

## RESEARCH ARTICLE OPEN ACCESS

# Do Environmental Certifications Pay? A Bibliometric and Systematic Review of Environmental Management Systems and Eco-Label Impacts

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## ABSTRACT

This paper investigates how environmental certifications—specifically, formal environmental management systems (EMSs) (ISO 14001, EMAS), and consumer-facing eco-labels—influence firm financial performance. Using a dual approach that includes a bibliometric review and a systematic analysis of key studies, we identify key trends, theoretical underpinnings, and methodological approaches across these distinct certification types. Our bibliometric results highlight a rapidly evolving field, with EMSs and eco-label research growing along different paths and showing varying levels of international collaboration. The systematic review complements these findings by examining evidence on how certifications impact internal efficiencies, market positioning, and overall profitability. We observe that benefits depend strongly on organizational context, implementation quality, and stakeholder engagement. By integrating insights from both reviews, this paper clarifies the conditions under which environmental certifications enhance financial outcomes and offers directions for future research aimed at advancing both environmental responsibility and firm-level success.

## 1 | Introduction

In recent years, corporate sustainability has become a major priority for businesses across different sectors around the world. This change is largely driven by tougher environmental rules, higher expectations from stakeholders, and a shared global understanding of how urgent it is to fight climate change. A key milestone in this area was the 2015 Paris Climate Agreement, which brought almost 200 countries together to set ambitious goals aimed at keeping global temperatures well below 2°C pre-industrial levels (Palea and Drogo 2020; Secinaro et al. 2020; Paris Agreement 2015). Building on that progress, subsequent climate meetings, such as COP26, have called for stronger efforts to lower greenhouse gas emissions and speed up the transition to cleaner energy on a global scale (UNFCC 2021). These developments show a growing understanding that companies must do

more to reduce their environmental impact while also remaining profitable. In other words, environmental performance has progressively shifted from a matter of compliance to a strategic dimension with direct implications for firms' risk profiles, competitive positioning, and access to capital.

One clear result of these global commitments is a wave of new regulations that require greater openness about a company's environmental record. The European Union (EU), for example, has introduced strict reporting rules through laws like the Non-Financial Reporting Directive (NFRD) and, more recently, the Corporate Sustainability Reporting Directive. These rules force large or publicly important companies—including those listed on stock exchanges—to share detailed information about their social and environmental actions (EU 2014). By making companies disclose more about their sustainability efforts, these laws aim to

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create a culture of greater accountability, encouraging businesses to handle environmental issues in a more organized way. At the same time, other policy measures—like the EU's Green Deal—set targets for carbon neutrality and raise the bar for companies to demonstrate good environmental behavior. Regulatory pressure, however, interacts with market dynamics: consumers, supply-chain partners, lenders and investors increasingly incorporate climate resilience and environmental responsibility into purchasing, contracting and allocation decisions (Benz et al. 2021).

Besides these legal requirements, market forces also play a big role in guiding sustainability. More consumers and investors are factoring in a firm's environmental responsibility and resilience against climate risks when they decide what to buy or where to invest (Hamilton and Zilberman 2006; Yu et al. 2017). Companies seen as doing poorly in sustainability could face consumer boycotts, negative publicity, and fewer opportunities for financing (Su et al. 2018; Wilburn and Wilburn 2011). On the flip side, firms that prove strong environmental performance can benefit from premium pricing, loyal customers, and a potentially lower cost of capital. This mix of stakeholder demands, market possibilities, and government rules makes environmental certifications—especially those checked by credible third parties—central to a company's strategy (Bansal and Bogner 2002; Orsato 2006; Xu et al. 2016). Crucially, certifications operate through distinct yet potentially complementary channels: internally, by structuring environmental management and efficiency; externally, by signaling credible “green” attributes to markets.

In other words, certifications are increasingly understood not only as compliance tools, but also as strategic levers for competitiveness. This growing importance provides the general motivation for our study: while there is broad agreement that certifications matter, the evidence on how and when they “pay off” remains highly fragmented. To move from this broad motivation to a focused inquiry, the next section systematizes how prior studies define, classify and measure certification schemes and their financial implications, thereby setting up the specific research questions we pursue.

The paper is structured as follows: Section 2 reviews the relevant literature, distinguishing environmental management systems (EMSs) (ISO 14001, EMAS) from market-oriented eco-labels and outlining the main findings and theoretical perspectives. Section 3 formulates the research questions and clarifies our contribution. Section 4 describes the methodological process, including inclusion criteria, search parameters, and review protocols. Section 5 reports the bibliometric results, outlining trends in publications, citation networks, and key thematic areas. Section 6 presents the systematic review, comparing theoretical backgrounds, methodological approaches, and observed financial impacts. Section 7 concludes by summarizing the main insights, highlighting implications for research and practice, and suggesting paths for future work on how environmental certifications influence financial performance.

## 2 | Literature Background

Building directly on the above motivation, this section clarifies how the literature defines environmental certifications, how

different schemes are argued to create value, and which outcomes and contexts are used to assess whether certifications “pay off.” Prior work often distinguishes between EMSs and market-oriented, product-level eco-labels, while also discussing firm-level certification initiatives.

Environmental certifications are tools companies use to show they seriously address environmental issues. These certifications typically fit into two main groups: formal EMSs, like ISO 14001 and EMAS (the EU's Eco-Management and Audit Scheme), and market-oriented certifications (often called eco-labels), such as EU Ecolabel, Leadership in Energy and Environmental Design (LEED), and Forest Stewardship Council (FSC). But each certification varies in what it covers, what it aims to achieve, and what results it can offer. Together, these certifications constitute key tools in corporate sustainability efforts, enabling organizations to formalize their environmental practices, benchmark performance, and signal accountability to stakeholders.

*Environmental Management Systems.* ISO 14001 and EMAS focus on structured environmental management. They require companies to set clear goals for cutting pollution, using energy more efficiently, and managing waste (Iraldo et al. 2009; Melnyk et al. 2003). ISO 14001 is well-known globally and offers a general framework that can be adapted to different industries, whereas EMAS, introduced by the EU, builds on ISO 14001 by adding stricter obligations like openly sharing environmental reports (Heras-Saizarbitoria and Boiral 2013). Previous research suggests that firms adopting these standards often experience operational efficiency improvements, although some studies indicate that companies may also adopt them primarily for symbolic reasons rather than substantive environmental improvements (Boiral 2011). Specifically, research suggests that putting an EMS in place can lead to savings in production, better innovation, and stronger reputation, which altogether can boost financial performance (Martín-de Castro et al. 2016; Su et al. 2018). However, these benefits are not guaranteed. Some studies say the outcomes depend a lot on how committed a company really is, which industry it is in, and how thoroughly the system is implemented (Hillary 2004; Oliveira et al. 2016). If a company only adopts EMS in a superficial way, the results might be trivial or even harmful when considering the costs of auditing and compliance (Heras-Saizarbitoria et al. 2016). Additionally, the financial benefits of these certifications appear to depend on external regulatory pressures and market expectations (Delmas 2001; Jiang and Bansal 2003). In short, EMS studies predominantly test an internal “efficiency and risk-reduction” mechanism, with outcomes often on the cost/productivity side; the primary object is the management system itself, and the audience is mostly internal/regulatory or supply chain (external signaling is typically indirect).

