizing ESG as a core determinant of strategic resilience, competitiveness, and compliance. Sood and Özen (2024) [30] demonstrated that ESG integration drives investment, product innovation, and risk management. Martí, Bastida-Vialcanet, and Marimon (2025) [31] analyzed disclosure quality, showing persistent inconsistencies in ESG key performance indicators (KPIs), while Bressan (2023) [32] explored fiscal trade-offs between sustainability commitments and profitability. Parallel to academia, consultancy and institutional publications, such as PwC (2022, 2023) [33][34], KPMG (2025) [35], and Deloitte (2023) [36], have underscored the need to strengthen climate risk governance and harmonize sustainability-related disclosures. At the policy level, The Geneva Association (2022) [37] defined insurance as a driver of social inclusion and resilience, while UNEP FI (2021, 2022) [38][39] provided specialized guidance for

managing ESG risks and aligning underwriting practices with climate transition objectives. Corporate evidence, exemplified by the *Sustainability Report 2023* (Vienna Insurance Group, 2023) [40] and Groupama's *ESG Climate Report 2022* [41], demonstrates that ESG has become integral to governance frameworks, regulatory compliance, and long-term corporate strategy.

Taken together, these three thematic trajectories reveal the interconnected evolution of ESG in the insurance sector, linking conceptual foundations, methodological consolidation, and institutional implementation into a coherent framework of sustainable governance. The reviewed literature confirms that ESG in insurance has evolved from an ethical commitment into a structural pillar of corporate governance and financial strategy. The transition from descriptive analyses to clustered, methodologically grounded frameworks illustrates the consolidation of ESG as an interdisciplinary domain linking environmental risk, governance efficiency, and social responsibility. The convergence between academic, regulatory, and industry narratives reinforces the notion that ESG in insurance is not a transient trend but a durable architecture of sustainable finance and institutional transformation.

Materials and Methods

The Web of Science Core Collection, recognized for its rigorous peer-review standards, robust indexing process, and broad multidisciplinary coverage, was selected as the data source for this study to ensure the reliability, consistency, and relevance of the analyzed data, as well as compatibility with citation-mapping and bibliometric visualization tools. The database was queried with the combined terms "ESG insurance" (without quotation marks) in the "Topic" category to identify the relevant body of literature.

The acronym *ESG* referring to *Environmental, Social, and Governance* criteria is widely used in both academic and policy literature to denote the multidimensional framework guiding corporate sustainability practices. Its combination with *insurance* captures a consolidated and conceptually recognized research area that links sustainability, financial performance, and risk governance within the insurance sector. Following the initial search, which generated 141 records, a set of systematic filters was applied to adjust the dataset. Based on the "Final Publication Year" field, records from 2025 were excluded, as this year corresponds to an ongoing publication and indexing cycle. Within the "Document Types" category, only *Article* and *Review Article* were retained, while *Proceedings Papers* and *Letters* were not considered. This selection ensured a homogeneous and analytically coherent dataset, enhancing the precision of bibliometric results and the interpretability of conceptual clusters. Additionally, only English-language publications were included to maintain terminological consistency, comparability, and replicability of the analysis. These criteria were applied to guarantee the quality, comparability, and analytical consistency of the dataset. After applying these filters, the resulting period, 2011–2024, was established as the analysis interval, corresponding to the first documented occurrence of the selected terminology and the most recent fully indexed year available.

After implementing these selection criteria, the final dataset comprised 88 publications. These records were exported in plain text format (*Full Record and Cited References*) to be processed through the bibliometric analysis software VOSviewer (version 1.6.20). The dataset was analyzed using a co-occurrence approach, with "All Keywords" as the unit of analysis and the "Full Counting" method. This analytical configuration was selected because keyword co-occurrence mapping provides a reliable indicator of conceptual connectivity within a scientific field, revealing how topics evolve and interact across disciplinary boundaries. The "Full Counting" method was preferred to "Fractional Counting" since it ensures that each occurrence of a keyword contributes equally to the network, thereby improving the representation of interdisciplinary linkages and emerging thematic intersections within the ESG insurance domain.

