Carbon Policy, ESG Adoption, and Industrial Marketing: A Bibliometric Analysis of an Empirically Empty Integrative Space

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Abstract: The extent to which academic literature aligns with the rapid regulatory changes introduced by the Corporate Sustainability Reporting Directive and the phased implementation of the European Sustainability Reporting Standards remains uncertain, particularly regarding the integration of carbon policy regulation, environmental, social, and governance (ESG) adoption, and industrial marketing strategies. To address this question, 2,370 peer-reviewed records harmonized across six search streams in OpenAlex (2004–2025) were examined. These records were retrieved using openalexR, analyzed with the Bibliometrix R package, and visualized with VOSviewer. The study employed five sequential analytical layers: performance metrics, co-citation networks, bibliographic coupling with sensitivity testing, keyword co-occurrence, and thematic mapping. The four-cluster coupling solution was validated through cluster stability analysis (Adjusted Rand Index = 0.575; Normalized Mutual Information = 0.638), yielding four structural rather than numerical findings. First, the intersection of carbon policy, ESG, and industrial marketing yielded no records under the harmonized vocabulary. Second, when ESG is excluded, the carbon–marketing relationship is represented by only eight records, indicating that ESG is an essential, non-bypassable mediating construct. Third, the Western Balkans account for only 4.8% of the global emerging-economy ESG corpus, with Albanian ESG-related scholarship comprising just 0.06% of that body (one record in 1,773) and 0.21% of the consolidated corpus (five records in 2,370). Finally, geographic specialization has advanced more rapidly than specialization in marketing strategies. Seven independent observations support the observed separation between carbon and marketing, indicating that this gap is structural rather than artefactual. These findings underscore the need for integrative research models that are both theoretically justified and contextually overdue, particularly in the underrepresented research environment of the Western Balkans. By establishing this gap through convergent bibliometric evidence rather than interpretation, the review offers a structural foundation and a research agenda for integrative models that link carbon policy pressure, ESG adoption, corporate reputation, green innovation, and industrial marketing strategy in manufacturing in emerging economies.

Keywords: ESG, Carbon policy, Industrial marketing, Bibliometric analysis, Emerging economies, Western Balkans

1. Introduction

The transition of sustainability reporting from a voluntary activity to a legal obligation has reshaped the questions firms must answer about their environmental conduct and the way they communicate it. The Corporate Sustainability Reporting Directive (CSRD; European Union, 2022) and the phased European Sustainability Reporting Standards (ESRS; European Financial Reporting Advisory Group, 2023) now bind three constructs together in practice: the regulatory pressure of carbon policy, the adoption of environmental, social and governance (ESG) practices, and the marketing strategy through which firms signal performance to stakeholders. Whether the academic literature has integrated these three constructs to the same degree is far from clear.

This paper takes up that question. We work with a harmonized corpus of 2,370 peer-reviewed records retrieved from OpenAlex over 2004–2025 across six search streams, applying a sequential pipeline of performance metrics, co-citation analysis, bibliographic coupling with sensitivity testing, keyword co-occurrence, and thematic mapping. The objective is not to add to the several thousand existing empirical ESG studies, but to map the topology of the integrative space, identifying, with anchor evidence rather than interpretation, where that space is occupied and where it stands empty. The resulting map is intended as a foundation for the integrative, theoretically motivated models the field now needs, particularly in emerging-economy manufacturing.

2. Theoretical Background

The corpus rests intellectually on a small set of references that the co-citation analysis later confirms empirically. Suchman's (1995) distinction between pragmatic, moral and cognitive legitimacy maps directly onto the differentiated audiences that ESG reports now address, investors, regulators and civil-society actors. While legitimacy theory explains why firms disclose, stakeholder theory, in Freeman's (1984) formulation, explains to whom disclosure is owed and underpins the materiality assessment standard in ESRS-compliant reporting. Barney's (1991) resource-based view supplies a complementary lens, treating ESG capabilities as potential

sources of competitive advantage rather than reporting overhead. Institutional theory (DiMaggio and Powell, 1983) accounts for the isomorphic pressures that drive convergence in disclosure practices, while signaling theory (Spence, 1973) frames disclosure as a costly signal of unobservable quality.