Market-oriented certifications (eco-labels). Eco-labels, on the other hand, aim at reassuring consumers that a product or service meets certain “green” standards (Esparon et al. 2014). By reducing the information gap between producers and consumers, eco-labels let consumers who care about the environment reward green companies with higher loyalty or a willingness to pay more (Hamilton and Zilberman 2006). Yet,

the financial results of eco-labels can differ widely: in markets where buyers know and trust these labels, companies may benefit significantly (Amacher et al. 2004). In markets where people doubt the labels or have low environmental awareness, these certifications may not help firms gain better prices or bigger market shares (Ibanez and Blackman 2016; Wen and Lee 2020). Similarly, studies indicate that while consumers express interest in eco-labels, their actual willingness to pay a price premium is often lower than expected, which raises concerns about the effectiveness of voluntary certification programs (Roheim et al. 2011). Moreover, certification procedures can be inconsistent, and the effort and expenses needed to get and keep these labels might undermine potential benefits, especially for smaller companies (Boström and Hallström 2010). Accordingly, eco-label studies primarily test a “market differentiation and signaling” mechanism, with outcomes more frequently on the revenue side (prices, volumes, share); the object is product-level attributes, and the audience is predominantly end consumers.

Beyond environmental and product-level certifications such as ISO 14001, EMAS, and eco-labels, a growing literature has examined the emergence of B-Corp certification as an organizational-level mechanism linking social, environmental, and governance dimensions within a unified verification framework (Villela et al. 2021). Unlike EMS and eco-labels, which focus respectively on environmental management processes and market-facing environmental claims, B-Corp certification integrates multiple dimensions of sustainability performance—evaluating governance practices, employee well-being, community engagement, and environmental impact within a single corporate responsibility assessment (Boiral et al. 2018).

From a theoretical standpoint, B-Corp is best interpreted as an evolutionary broadening of the market-oriented certification logic associated with eco-labels: it extends third-party, outward-facing verification from the product level to the firm level, while expanding the content from environmental attributes to integrated ESG accountability. In this respect, B-Corp and eco-labels share a common institutional function—they act as external signaling mechanisms (Stubbs 2017) and legitimacy devices addressed to outside—whereas EMS primarily operates as inward-looking management systems, with performance and compliance effects inside the firm and only indirect implications for external signaling (Darnall and Sides 2008; Delmas and Montes-Sancho 2011). This continuity in outward-facing signaling between B-Corp and eco-labels, coupled with their shared reliance on third-party verification, provides a coherent conceptual bridge within the broader stream of market-oriented sustainability certifications.

Empirical studies on B-Corp performance outcomes are still emerging and often produce mixed evidence. Some research points to positive indirect effects through stakeholder trust, reputational enhancement, and employee engagement (Chen and Kelly 2015), or to greater resilience and adaptability in times of crisis (Stubbs 2017). Others highlight the costs and operational complexity of certification (Patel and Dahlin 2022; Romi et al. 2018) and the difficulty of linking B-Corp status to short-term financial metrics. Because B-Corp certification is

relatively recent, longitudinal evidence remains scarce, and the net effect on financial performance appears contingent on industry context, stakeholder orientation, and the firm's ability to leverage.

Overall, research suggests that different sustainability certifications can improve efficiency, build positive consumer attitudes, and enhance a company's market value. Still, the scale of these benefits is strongly dependent on several factors such as the industry sector, the size of the company, where it operates, how aware local consumers are, and whether the firm's sustainability approach is (Dangelico 2017; Ibanez and Blackman 2016; Nawrocka and Parker 2009). For instance, empirical findings indicate that the financial impact of green certifications is highly contingent on firm size and regulatory frameworks, with large firms often able to absorb certification costs more easily than SMEs (Testa et al. 2020). Moreover, researchers use many different methods to evaluate financial performance, ranging from standard accounting ratios (like return on assets [ROA]) to stock market indicators (like Tobin's Q) or narrower metrics like productivity or cost savings (Miroshnychenko et al. 2017; Wen and Lee 2020). This variety makes it harder to compare findings directly, resulting in an ongoing debate over when and how environmental certifications boost financial outcomes.

Although some systematic reviews cover single certifications—like ISO 14001 (Boiral et al. 2018; Camilleri 2022) or eco-labeling (Galarraga Gallastegui 2002; Yokessa and Marette 2019)—fewer studies compare multiple certification systems side by side. This is a notable gap, since many companies need to decide among different certifications or might use more than one at the same time, without fully knowing the relative costs and benefits (Orsato 2006). Also, the theories that researchers use to explain these outcomes—such as institutional theory, stakeholder theory, the resource-based view, or signaling theory—are often used one at a time, making it unclear how these perspectives could be combined to understand certification strategies (Chen and Kelly 2015; Delmas and Montes-Sancho 2010).

Taken together, the literature delineates two main mechanisms (internal efficiency vs. market signaling), different outcome metrics (cost/productivity vs. price/volume), and contextual moderators (industry, firm size, geography, regulatory intensity, consumer awareness). These differences help explain heterogeneous findings but also hinder cumulative understanding and cross-scheme comparability. The next section converts this synthesis into explicit research questions and explains how our design addresses these comparability and identification issues.

### 3 | Research Questions and Contribution

Building on Section 2, we translate the insights from prior research into a focused design that both maps the field and interprets how environmental certifications may relate to firm-level financial outcomes. Our objective is to provide an integrated view that compares certification schemes while clarifying the conditions under which observed effects tend to emerge.

Given this aim, this review uses a two-step approach—bibliometric analysis along with a systematic review—to compare EMS-based certifications (e.g., ISO 14001, EMAS) and outward-facing certifications. Within the latter family, we include product eco-labels and, owing to their limited but growing literature and partial overlap in external signaling logic, B-Corp certification as a firm-level sub-stream of market-oriented mechanisms. For clarity, B-Corp evidence is tagged and discussed separately where relevant (see Section 4 for details).