Out of 519 terms initially identified, a minimum occurrence threshold of five was applied to exclude isolated or low-frequency terms that could introduce noise and distort cluster interpretation. This threshold was determined after exploratory testing with alternative values, which confirmed that a cut-off of five occurrences provided the best balance between conceptual inclusiveness and analytical precision. As a result, 26 representative keywords were retained, forming the core of the network and capturing the conceptual essence of the field. The bibliometric visualization generated by VOSviewer

revealed the conceptual structure and internal organization of the ESG insurance research field, delineating major thematic clusters that reflect its intellectual consolidation, diversification, and progressive maturation over time.

Limitations of the study

This study is subject to several methodological and technical constraints that should be acknowledged when interpreting the results. The exclusive reliance on the Web of Science Core Collection, although justified by its rigorous peer-review standards, robust indexing, and compatibility with bibliometric visualization tools, may restrict the scope of coverage by omitting relevant studies indexed in other databases such as Scopus or Google Scholar. Likewise, the inclusion of English-language publications only intended to ensure terminological consistency and analytical comparability introduces a potential linguistic bias, limiting the inclusion of research published in other languages.

The exclusion of records from 2025, due to the ongoing indexing process, and the focus on specific document types (Article and Review Article) were methodological decisions aimed at improving data reliability and analytical coherence. However, these restrictions inevitably reduce the ability to capture the most recent scientific developments and non-traditional scholarly outputs. Additionally, the search string “ESG insurance”, while thematically precise, may not encompass all relevant studies employing alternative expressions or related terminological variations.

From a technical standpoint, the use of the “Final Publication Year” field instead of “Publication Year” could result in minor discrepancies in temporal distribution. Furthermore, the analytical configuration applied in VOSviewer a co-occurrence analysis using “All Keywords” and the “Full Counting” method may emphasize frequently recurring terms while underrepresenting emerging or low-frequency concepts. The adoption of a five-occurrence threshold, established after exploratory testing, enhanced interpretative clarity but also excluded marginal topics that could reflect early conceptual developments.

Finally, while VOSviewer ensures transparency and replicability, its analytical capacity is limited compared to integrated or algorithmically advanced bibliometric platforms capable of cross-database comparisons. These methodological and analytical limitations highlight that the present study offers a structured but partial mapping of the ESG insurance research field, providing a foundation for future studies to expand and refine the results through complementary databases and analytical techniques.

Results and discussion

The analysis demonstrates that research on “ESG insurance” has expanded rapidly after 2020, driven by the consolidation of the European sustainability framework, and this evolution is consistently reflected across all five analytical dimensions. (1) The temporal evolution and conceptual maturation highlight a marked post-2020 increase directly associated with major European regulatory reforms. (2) The citation impact and influential contributions confirm the consolidation of ESG as a central analytical instrument for assessing performance and risk. (3) The thematic cluster and conceptual integration reveal a structurally coherent domain aligned with EU priorities on social responsibility, economic performance, managerial integration, and climate-related risk. (4) The evolutionary dynamics and conceptual progression indicate a shift from normative debates to the full operationalization of ESG as reporting and risk-management obligations intensified. (5) The density structure and emerging trajectories confirm the centrality of ESG within the field and point to underexplored directions, such as the interaction between financial markets and sustainable insurance products or the prudential implications of green investments.

1. Temporal evolution and conceptual maturation

Figure 1 illustrates the evolution of research on the topic of “ESG insurance” between 2011 and 2024, highlighting an accelerated growth after 2020. During the 2011–2018 period, scientific activity remained limited, with only two publications in 2011 and one in 2016, indicating a marginal interest in the field. In 2020 and 2021, five papers were published each year, coinciding with the adoption of the

European legislative framework for sustainable investment (Regulation (EU) 2020/852 the EU Taxonomy). The year 2022 marks a sharp increase, reaching 18 publications, parallel to the enactment of Directive (EU) 2022/2464 on corporate sustainability reporting (CSRD). The upward trend continues in 2023, with 19 publications, driven by the introduction of the European Sustainability Reporting Standards (ESRS - Regulation (EU) 2023/2772), while the peak in 2024, with 34 publications, reflects the consolidation of the field following the release of EIOPA’s reports on the prudential treatment of sustainability risks in the insurance sector. Figure 1 thus demonstrates a clear correlation between the intensification of scientific production and the advancement of European regulatory initiatives in sustainable finance.