Porter and van der Linde's (1995) hypothesis that well-designed environmental regulation can stimulate rather than impede innovation supplies the analytical bridge between the carbon-policy and green-innovation constructs. Together, these references articulate the causal pathway from regulatory pressure to innovation and reputational outcomes that the integrative model proposes to specify. Greenwashing scholarship (Delmas and Burbano, 2011) provides the critical counterpoint, locating the marketing-communication dimension of ESG within a literature concerned with the gap between claimed and actual performance.

3. Methodology

Corpus construction was conducted using OpenAlex, accessed programmatically via the openalexR package in R. OpenAlex consolidates bibliographic records previously distributed across several archives and indexes more than 250 million works through an open, reproducible application programming interface (Priem, Piwowar and Orr, 2022). The choice over Scopus and Web of Science carries an explicit limitation, acknowledged in Section 7, but it follows established precedent: a recent Scopus-target bibliometric study used openalexR as its primary retrieval engine for more than 41,000 records (Bochenek et al., 2025). The structural findings reported below derive from the corpus's relational architecture rather than from absolute counts that would be sensitive to database selection.

Six search streams were defined: carbon–ESG (S1), ESG–marketing (S2), carbon–marketing (S3), the trinary intersection of all three constructs (S4), emerging economies (S5), and the Western Balkans (S6). All six streams were queried on 10 May 2026. Retrieval identified 2,418 records; after deduplication and removal of cross-stream duplicates, the consolidated corpus M comprised 2,370 records (Figure 1). Because OpenAlex is updated continuously, these counts reflect the database state on that date; later retrievals may yield marginally different totals, although the structural relationships underpinning the findings are robust to such variation.

Analysis proceeded through five sequential analytical layers, following the protocol consolidated by Donthu et al. (2021): (i) descriptive performance metrics; (ii) co-citation networks, which recover the field's foundational intellectual base; (iii) bibliographic coupling with sensitivity testing, which maps the synthesis active in the citing literature; (iv) keyword co-occurrence; and (v) thematic mapping. Implementation relied on the Bibliometrix R package (Aria and Cuccurullo, 2017) for descriptive statistics, network construction, and clustering, and on VOSviewer (van Eck and Waltman, 2010) for visualization. Louvain community detection was applied to the co-citation, coupling, and keyword graphs.

The four-cluster coupling solution was subjected to a sensitivity analysis: the same algorithm was re-applied to a top-40 subset of the top-50 records, and stability was measured by the Adjusted Rand Index, the Normalized Mutual Information score, and the greedy maximum overlap of cluster assignments. The procedure provides explicit assurance that the reported cluster structure is not an artefact of threshold choice.