This two-step design responds directly to the fragmented and multidisciplinary nature of research on environmental certifications. Prior studies have shown that the literature is characterized by heterogeneous findings and diverse theoretical perspectives (Boiral et al. 2018; Camilleri 2022; Yokessa and Marette 2019). Relying exclusively on a systematic review would limit the analysis to a narrower corpus, whereas bibliometric techniques alone would mainly describe structural patterns without critically assessing the underlying mechanisms. Combining the two therefore ensures both breadth and depth: bibliometric mapping provides a comprehensive and objective overview of publication trends, thematic clusters, and citation structures, while the systematic review allows us to interpret these findings in light of theoretical frameworks, methodological choices, and contextual factors. In this way, the paper contributes a richer understanding of how environmental certifications influence financial outcomes, compared to what either method could deliver on its own.

We systematically searched major academic databases (Scopus and Web of Science [WoS]) using keywords that capture these certifications and how they relate to financial outcomes (see Section 4 for details). By applying bibliometric methods—like co-citation analysis, keyword mapping, and content clustering—we clarify which papers have been most cited, which themes are trending, and the central theories in this domain. Then, we performed a systematic review of key papers, examining their methods, contexts, and findings in detail, giving a fuller picture of how certifications affect firm performance.

Our study addresses the following three research questions:

1. How does existing literature depict the relationship between different environmental certifications and financial outcomes?
2. In what ways do financial results vary between EMS-focused standards (ISO 14001, EMAS) and consumer-facing eco-labels, and which theoretical or contextual factors might explain these variations?
3. Which methodological approaches and knowledge gaps emerge from this bibliometric and systematic review, and how could upcoming research improve our understanding of this topic?

By comparing EMS and eco-labels within a single design and making mechanisms and contexts explicit, we aim to clarify when certifications pay (boundary conditions), through which channels (efficiency vs. signaling), and with which measurement implications (choice of outcomes and identification). This combined perspective is especially helpful for scholars, managers,

and policymakers seeking to figure out which certifications might give the best overall returns and how to avoid common challenges when putting these sustainability measures in place.

## 4 | Methodology

### 4.1 | Data Sources and Search Strategy

To address our research question and gain insights into the current debate on green certifications—including ISO 14001, EMAS, eco-labels, and B-Corp—and their impact on financial performance, we combine a systematic literature review with bibliometric techniques (such as citation analysis, keyword mapping, and content analysis). Bibliometric analysis, a quantitative and statistical examination of existing literature, allows us to identify the structure, impact, and key themes shaping the field of sustainability certifications and corporate performance. In particular, we focus on citation metrics, keyword co-occurrence, and content analysis to uncover intellectual patterns, influential works, and knowledge gaps (Christofi et al. 2021; Stanley 2001).

To complement this mapping exercise, we conduct a systematic review that provides depth of analysis. While the bibliometric approach highlights publication dynamics and the intellectual structure of the field, the systematic review enables a critical appraisal of how theories, methods, and empirical findings link certifications to firm-level performance. The combination of the two ensures that the analysis is both comprehensive and explanatory, overcoming the descriptive limits of bibliometrics and the narrower focus of systematic reviews taken in isolation.

We use Scopus and WoS as our primary data sources, given their extensive coverage of peer-reviewed journals and their frequent use in bibliometric research (Aria and Cuccurullo 2017; Geissdoerfer et al. 2017; Khan 2022; Pham et al. 2021). Although Scopus generally offers broader coverage, including emerging or niche topics (Bretas and Alon 2021; Martín-Martín et al. 2018; Pranckutė 2021), WoS is often praised for its robust citation analysis and visualization tools (Falagas et al. 2008). Both databases are highly compatible with software solutions such as Bibliometrix (including the Biblioshiny package in R) (Aria and Cuccurullo 2017; Derviş 2020), which we employ to conduct our bibliometric mapping. Using these two databases also reduces the likelihood of missing relevant publications.

### 4.2 | Search Strategy and Article Selection

Our search strategy aimed to capture research on EMSs (ISO 14001, EMAS), green certifications (eco-labels), and B-Corp, as each represents a distinct yet interconnected approach to corporate sustainability. ISO 14001 and EMAS operate as formal EMS standards, with EMAS, developed in the EU, imposing additional disclosure requirements. Green certifications serve as market-based instruments that influence consumer and investor perceptions of environmental responsibility, while B-Corp emphasizes broader social and environmental performance.

To ensure a systematic and replicable selection of relevant studies, we developed a structured keyword-based search strategy. The

search focused on two primary dimensions: (1) environmental certifications, including green labels, EMSs, and sustainability-related certifications, and (2) financial performance, incorporating various economic and market-based indicators.

For the first dimension, the search string included the following variants: *eco label, eco certification, green label, green certification, environmental label, sustainability label, green product certification, carbon label, sustainability certification, eco-friendly certification, environmentally friendly certification, green award, sustainability award, environmental award, ISO 14001, EMAS, eco-management and audit scheme, environmental management system, B-Corp, and sustainable certification*. For the second dimension, financial aspects were captured through terms such as *financial performance, economic performance, firm performance, profitability, market value, competition, cost of equity, cost of debt, financial benefit, equity cost, and debt cost*.

Truncation was systematically applied to account for singular/plural and minor lexical variations. For WoS, the query was run in the topic field (TS), while in Scopus it was applied to title, abstract, and keywords (TITLE-ABS-KEY). The complete Boolean search strings for both databases are reported in Appendix A to ensure transparency and replicability.

The search was restricted to peer-reviewed journal articles published in English before April 2025. To maintain relevance to the research scope, we limited the subject areas to business (BUSI), economics (ECON), and environmental sciences (ENVI). Furthermore, only journal articles (article document type) were included, excluding conference proceedings, book chapters, and grey literature.

Following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (Moher et al. 2015), we retrieved 425 papers from WoS and 448 from Scopus. The two datasets were then merged using the *combined* function in RStudio. Duplicate records were automatically detected and merged and subsequently verified manually by cross-checking DOI and article titles. This procedure reduced the dataset from 873 to 588 unique records.

At the screening stage, we assessed titles and abstracts against predefined eligibility criteria. We retained only empirical or conceptual studies explicitly examining the relationship between environmental certifications and firm-level financial performance. Studies were excluded if they did not report financial metrics, or if the certification scheme was mentioned only tangentially (e.g., as part of a broader discussion on sustainability without direct testing of its impact on firm performance). This distinction ensured that the final corpus was directly relevant to our research questions.

Abstract screening was conducted by the author. To enhance reliability and reduce potential subjectivity, an independent academic with expertise in sustainability management cross-checked a random subset of abstracts. No significant discrepancies were identified. This process yielded 216 articles, which were subsequently assessed in full text and retained for bibliometric analysis and systematic review. The complete procedure is documented in the PRISMA flow diagram (Figure 1).