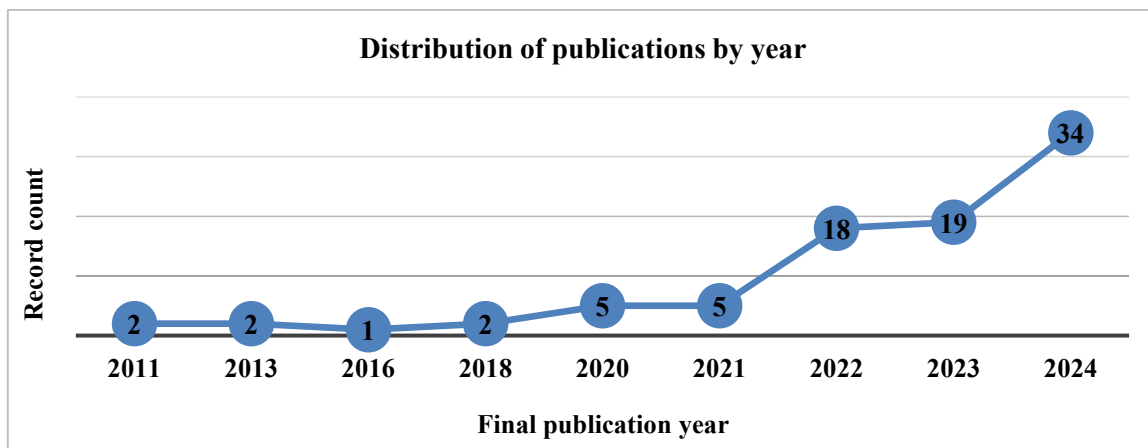


Figure 1. Distribution of publications by year on “ESG insurance” (2011-2024)

Source: Authors’ own research results.

2. Citation impact and influential contributions

Table 1 summarizes the most cited works shaping the field of “ESG insurance” (2011–2024). “Market Interest in Nonfinancial Information” (Eccles, Serafeim, and Krzus, 2011; 286 citations) [42] demonstrates investors’ growing demand for ESG-related data. “Stock market reactions to adverse ESG disclosure via media channels” (Wong and Zhang, 2022; 222 citations) [43] confirms that negative ESG news significantly reduces firm valuation. “Economic policy uncertainty, stakeholder engagement, and environmental, social, and governance practices: The moderating effect of competition” (Vural-Yavaş, 2021; 137 citations) [44] shows that companies intensify ESG efforts during periods of high uncertainty as a risk-mitigation strategy. The remaining leading contributors, Landi et al. (2022) [45], de la Fuente et al. (2022) [46], Zhou et al. (2024) [47], Lu et al. (2022) [48], Lin and Dong (2018) [49], Li et al. (2022) [49], and Breitenstein et al. (2021) [50], expanded the field through diverse empirical and conceptual approaches addressing sustainability integration, financial performance, innovation, and risk management. Collectively, these studies underscore the consolidation of ESG insurance as a mature and dynamically evolving area of scholarly inquiry within the broader sustainability and finance research landscape.

Table 1. Top 10 most-cited articles in the “ESG insurance” dataset (2011–2024)

No.	Title	Authors	Publication Year	Total Citations	Average per Year
1	Market Interest in Nonfinancial Information	Eccles, Robert G.; Serafeim, George; Krzus, Michael P.	2011	286	19,07
2	Stock market reactions to adverse ESG disclosure via media channels	Wong, Jin Boon; Zhang, Qin	2022	222	55,5

No.	Title	Authors	Publication Year	Total Citations	Average per Year
3	Economic policy uncertainty, stakeholder engagement, and environmental, social, and governance practices: The moderating effect of competition	Vural-Yavas, Cigdem	2021	137	22,83
4	Embedding sustainability in risk management: The impact of environmental, social, and governance ratings on corporate financial risk	Landi, Giovanni Catello; Iandolo, Francesca; Renzi, Antonio; Rey, Andrea	2022	111	27,75
5	The value of a firm's engagement in ESG practices: Are we looking at the right side?	de la Fuente, Gabriel; Ortiz, Margarita; Velasco, Pilar	2022	82	20,5
6	ESG rating divergence and corporate green innovation	Zhou, Jian; Lei, Xiaodong; Yu, Jianglong	2024	72	24
7	Are firms with better sustainability performance more resilient during crises?	Lu, Jing; Rodenburg, Kathleen; Foti, Lianne; Pegoraro, Ann	2022	71	17,75
8	Corporate social responsibility engagement of financially distressed firms and their bankruptcy likelihood	Lin, K. C.; Dong, Xiaobo	2018	67	8,38
9	ESG performance and stock prices: evidence from the COVID-19 outbreak in China	Li, Zengfu; Feng, Liu Hua; Pan, Zheng; Sohail, Hafiz M.	2022	49	12,25
10	Environmental hazards and risk management in the financial sector: a systematic literature review	Breitenstein, Miriam; Nguyen, Duc Khuong; Walther, Thomas	2021	47	9,4