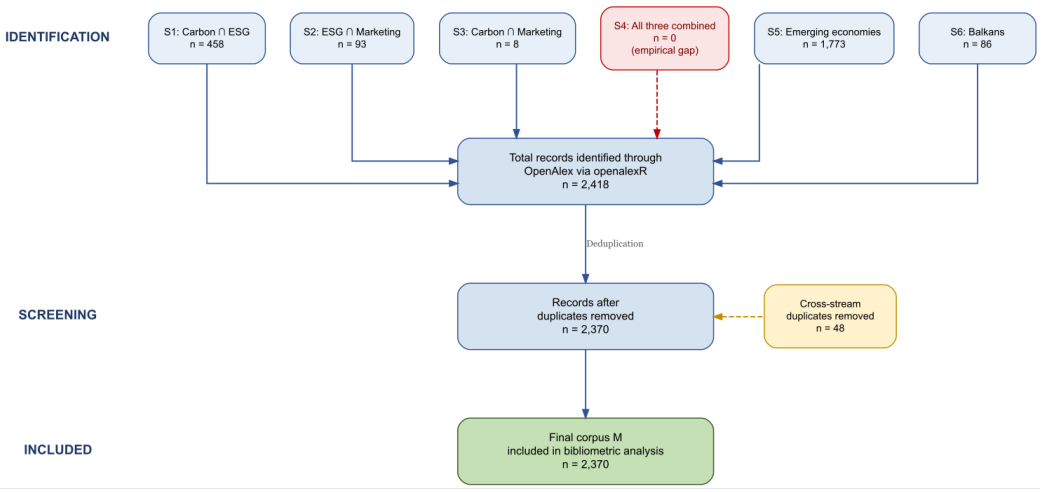


Figure 1: Corpus construction. Six search streams retrieved via OpenAlex/openalexR (S1 carbon–ESG = 458; S2 ESG–marketing = 93; S3 carbon–marketing = 8; S4 trinary = 0; S5 emerging economies = 1,773; S6 Western Balkans = 86) consolidate, after deduplication, into corpus M (n = 2,370)

4. Results

4.1 Performance

The corpus comprises 2,370 records from 1,020 distinct sources, with an annual growth rate of 39.53% and an average document age of 2.4 years. Production accelerates sharply after 2022: 161 records in 2022, 341 in 2023, 523 in 2024, and 1,091 in 2025, with the 2025 cohort alone accounting for 46% of the corpus, coinciding with the staged adoption of the CSRD and ESRS. The author distribution is steep: of 5,843 authors, approximately 88.8% appear exactly once, a Lotka-style pattern (Lotka, 1926) indicative of a field yet to consolidate. Leading peer-reviewed outlets are Sustainability (n = 111), Finance Research Letters (n = 57), Corporate Social Responsibility and Environmental Management (n = 38), and Business Strategy and the Environment (n = 29); marketing-discipline journals are notably absent. Geographically, China (19.6%), India (9.0%), and Indonesia (7.8%) dominate first-author production.

4.2 Co-citation Analysis

Co-citation analysis recovers the field's intellectual foundation and empirically confirms its theoretical anchors. Suchman (1995) and DiMaggio and Powell (1983) each receive 69 in-corpus citations and are co-cited as a paired foundation; Barney (1991) and Freeman (1984) receive 68 and 64, respectively; and Porter and van der Linde (1995) receive 58, consistently co-cited with the institutional and stakeholder anchors. The empirical centrality of these references corroborates the theoretical positioning set out in Section 2 (Figure 2).