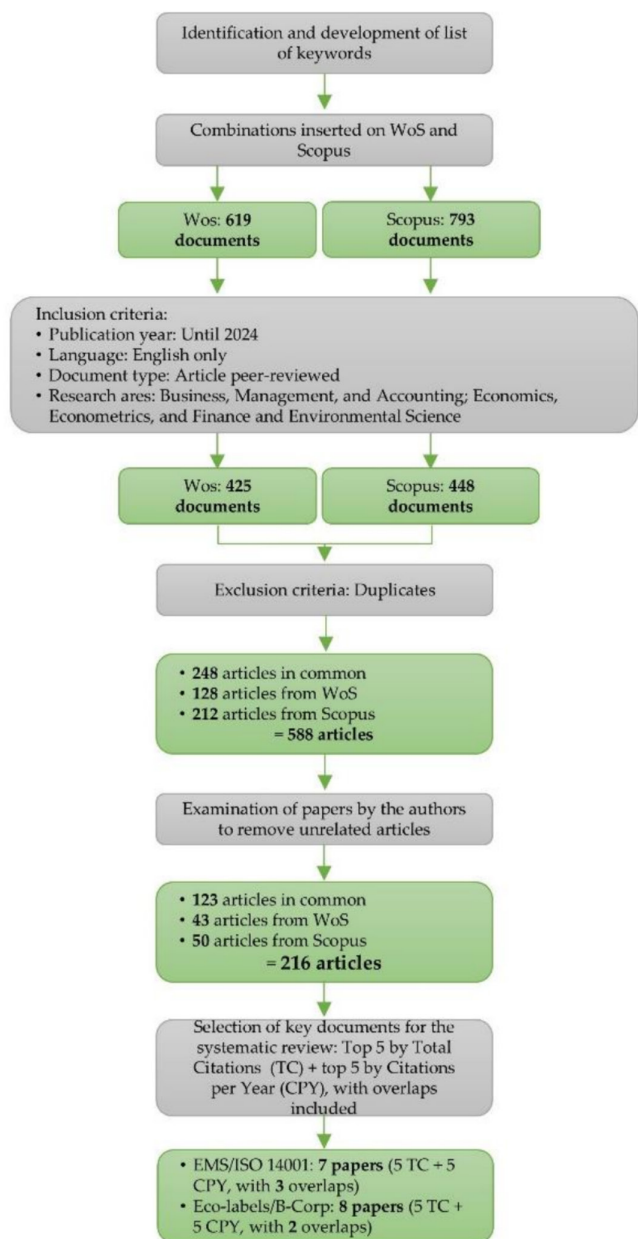


FIGURE 1 | Methodological process and results.

### 4.3 | Bibliometric Analysis and Systematic Review

After collecting the data, we carried out a bibliometric analysis using Bibliometrix. This included an examination of citation counts, co-citation patterns, keyword mapping, and bibliographic coupling to explore how research on sustainability certifications and financial performance has evolved. We then conducted an in-depth systematic review of the screened core set, focusing on the comparison between process-oriented EMS certifications (ISO 14001, EMAS) and market-oriented, outward-facing certifications (eco-labels and, where relevant, B-Corp).

Although B-Corp studies were less represented in the corpus, they were included because of their conceptual and empirical proximity to eco-labels: both rely on third-party verification and outward signaling of sustainability commitment, even if B-Corp operates at the firm level with a broader ESG scope. This

methodological choice—motivated by the theoretical alignment discussed in Section 2—ensures that emerging B-Corp research is captured without conflating it with EMS-based standards.

This combined bibliometric-systematic approach allows us to map the intellectual structure of the field and to interpret how and why mechanisms differ between inward-looking EMS and outward-facing, market-oriented certifications.

#### 4.4 | Preliminary Overview of Selected Studies

A preliminary classification of the 216 articles reveals how scholars have approached these certifications from methodological, contextual, and thematic standpoints. Table 1 offers a concise breakdown by research method, certification focus, and geographic coverage.

In terms of research methods, 67.6% of the articles employ quantitative approaches, typically using statistical or econometric techniques to measure the impact of adopting sustainability certifications on firm-level performance indicators, highlighting a

strong preference for statistical and econometric analyses when investigating the relationship between green certifications and financial performance. The remaining 32.4% are qualitative or conceptual in nature, with 14.8% dedicated to theoretical frameworks, 13.0% based on survey data, 2.8% structured in case studies, and 1.9% presented as review studies. While the prevalence of quantitative methods signals a strong empirical orientation, the presence of qualitative and conceptual work indicates ongoing efforts to refine theoretical underpinnings and explore emerging issues.

Regarding certification focus, ISO 14001 (31.9%) and EMS (37.0%) together form the largest group, highlighting extensive academic interest in structured EMSs. Eco-labels represent 25.5% of the sample, reflecting growing interest in market-based instruments that enable firms to communicate environmental responsibility to consumers. B-Corp studies account for 5.6% of the total—still a small share but noticeably concentrated in the most recent publication years. Untabulated results indicate that B-Corp articles first appear after 2015 and are predominantly clustered in the 2021–2025 period. Their limited presence and temporal concentration suggest that B-Corp constitutes an emerging research niche within the broader set of outward-facing certifications, partially overlapping with the eco-label literature in terms of period and thematic orientation.

On the geographical dimension, China is the most frequently studied single-country context (13.7%), reflecting both its rapidly growing economy and heightened global attention to its environmental practices. The United States (9.6%), Spain (8.9%), Malaysia (7.5%), Indonesia (5.5%), Italy (5.5%), Taiwan (3.4%), and the United Kingdom (3.4%) follow as prominent single-country contexts. About 17.1% of the articles take an international or multicountry perspective, while the remaining 25.3% investigate various single-country contexts in smaller proportions. These findings underscore the global relevance of sustainability certifications, as well as the diverse economic and regulatory landscapes in which firms operate.

Overall, these descriptive results reveal a broad methodological spectrum and emphasize that EMS-based standards (ISO 14001, EMAS) attract significant attention relative to market-facing eco-labels. Nevertheless, eco-labels and, to a lesser extent, B-Corp, bring to the fore the importance of external stakeholder perceptions in shaping how firms integrate environmental practices. By integrating bibliometric methods with a systematic review of top-cited works focusing on EMS versus eco-labels, this study delineates not only how different certification mechanisms are approached in the literature but also the evolving discourse on their financial implications.

## 5 | Bibliometric Literature Review

### 5.1 | Descriptive Statistics and Temporal Trends in EMS/ISO 14001 and Eco-Labels Research

As shown in Table 2, the complete sample spans the period from 1995 to 2025 and includes 216 documents, whereas the subset devoted to EMS/ISO 14001 also covers the same timespan (1995–2025) with 149 documents. In contrast, the eco-labels/B-Corp subset, comprising 67 documents, starts later (2004–2024).