Source: Authors' own research results.

3. Thematic clusters and conceptual integration

The bibliometric analysis of the literature dedicated to the concept of “ESG insurance”, illustrated in Figure 2¹, reveals a complex thematic network structured into four main clusters, each representing a distinct dimension. The numbers indicate the frequency of term occurrences. The visualization produced with VOSviewer demonstrates that the integration of ESG principles into the insurance sector unfolds along four major directions: social responsibility, corporate governance, financial performance, and climate risk management, highlighting a conceptual coherence between the scientific literature and the European regulatory framework.

Representing the normative dimension of ESG, the red cluster focuses on corporate social responsibility and transparency, thereby reinforcing companies' institutional legitimacy. It is defined by terms such as “corporate social responsibility” (6), “csr” (9), “disclosure” (9), “environmental” (9), “responsibility” (12), “market” (7), “reputation” (6), and “social” (6), which illustrate concerns for organizational ethics and sustainable reporting in line with the CSRD, ESRS, and SDG 12.

¹ The analysis was based on normalization by “association strength”, with standard layout parameters (attraction = 2, repulsion = 0), a clustering resolution of 1.00, and the minimum cluster size set to 1, while the “Merge small clusters” option was enabled to avoid fragmentation. The visualization was generated using “occurrences” (size = 0.89) as the weighting variable, with labels displayed as “frames” (font “Open Sans”, size 0.50, maximum 35 characters). Lines were color-coded by cluster, with a minimum strength threshold of 0 and a maximum of 1000 connections, while the “size variation” parameter was set to 1.00.

Reflecting the economic dimension of ESG, the green cluster demonstrates the connection between sustainable performance, governance, and corporate financial value. It includes “corporate social-responsibility” (19), “esg performance” (5), “financial performance” (13), “firm value” (5), “governance” (16), “social-responsibility” (8), and “impact” (20), emphasizing how sustainability contributes to corporate performance and competitiveness, consistent with the EU Taxonomy and SDG 8. Emphasizing the managerial dimension of ESG, the blue cluster centers on the integration of sustainability principles into corporate and investment strategies. It comprises “esg” (35), “firm” (5), “insurance companies” (5), “investment” (7), “management” (11), and “sustainability” (11), demonstrating the application of ESG within decision-making processes and corporate development strategies. This framework is regulated under Solvency II, which requires the inclusion of sustainability risks in governance, and is reinforced by the European Green Deal (2019).

Illustrating the climatic and prudential dimension of ESG, the yellow cluster underscores the essential role of insurance companies in managing climate risks and maintaining financial stability. It focuses on “climate” (5), “insurance” (18), “performance” (19), “risk” (15), and “stakeholder theory” (5), emphasizing the importance of environmental risk assessment and prudential performance in accordance with SDG 13 and the 2024 EIOPA Reports.

Overall, these four clusters define a coherent structure of the ESG field within the insurance sector, demonstrating its evolution from social responsibility and transparency (red), to economic performance (green), investment strategy (blue), and climate risk management (yellow), thereby confirming the integrated and regulated nature of corporate sustainability in this industry.