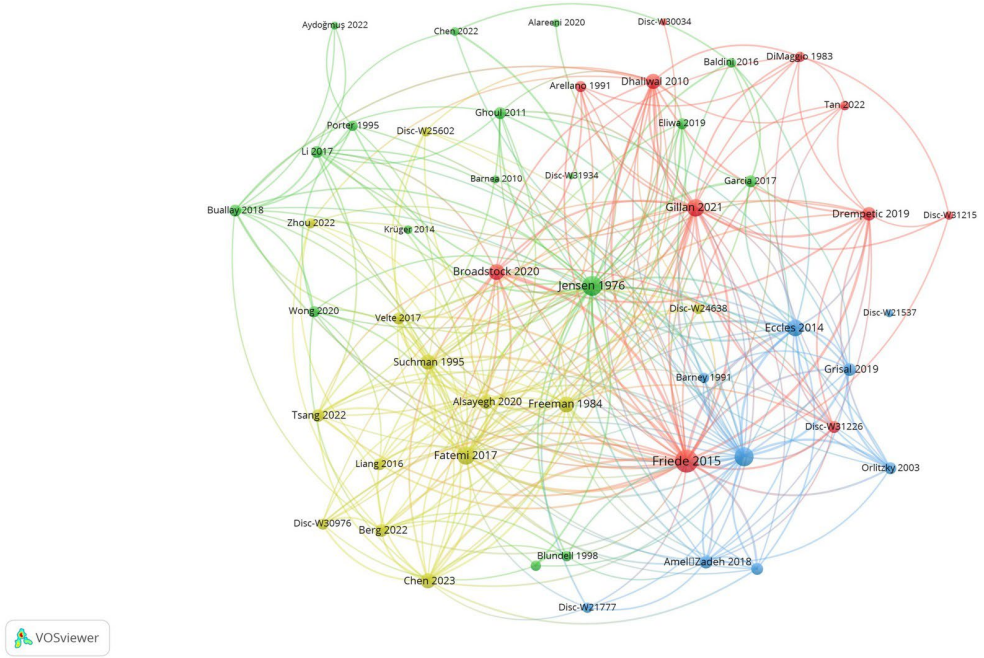


Figure 2: Co-citation network of the most-cited references (VOSviewer), showing four communities organized around the legitimacy, institutional, stakeholder and resource-based foundations of the field

4.3 Bibliographic Coupling and Cluster Stability

Louvain community detection on the top-50 coupling subnetwork returns four communities (modularity Q = 0.0706). Cluster 1 comprises bibliometric and systematic ESG reviews (Thomas, Jayachandran and Biju, 2024; Zhang, Yang and Wang, 2024); Cluster 2 comprises empirical studies of the ESG–financial-performance relationship (Singh, Verma and Shome, 2023); Cluster 3, the most relevant to the integrative model, addresses climate-policy uncertainty, ESG, and firm performance (Persakis, 2023; Sahu, Debata and Khanna, 2025); and Cluster 4 comprises a heterogeneous set organized around ESG ratings and governance (Figure 3). The sensitivity analysis confirms robustness: comparing the top-50 baseline with a top-40 subset yields an Adjusted Rand Index of 0.575, Normalized Mutual Information of 0.638, and a greedy maximum overlap of 77.5% (31 of 40 records preserved). Three clusters migrate cohesively; the largest splits into two coherent subgroups when its weakest-coupled members are removed, with modularity rising slightly (Q = 0.0739), providing evidence that the structure is not a threshold artefact.

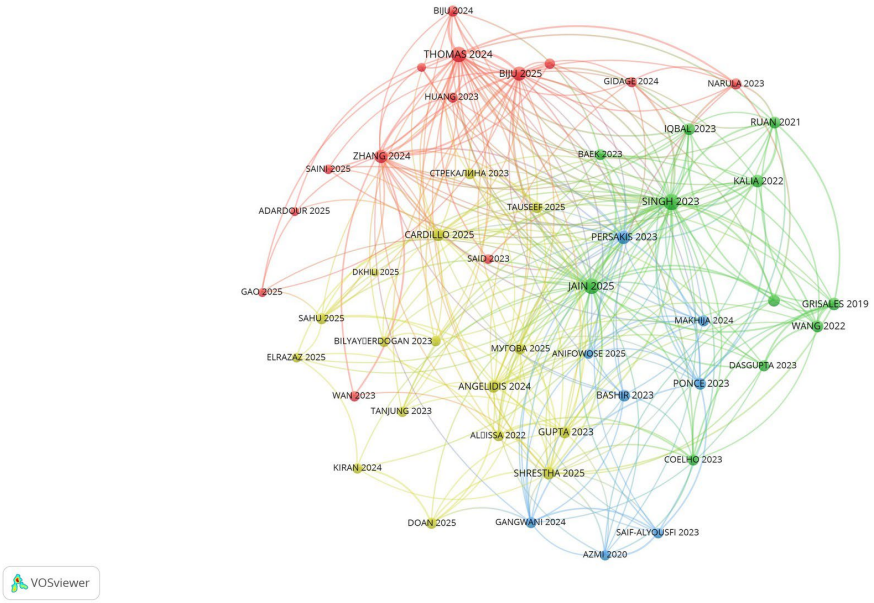


Figure 3: Bibliographic coupling network of the top-50 records (VOSviewer), with the four Louvain communities encoded by colour: ESG reviews (red), the ESG–financial-performance literature (green), the climate-policy-uncertainty cluster (yellow), and ESG ratings and governance (blue)

4.4 Keyword co-occurrence

The keyword co-occurrence network locates the constructs relative to one another. 'Marketing' sits at the periphery of the ESG–disclosure community and 'climate change' at the periphery of the macro-environmental community, while 'sustainability' lies on the boundary between the two without activating it as a bridge (Figure 4). The structural separation of the marketing and climate vocabularies, and the peripheral position of each within its own community, supplies a further independent confirmation of the carbon–marketing isolation.