**TABLE 1** | Sample description.

Research method		# of Articles	% of Articles
Quantitative		146	67.6
Qualitative/conceptual		70	32.4
Of which	Theoretical	32	14.8
	Survey	28	13.0
	Case studies	6	2.8
	Review	4	1.9
<b>Certifications</b>			
EMS		80	37.0
ISO 14001		69	31.9
Eco-Labels		55	25.5
B-Corp		12	5.6
<b>Countries</b>			
China		20	13.7
USA		14	9.6
Spain		13	8.9
Malaysia		11	7.5
Indonesia		8	5.5
Italy		8	5.5
Taiwan		5	3.4
UK		5	3.4
International		25	17.1
Others		37	25.3

**TABLE 2** | Summary of articles.

Description	Results		
	Complete sample	EMS/ISO14001	Eco-labels/B-Corp
Main information			
Timespan	1995:2025	1995:2025	2004:2024
Sources	126	91	53
Documents	216	149	67
Annual growth rate %	2.34	2.34	8.38
Document average age	8.3	9.23	6.24
Average citations per doc	52.04	62.01	29.87
References	11,932	8046	4110
Document contents			
Keywords Plus	736	577	253
Author's keywords	610	405	252
Authors			
Authors	553	383	181
Authors of single-authored docs	29	19	10
Author collaboration			
Single-authored docs (no.)	32	21	11
Single-authored docs (%)	25.4	23.1	20.8
Coauthors per doc	2.9	2.9	2.8
International coauthorships %	2.8	2.0	4.5

This temporal asymmetry is itself informative: EMS- and ISO-related research has a longer history, reflecting their earlier introduction as formal standards, while eco-labels and B-Corp represent more recent market-facing initiatives that only began to attract scholarly attention after the early 2000s. Comparing the two streams therefore offers insights into different stages of academic maturity. EMS/ISO 14001 research has benefited from time to consolidate findings, accumulate citations, and embed itself into managerial and institutional debates. Eco-label and B-Corp studies, by contrast, are less established but show steeper growth trajectories and higher international co-authorship rates, signaling an emerging but dynamic frontier in the literature. The indicators used—such as annual growth rates, citation patterns, and collaboration structures—remain comparable across the two

subsets, since they capture relative dynamics rather than absolute volumes, and thus provide a robust basis for interpreting their different developmental paths.

Looking into more detail, the eco-labels/B-Corp group, despite being a smaller subset, shows a notably higher annual growth rate (8.38%) compared to the relatively modest 2.34% in the EMS/ISO 14001 sample. This accelerating trend underscores the increasing appeal of consumer-facing or stakeholder-oriented certifications. It also aligns with the younger document age (6.24 vs. 9.23 years on average), reinforcing the idea that eco-labels and B-Corps represent a more emergent but fast-developing research stream.

Citation patterns further highlight this divergence. The average citations per document are significantly higher in the EMS/ISO 14001 cluster (62.01 vs. 29.87), consistent with the longer history and more established role of EMS scholarship. The eco-label/B-Corp subset, by contrast, has accumulated fewer citations, largely reflecting its more recent emergence and smaller overall size.

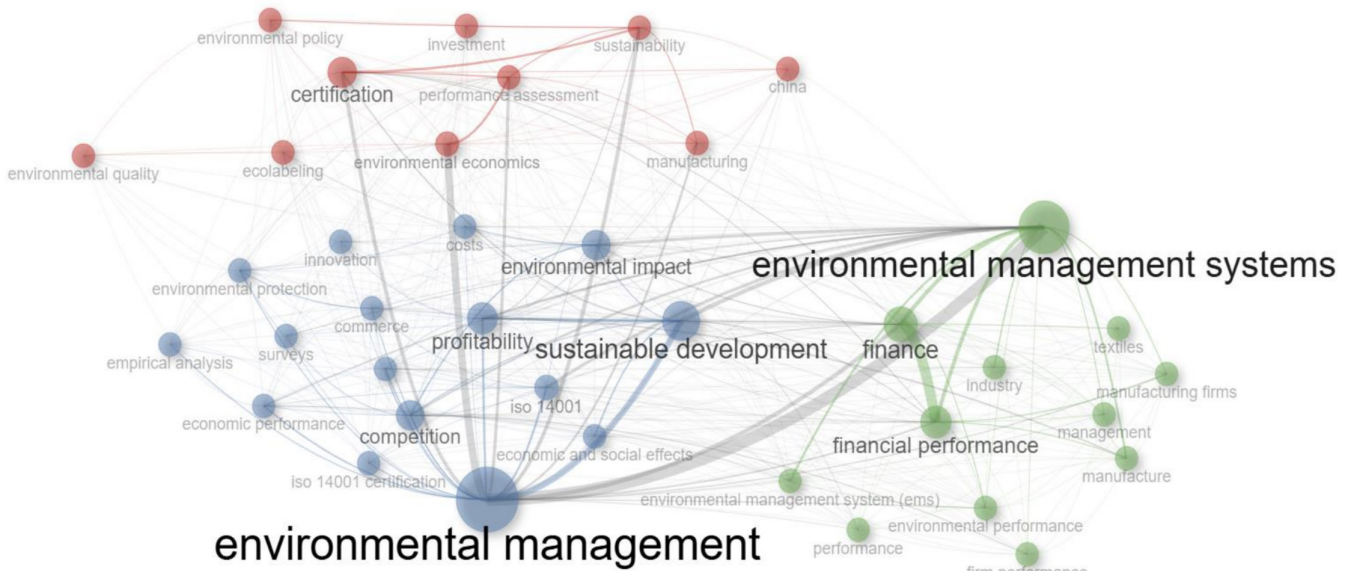
An examination of annual production over time confirms these observations. While the EMS/ISO 14001 literature produced at least one publication annually from 1995 onward (albeit in very small numbers at first), the eco-labels/B-Corp stream did not appear until 2004. Growth in this domain was gradual during the late 2000s but accelerated noticeably from around 2015 onward, with more frequent spikes in publication volume after 2016. Such an upward trajectory aligns with the notion that market-facing certifications have attracted growing scholarly attention in recent years, paralleling wider societal debates on sustainability, responsible consumption, and investor awareness.

Looking at authorship and collaboration, both subsets exhibit broadly similar patterns of multiauthorship, with co-authors per document hovering around 2.8–2.9 and the share of single-authored works comparable (20–25%). A notable difference emerges in international collaboration: 4.48% of the eco-label/B-Corp articles involve cross-country co-authorship, compared to 2.01% in the EMS/ISO 14001 sample. This suggests that research on eco-labels and B-Corp, despite its smaller size, is more globally networked, perhaps reflecting the inherently international appeal of consumer-facing labels and stakeholder-oriented frameworks.