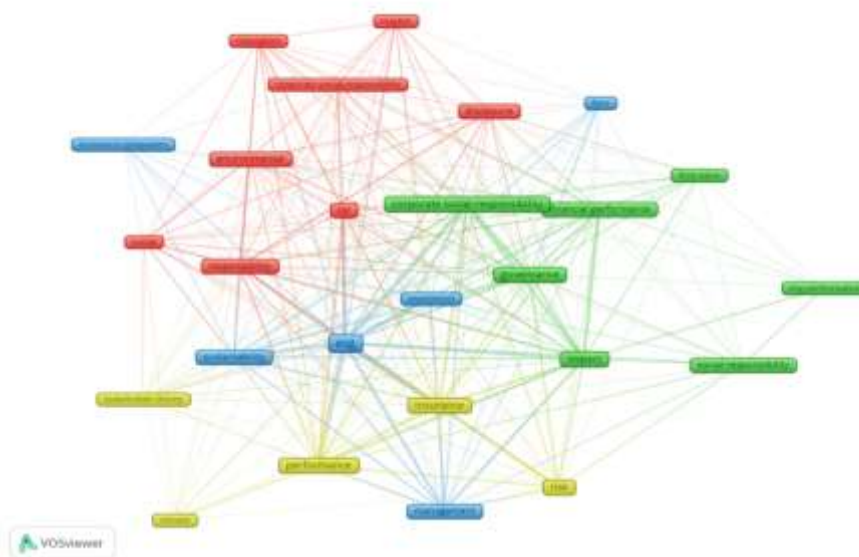


Figure 2. Network visualization of thematic mapping in VOSviewer based on keyword analysis of “ESG insurance”

Source: Authors' own research results.

4. Evolutionary dynamics and conceptual progression

Figure 3² illustrates the evolutionary development of ESG insurance research between 2020 and 2024, as depicted through the overlay visualization generated in VOSviewer. The image reveals a densely

² The analysis was performed using normalization by “association strength”, with standard layout parameters (attraction = 2, repulsion = 0), a clustering resolution of 1.00, and the minimum cluster size set to 1, while the “Merge small clusters” option was enabled to prevent fragmentation. The visualization was generated using “occurrences” (size = 0.89) as the weighting variable, with labels displayed as frames (font “Open Sans”, size 0.50, maximum 35 characters). The score dimension was set to “average publication year”, which enabled the temporal distribution of terms within the network. Colors were assigned according to the “Spectral” overlay scheme, with a minimum strength threshold of 0 and a maximum of 1000 connections, while the “size variation” parameter was fixed at 1.00.

interconnected network of keywords whose spatial proximity and chromatic gradation capture the chronological and conceptual progression of the field. The color spectrum, ranging from blue (2020) to red (2024), encodes the average publication year, allowing for a clear interpretation of the evolutionary trajectory of ESG research within the insurance domain. The network, characterized by strong cohesion, is structured around central terms such as “ESG”, “CSR”, “corporate social responsibility”, “financial performance” and “governance” which together form the conceptual core of the scientific field. Their strong interconnectivity confirms that ESG has become an integrative framework uniting the ethical, managerial, financial, and climatic dimensions of insurance research.

Terms such as “market” and “CSR” (2021) reflect the early theoretical foundations of ESG, rooted in corporate social responsibility theory and concerns regarding market legitimacy. The transition toward the yellow and orange tones corresponding to 2022–2023 indicates a thematic expansion toward governance (governance, management, investment, performance) and operationalization (insurance, financial performance, risk). This stage coincides with the institutional consolidation of ESG, driven by European regulatory frameworks (CSRD, ESRS), which extended the principles previously established within the normative structure of Solvency II.

Between 2023 and 2024, the emergence of orange and red nodes such as “disclosure”, “ESG performance”, “stakeholder theory” and “insurance companies” marks the transition of ESG insurance research toward a stage of empirical validation, reporting standardization, and stakeholder integration, defining the process of ESG institutionalization within the insurance sector.

Conceptually, this visualization confirms that ESG insurance research has evolved from descriptive and ethically oriented debates to an advanced, multidimensional framework addressing performance, governance, and risk. The structural density and even distribution of connections indicate that no isolated subfields persist, reflecting a consolidated and interdisciplinary research domain. The chromatic progression further suggests a phase of increasing thematic coherence, with the figure capturing the dominant co-occurrence dynamics that shape contemporary ESG insurance research. Overall, the visualization illustrates a field influenced by regulatory developments, strengthened expectations for organizational responsibility, and a sustained orientation toward sustainability and long-term resilience.