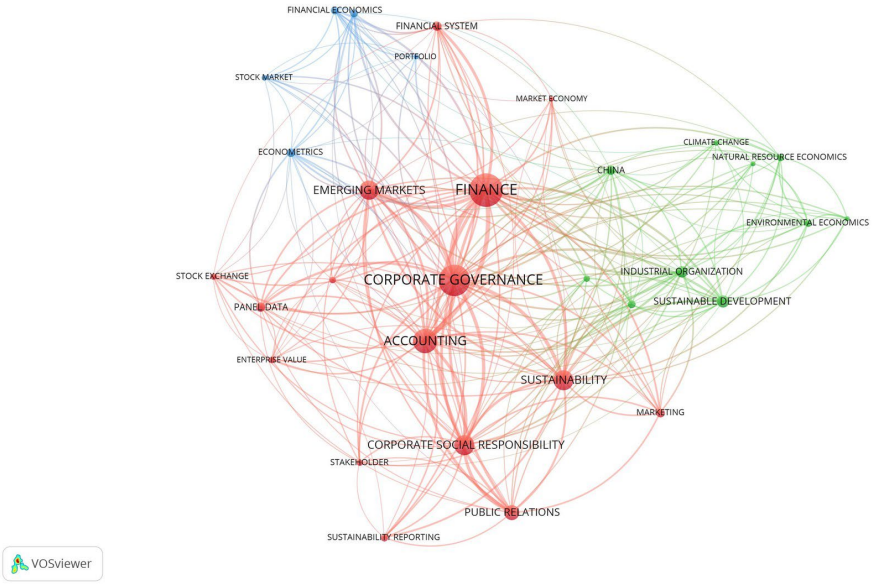


Figure 4: Keyword co-occurrence network (VOSviewer). 'Marketing' sits at the periphery of the ESG–disclosure community (red) and 'climate change' at the periphery of the macro-environmental community (green), with 'sustainability' on the boundary between them

4.5 Thematic Mapping

Thematic mapping (Cobo et al., 2011) returns four clusters: a motor cluster (101 keywords) anchored by 'business', 'economics', and 'political science'; a niche cluster (60) anchored by 'finance' and 'emerging markets'; a basic cluster (82) anchored by 'corporate governance', 'accounting', and 'sustainability'; and a small emerging

or declining cluster (7). Critically, neither 'marketing' nor 'climate change' constitutes a separate theme: despite high frequencies (209 and 123 occurrences, respectively), both are subsumed into the motor cluster as subordinate vocabulary (Figure 5). The temporal profile completes the picture: the density of the marketing keyword, measured by the share of papers mentioning it, falls from 19.9% in the foundation period (2004–2020) to 6.2% in the most recent (2024–2025), a threefold relative decline of 13.7 percentage points, while ESG-related vocabulary expands to dominate (Figure 6). The integrative space has thus become structurally less likely, not more, to be filled by the natural growth of the literature.