## 5.2 | Co-Occurrence Network and Temporal Trends in Research

To explore the conceptual structure of the literature, we analyze the co-occurrence network of keywords, mapping the relationships between the main research topics.

As highlighted in Figure 2, the most central keywords in the network confirm the dominance of environmental management and EMSs, often appearing in direct connection with ISO 14001. Their high degree and betweenness centrality values show that these nodes act as conceptual anchors, linking debates on environmental practices with discussions of firm-level outcomes. In contrast, the node certification is present but less central and peripheral in terms of betweenness, suggesting



**FIGURE 2** | Topics' relevance as analyzed in the co-occurrence network.

that certification schemes are typically discussed in relation to broader themes—such as management systems, sustainability, or performance—rather than as stand-alone conceptual hubs.

The clustering structure further illustrates this configuration. The blue cluster, which includes environmental management, ISO 14001, competition, commerce, profitability, innovation, and supply chain, represents the dominant strand of research. This cluster is broad in scope: it combines the organizational and regulatory implications of EMS with a strong interest in competitive advantage, market positioning, and cost–benefit dynamics. The frequent presence of methodological keywords such as empirical analysis and surveys also indicates that this strand has been extensively investigated through quantitative approaches.

The green cluster, centered on EMSs, finance, firm performance, and financial performance, reflects a second major research stream. Compared to the blue cluster, it is narrower but more focused: studies in this cluster directly examine the link between EMS adoption and firm performance, both financial and environmental. The presence of sector-specific terms such as manufacturing firms, manufacture, and textiles highlights the applied nature of this research, which often analyses industries with a high environmental impact as reference contexts for evaluating certification outcomes.

Finally, the red cluster, dominated by certification, eco-labeling, sustainability, environmental policy, environmental quality, investment, and environmental economics, points to a more fragmented and peripheral stream. Here, certifications are discussed as policy tools and market signals, often in connection with consumer trust, investment decisions, or environmental quality standards. However, the relatively weak centrality of certification compared to EMS-related nodes indicates that this strand is less integrated into the mainstream debate, developing as a parallel body of work rather than a fully connected core.

Overall, the co-occurrence network depicts a fragmented conceptual landscape. EMS and ISO-based studies (blue and green

clusters) remain the backbone of the field, while market-facing certifications (red cluster) form a separate but less consolidated literature. Financial aspects are present across clusters—ranging from profitability and competition to finance and investment—but they do not converge into a single dominant stream, reflecting the heterogeneity of approaches. The absence of B-Corp among the most relevant nodes further highlights the limited maturity of this line of inquiry. Overall, the structure of the network confirms both the thematic diversity and the intellectual fragmentation of research on environmental certifications and firm performance.

Building on these findings, the temporal evolution of keywords provides further insight into the shifting focus of the literature over time. To capture major turning points in the research agenda, we divided the timespan into three periods: 1995–2015, 2016–2020, and 2021–2025.

The rationale for this segmentation rests on both global events and the internal dynamics of the field. The 2015 Paris Agreement represented a watershed moment in international climate policy, creating a shared framework for nearly 200 countries and stimulating a visible expansion of research on corporate sustainability practices. Similarly, the onset of the COVID-19 pandemic in 2020 generated a systemic shock that cut across all sectors and geographies, bringing new attention to supply chain resilience, disclosure practices, and the economic value of environmental certifications. While other shocks also influenced the debate, their impact was more limited in scope. The 2008 financial crisis, for instance, redirected attention to financial stability and governance but did not fundamentally reshape research on environmental certifications. The Kyoto Protocol, although symbolically important, lacked binding commitments for key countries such as the United States, which reduced its capacity to reorient corporate practices and related academic inquiry. The growth of emerging economies broadened the geographical scope of the literature, but as a gradual and uneven process rather than a discrete turning point. Finally, European regulations—such as the NFRD or the EU Emissions Trading System—proved highly

relevant for firms within the Union, but their reach remained largely regional. By contrast, the Paris Agreement and COVID-19 stand out as events with global resonance and immediate consequences for both corporate strategies and academic agendas.

The segmentation also mirrors endogenous shifts in the literature. While EMS-based standards such as ISO 14001 and EMAS have been studied since the mid-1990s, consumer-facing certifications (eco-labels, B-Corp) and economic evaluations of sustainability practices gained traction only in more recent years. Structuring the timeline into three periods therefore makes it possible to capture both exogenous shocks with worldwide impact and endogenous changes in research priorities, while ensuring that each segment includes a sufficiently robust set of publications for meaningful analysis.

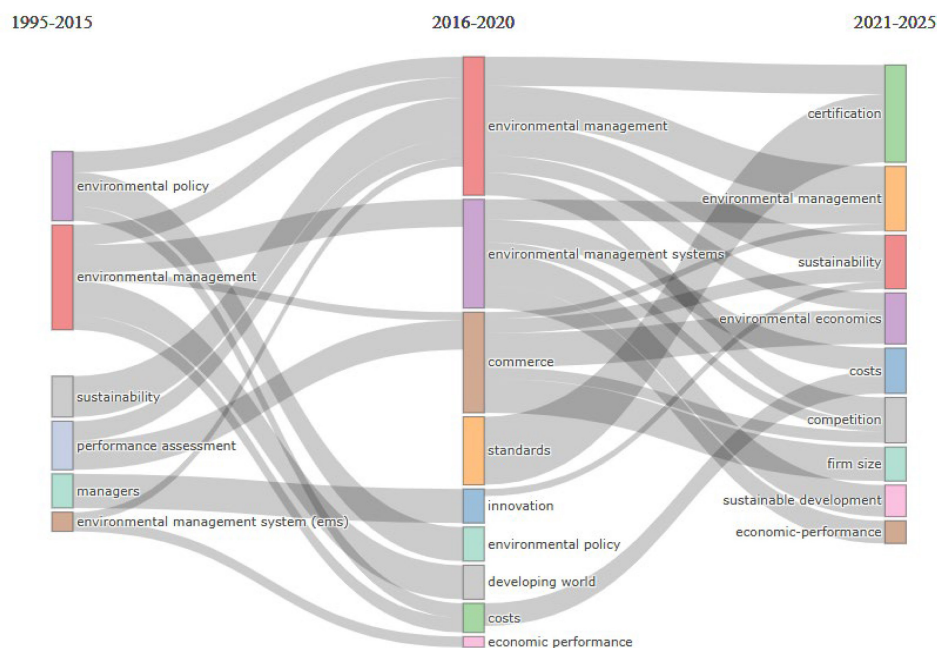
Figure 3 is a Sankey-style diagram that visualizes how research themes persist or transform over time. It should be read from left to right across the three sub-periods. Each node represents a keyword cluster within a period; its width reflects the frequency of occurrence. Each link connecting two periods represents a shared conceptual space between keywords, meaning that the same term—or two closely related ones—appear jointly across the two-time spans. Thicker links correspond to stronger continuity or overlap in the research focus. When a keyword in period  $t$  connects to the same keyword in period  $t + 1$ , the flow indicates thematic persistence (e.g., environmental management → environmental management). When a keyword connects to a different concept, it signals a shift or recombination of themes—for

example, EMS → sustainability (reflecting the move from procedural to strategic analysis) or standards → certification (reflecting the shift from regulatory standards to certification as a market and legitimacy signal). Other transitions, such as EMS → economic performance or commerce → firm size, point to the increasing attention paid to the business and financial implications of sustainability practices. Colors serve purely to distinguish nodes and have no analytical meaning.