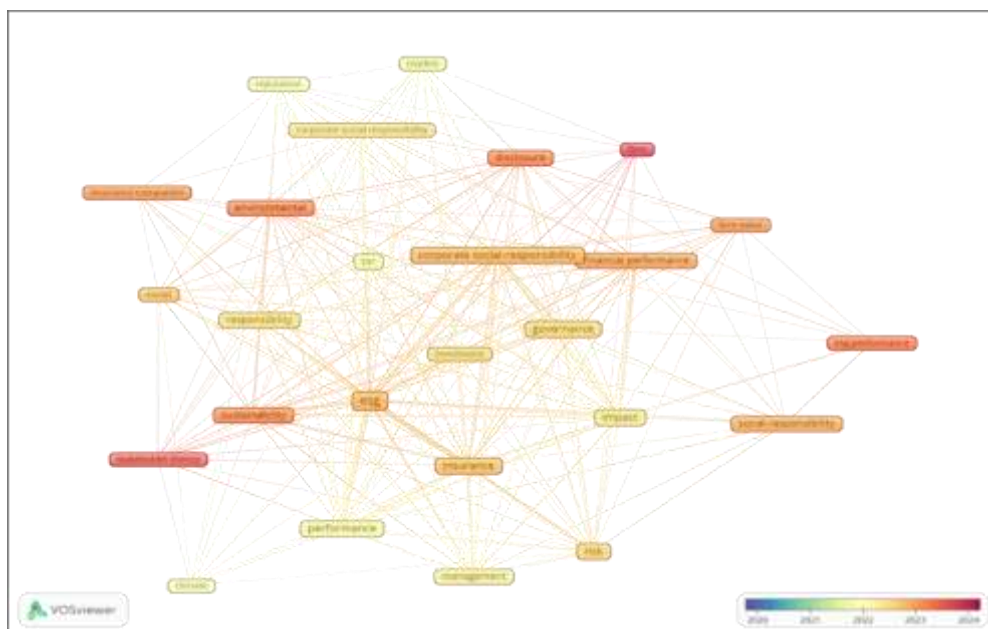


Figure 3. Overlay visualization of thematic mapping in VOSviewer for “ESG insurance” (2020–2024).

Source: Authors’ own research results.

5. Density structure and emerging trajectories

Figure 4³ the density visualization for the thematic domain of ESG insurance reveals that the literature is structured around the central concept of “ESG” which constitutes the conceptual core of the research field. This term appears in direct connection with “insurance”, “performance”, “corporate social-responsibility”, “governance” and “impact” illustrating the integration of ESG principles into governance strategies and organizational performance assessment. This convergence confirms that, in recent years, the reporting and transparency standards imposed through CSRD and ESRS have strengthened ESG as an operational instrument within insurance company governance.

A complementary set of concepts “sustainability”, “responsibility”, “risk”, “management”, and “financial performance” captures the managerial dimension of the field, where ethical responsibility, financial objectives, and risk management processes are addressed in an integrated manner. These themes align with the classification requirements and consistency mechanisms established by the EU Taxonomy, as well as with the incorporation of sustainability risks into the prudential framework defined by Solvency II. On the social and reputational level, the literature highlights the importance of terms such as “stakeholder theory”, “social”, “reputation” and “corporate social responsibility” indicating that organizational legitimacy and alignment with stakeholder expectations constitute essential components of ESG evaluation. The consolidation of a coherent reporting system is reflected by the presence of concepts such as “disclosure”, “firm value”, “esg performance”, and “social-responsibility” marking the transition from voluntary reporting practices to a standardized system based on comparable and verifiable assessments. At the emergent level, terms such as “market”, “environmental”, “investment”, “insurance companies” and “climate” signal a growing interest in the integration of ESG into financial markets, investment strategies, and the insurance industry’s management of climate-related risks. These developments reflect the strategic influence of the European Green Deal and are reinforced by recent legislative adjustments introduced through Omnibus I, which aim to harmonize sustainability obligations and streamline reporting requirements.

Overall, the density map illustrates a stratified evolution of the field: the central core encompasses the integration of ESG into governance and performance; the intermediate layer brings together social responsibility and managerial sustainability; and the peripheral area reflects emerging directions related to climate, markets, and investments. This structure confirms the maturation of an interdisciplinary domain strongly shaped by European legislative transformations and by the growing emphasis on sustainability within the insurance sector.