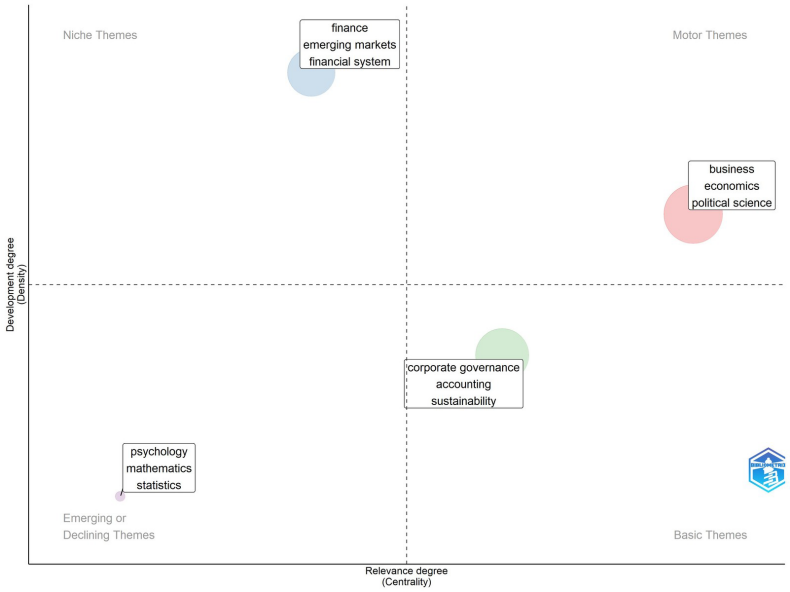


Figure 5: Thematic map. Marketing and climate change appear as subordinate vocabulary within the motor cluster rather than as themes in their own right

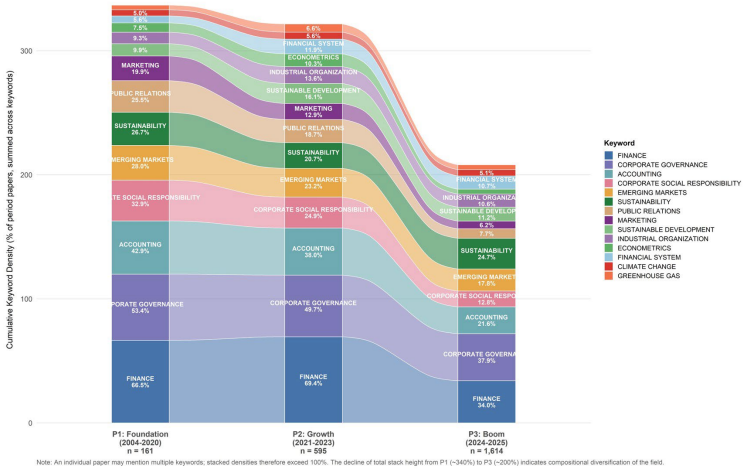


Figure 6: Compositional transition. The density of the marketing keyword falls from 19.9% to 6.2% across three successive periods (2004–2020, 2021–2023, 2024–2025), a threefold relative decline, while ESG-related vocabulary expands to dominate

5. Gap Analysis

Four findings constitute the argument's core. Each is grounded in an explicit count, ratio, or zero, and together they form a logical chain: the first establishes that the integrative space is empty; the second provides the mechanism; the third establishes the contextual deficit; and the fourth explains why the deficit persists.

5.1 The Trinary Integration is Categorically Empty

Under the harmonized vocabulary, the intersection of carbon policy, ESG, and industrial marketing yields no peer-reviewed records from 2004–2025. A single near-miss in the consolidated corpus (Lutfiana et al., 2025) engages carbon policy and ESG performance but does not treat industrial marketing as a strategic construct. The

convergence of the stream-level zero with the absence of substantive trinary work elsewhere indicates a categorical structural absence rather than a vocabulary artefact.

5.2 The Carbon–marketing Dyad is Structurally Isolated

When ESG is removed as an intermediate construct, the carbon–marketing literature contains only 8 records, compared with 458 for the carbon–ESG dyad and 93 for the ESG–marketing dyad, ratios of 57:1 and 12:1. The carbon–marketing dyad shares none of its 8 records with either ESG-anchored dyad. The pattern indicates that ESG functions as a non-bypassable mediating construct: when ESG is present, the integrative literature expands to more than 500 records; when absent, the dyad collapses to a handful of supply-chain studies that touch on integrative concepts only obliquely.