This structure allows the reader to identify both continuities—the stable foundations of the field—and cross-connections, which reveal how new research trajectories have emerged through conceptual convergence. The examination of keyword usage reveals a progressive reorientation of scholarly attention.

As illustrated in Figure 3, between 1995 and 2015 research concentrated on environmental management, policy, and sustainability, alongside emerging concerns about performance assessment and the role of managers in implementing EMSs. Keywords such as *environmental management system* and *performance assessment* reflect an early focus on internal organizational processes, largely driven by regulatory pressures and societal expectations. The strongest flows in this period connect sustainability with environmental management, confirming the centrality of environmental practices as a building block for subsequent debates.

In the period 2016–2020, Figure 3 shows that environmental management remained central, but the prominence of EMS-related terms indicates deeper engagement with standardized



Thematic evolution across 1995–2015, 2016–2020, and 2021–2025. Nodes represent the most recurrent keywords in each sub-period; node width is proportional to within-period frequency. Flows indicate the persistence/transition of topics over time; thicker links denote stronger continuity.

**FIGURE 3** | Thematic evolution. Thematic evolution across 1995–2015, 2016–2020, and 2021–2025. Nodes represent the most recurrent keywords in each sub-period; node width is proportional to within-period frequency. Flows indicate the persistence/transition of topics over time; thicker links denote stronger continuity.

practices such as ISO 14001 and EMAS. At the same time, new connections become visible: commerce and standards reflect growing market requirements and global supply-chain pressures, while innovation captures managerial and technological novelties improving sustainability outcomes. Economic dimensions surface more explicitly, with costs and economic performance highlighting attention to financial implications. A noticeable set of cross-topic links (e.g., EMS → sustainability, standards → certification) signals a gradual move from procedural compliance to market- and performance-oriented perspectives. The emergence of the developing world further illustrates the geographical diversification of research, extending beyond Europe and North America to new regional contexts.

By 2021–2025, Figure 3 highlights the broadening of thematic scope. Certification emerges as a distinct and prominent keyword, consistent with the rising importance of consumer- and market-facing labels (e.g., eco-labels, B-Corp) as signals of sustainability commitment. In parallel, environmental economics gains ground, underscoring closer integration between green practices and market-based measures. The appearance of competition, firm size, sustainable development, costs, and economic performance indicates a shift toward strategic and economic considerations, as firms grapple with the balance between competitiveness, growth, and stakeholder demands. Persistent flows such as environmental management → environmental management highlight continuity in core themes, while cross-links from commerce → competition/firm size capture the consolidation of market and strategic dimensions.

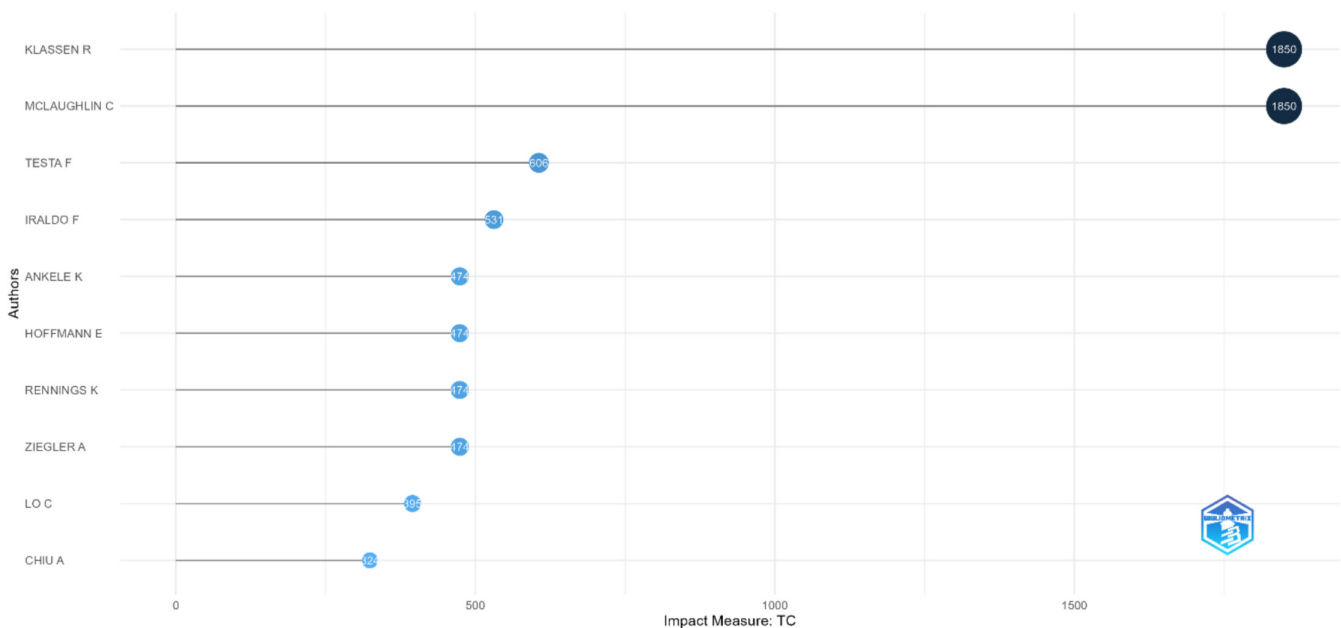
Across periods, the thematic evolution points to a gradual shift from a compliance-oriented focus on internal organizational processes to a more diversified agenda that integrates standardized systems, consumer-facing certifications, and explicit economic and strategic dimensions. While the visualization is dense, this complexity is a faithful representation of the field, where multiple thematic flows coexist and evolve in parallel. The figure thus captures both the progression of topics over time and the plurality of perspectives

through which environmental certifications and financial outcomes have been examined. To prevent over-interpretation, we emphasize that flows depict co-occurrence-based continuity and recombination of themes across periods; they do not imply causal relations. Read in this way, Figure 3 provides a transparent and logically coherent representation of how the literature on environmental certifications and firm performance has progressively evolved over three decades.