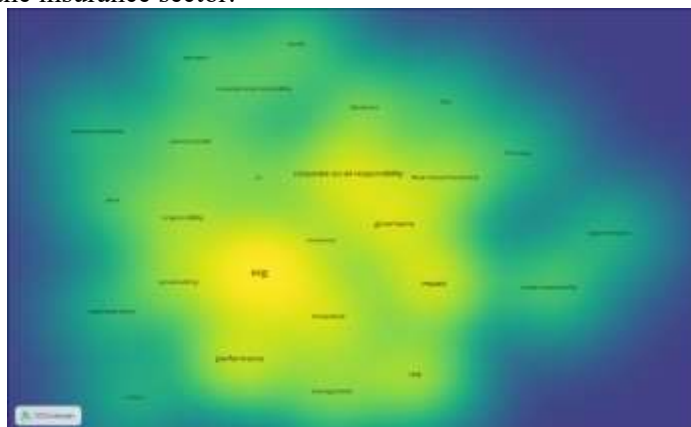


Figure 4. Density visualization of thematic mapping in VOSviewer for “ESG insurance”.

Source: Authors’ own research results.

³ The analysis was performed using normalization by “association strength”, with standard layout parameters (attraction = 2, repulsion = 0), a clustering resolution of 1.00, and the minimum cluster size set to 1, while the option “Merge small clusters” was enabled to prevent fragmentation. The visualization was generated using “occurrences” (scale = 0.77) as the weighting variable, with labels displayed in the “Open Sans” font (maximum 35 characters). The density kernel width was set to 2.30, and the visualization mode was configured to “item density.” Colors were assigned according to the “Viridis” density color scheme.

Conclusion

A bibliometric analysis of ESG research trends in the insurance sector for the period 2011-2024 highlights accelerated development, deeply influenced by major changes in the European regulatory framework on sustainability. The substantial increase in scientific output after 2020 confirms the decisive role of legislative instruments, such as the revisions of the EU taxonomy, CSRD, ESRS, and Solvency II, in redirecting academic interest toward topics such as reporting, transparency, risk management, and sustainable performance. Thus, the answer to the first research question, concerning the evolution and diversification of the field, indicates a transition from a narrow thematic core to a broad, articulated, and methodologically coherent field.

Thematic mapping has identified four major groups: social responsibility, governance and financial performance, managerial integration of ESG principles, and climate risks, which outline the conceptual architecture of the field and provide the answer to the second research question. The coherence of these groups shows that ESG in insurance is no longer treated as a simple ethical benchmark, but as an integrated analytical tool, necessary both for shaping performance and for informing strategic decisions and reporting obligations.

The influence of the European legislative framework, investigated through the third research question, is clearly reflected in the reconfiguration of academic priorities. The Green Deal, CSRD, ESRS, EU Taxonomy, Solvency II, and Omnibus I have redefined not only institutional expectations regarding sustainability reporting, but also the directions of scientific research, favoring studies focused on transparency, climate risk integration, the consequences of sustainable investments, and alignment with green transition objectives. The results suggest that academia is responding directly to legislative changes, producing the knowledge needed for the insurance sector to adapt to new sustainability requirements.

At the same time, the analysis highlights the need to strengthen ESG reporting tools, develop common methodologies for integrating climate risks, and deepen the relationship between sustainable investments and the financial stability of insurance companies. It also emphasizes the need for increased interdisciplinary collaboration between environmental sciences, finance, economics, and data sciences, so that models for assessing sustainable performance and systemic risks are based on rigorous foundations.

An important contribution of this study is the methodological model used, a replicable procedure for data selection, bibliometric analysis, and conceptual mapping using VOSviewer, which can also be applied in other areas of sustainable finance or corporate governance. In addition, the results highlight emerging areas that require further investigation, such as the integration of ESG standards into solvency models, the effectiveness of green investments in reducing financial risks, and the impact of regulatory pressure on the quality of corporate reporting.

Overall, ESG in the insurance sector is emerging as a mature field, essential for understanding the profound transformations generated by the European transition to sustainability. The development of climate risk research, ESG data infrastructures, and sustainable performance assessment models are priority areas for progress, with the potential to guide public policy, funding agendas, and institutional strategies. The study thus contributes to strengthening the dialogue between academia and the legislative environment, providing a solid basis for future analytical investments dedicated to a more resilient and sustainable financial system.

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