5.3 The Western Balkans and Albania are Systematically Under-represented

The global emerging-economy ESG literature (S5) contains 1,773 records; the Western Balkans literature (S6) contains 86, an underrepresentation of approximately 21:1, with Serbia (25 records) and Bosnia and Herzegovina (10) ahead of single-digit Albania, Kosovo, Montenegro, and North Macedonia. Within this, ESG-substantive Albanian scholarship appears in five records (Dorri and Shahini, 2025; Feimi and Vela, 2025; Kruja, Canco and Kola, 2025; Delova-Jolevska et al., 2024; Dedaj et al., 2019). Without the regionally dedicated stream, Albanian ESG scholarship would register as a single voice in 1,773 records (0.06%); even with it, it accounts for only 0.21% of the consolidated corpus (5/2,370). The regional field has not yet taken shape at the indexed-publication scale.

5.4 Geographic Specialization has Outpaced Marketing Specialization

The emerging-economy ESG literature (1,773 records) exceeds the ESG–marketing literature (93 records) by a factor of nineteen. Contextual, geographic deepening of ESG research has progressed considerably further than the integrative thematic axes, with marketing-strategy specialization lagging by an order of magnitude. Read together, the four findings cohere: the integrative space is categorically empty, ESG is its non-bypassable mediator, the regional and Albanian base is near-zero, and contextual specialization has outpaced integrative-marketing specialization, explaining why the gap has remained unfilled. Across the five analytical layers, seven independent observations converge on the carbon–marketing isolation: the eight-record dyad; the two null overlaps between the carbon–marketing stream and each ESG-anchored stream; the absence of marketing from the co-citation base; the absence of a marketing-integrative coupling cluster; the absorption of marketing within the thematic map; and its peripheral, separated position in the keyword network.

6. Discussion and Implications

The corpus describes a field at an inflection point: exponential, regulation-coincident growth; weak consolidation around stable scholars or conceptual axes; and several loosely connected schools of thought. This configuration offers a window through which integrative reviews and theoretically grounded empirical models can shape the trajectory of consolidation in ways they cannot in mature fields.

The findings imply a clear research agenda. The categorically empty trinary integration calls for models that jointly specify carbon-policy pressure, ESG adoption, and industrial marketing strategy. The carbon–marketing isolation calls for empirical work to test ESG as a mediator, including its direct, indirect, and conditional pathways. The regional deficit calls for country-comparative work in underrepresented emerging economies using harmonized instruments. There are practical implications too: as greenwashing-prevention frameworks advance, policy-relevant academic input on the marketing-communication dimension of ESG remains scarce relative to demand (Delmas and Burbano, 2011).

7. Conclusion and Limitations

This review of 2,370 records establishes four structural findings rather than counts: the trinary integration of carbon policy, ESG, and industrial marketing is empirically empty; ESG serves as an inescapable mediator between carbon policy and marketing; the Western Balkans and Albania are profoundly underrepresented; and geographic specialization has outpaced marketing specialization. Seven independent observations, drawn from the five analytical layers, converge on the same carbon–marketing isolation, indicating a structural rather than artefactual gap.

Two limitations qualify the findings. First, OpenAlex is the sole bibliographic source; while it offers broad, reproducible coverage, including non-Anglophone outlets relevant to the region, a companion study will cross-validate with Scopus and Web of Science. Second, the carbon and marketing vocabularies are not perfectly

symmetric across streams, a deliberate scoping choice to exclude peripheral general-management literature; the trinary-gap finding holds both at the stream level and in a substantive examination of the corpus. The review provides a structural foundation and a research agenda for integrative ESG models in emerging-economy manufacturing and stands as a contribution to the literature in its own right.

Acknowledgements

The authors gratefully acknowledge the Polytechnic University of Tirana and the Faculty of Mechanical Engineering for funding the first author's participation in the conference.

Ethics Declaration: This research did not involve human participants, personal data, or animal subjects and relied solely on publicly available bibliographic metadata; therefore, ethical clearance was not required.

AI Declaration: AI-based tools were used for language editing and formatting. All ideas, analysis, results, and conclusions are the authors' own, and the authors take full responsibility for the final text.

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