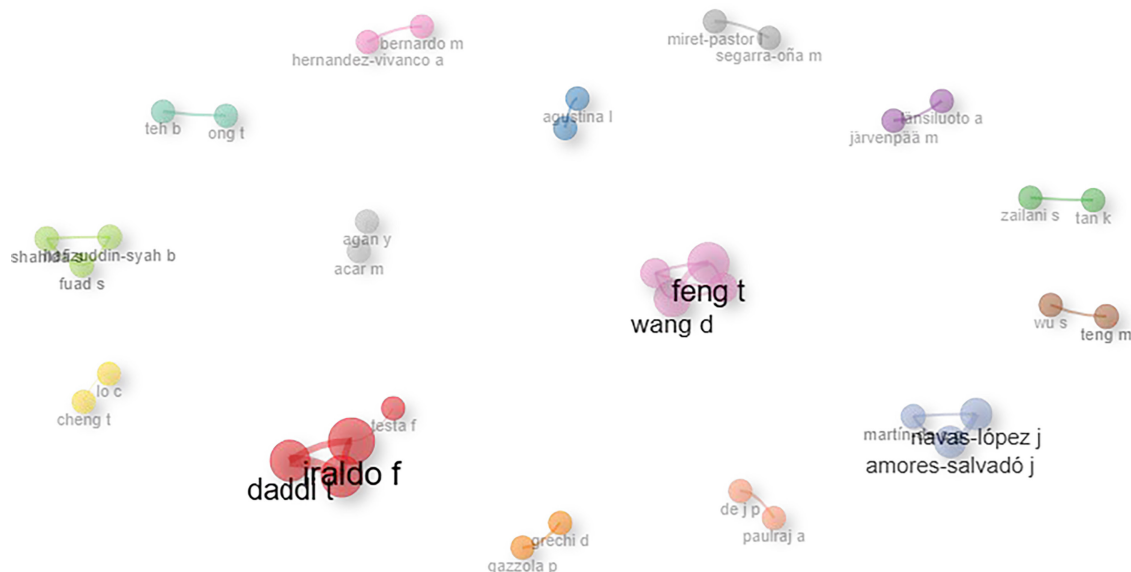
### 5.3 | Authorship, Collaboration, and Journal Impact

As summarized in Figure 4, an initial look at author impact, measured by total citations (TC), shows that Klassen R. and McLaughlin C. stand out with over 1850 citations each, attributable to their foundational 1996 work, *The Impact of Environmental Management on Firm Performance*, published in *Management Science*. This study remains a key reference for exploring how corporate environmental strategies interface with financial outcomes, which explains its ongoing methodological and historical relevance. Other highly cited contributors include Testa F. (606 citations) and Iraldo F. (531 citations), both of whom focus on ISO 14001 and EMS adoption, illuminating the operational and managerial aspects of implementing formal EMSs. A second group of authors, including Ankele K., Hoffmann E., and Rennings K., ranks slightly lower in citation counts but similarly expands the empirical and theoretical foundations in the field.

The co-authorship network in this field reveals a highly fragmented research landscape, with multiple small clusters of researchers working relatively independently. As illustrated in Figure 5, no single, dominant collaboration hub emerges, suggesting that studies on environmental certifications and firm performance are conducted by distinct research groups rather than a tightly connected academic community. A few clusters stand out in terms of relative connectivity. Cluster 1, for instance, includes scholars such as Iraldo F., Daddi T., Marrucci L., and Testa F., who have notable



**FIGURE 4** | Author impact by TC index.



**FIGURE 5** | Author network.

connections in the field. Other clusters appear to be largely independent research teams, each potentially focusing on specific dimensions of sustainability certifications.

This dispersion can partly be explained by the inherently diverse nature of the topic. Research on environmental certifications spans different certification schemes (e.g., ISO 14001, EMAS, eco-labels, B-Corp), multiple disciplinary perspectives (management, economics, environmental science), and heterogeneous approaches (regulatory, strategic, operational) across a wide range of industries and geographic contexts. Such diversity naturally fosters independent lines of inquiry, often developed in parallel by distinct research communities.

Nevertheless, this finding is not trivial. In other domains of sustainability research, such as CSR reporting or ESG ratings, international collaborations have served as catalysts for theoretical consolidation and methodological convergence. By contrast, the fragmented nature of the environmental certification literature indicates that knowledge accumulation occurs in relatively isolated pockets, with limited cross-fertilization among approaches. This helps explain why the field still lacks a unified conceptual framework and why findings on financial impacts often remain heterogeneous and difficult to compare.

The absence of strong collaboration hubs also affects theoretical development. Isolated clusters tend to rely on distinct perspectives—such as stakeholder theory, institutional theory, or the resource-based view—without integrating them into a broader conversation. Fragmentation also appears to separate research streams around management standards (e.g., ISO 14001, EMAS) from those focused on market-oriented certifications (eco-labels, B-Corp), with relatively little interaction between the two. This structural configuration is therefore not merely descriptive but constitutes a substantive challenge for the advancement of cumulative knowledge in this area.

Finally, an examination of leading journals (see Table 3) reveals that the *Journal of Cleaner Production* is the most

**TABLE 3** | Most influential journals.

#	Journal	Number of articles		Number of citations	
1	<i>Journal of Cleaner Production</i>	26	12.04%	2408	21.42%
2	<i>Business Strategy and The Environment</i>	14	6.48%	727	6.47%
3	<i>Sustainability</i>	13	6.02%	479	4.26%
4	<i>Corporate Social Responsibility and Environmental Management</i>	6	2.78%	315	2.80%
5	<i>International Journal of Production Economics</i>	5	2.31%	418	3.72%
	<b>Total</b>	<b>64</b>	<b>29.63%</b>	<b>4347</b>	<b>38.67%</b>

frequent publication venue, hosting 12.0% of the articles and accounting for 21.4% of total citations. *Business Strategy and the Environment* (6.5% of articles, 6.5% of citations) and *Sustainability (Switzerland)* (6.0% of articles, 4.3% of citations) follow. To ensure a robust analysis, we focused on journals with at least five published articles on the topic, allowing us to identify key publication outlets while maintaining a comprehensive view of the literature. Overall, the top five journals represent 29.6% of the papers and 38.7% of the citations, indicating a modest but notable concentration of research output. Nonetheless, the field is clearly not monopolized by a narrow set of specialized outlets: contributions also appear in broader management and production journals, including *Management Science*, which emerges as the second most cited journal due to the lasting impact of Klassen and McLaughlin's (1996) study. This distribution

attests to a multidisciplinary interest in the topic, spanning from sustainability-oriented publications to those with a more general managerial or strategy focus.

Collectively, these three analyses (authors, collaboration, and journals) depict a field in continuous evolution, wherein particular groups of scholars are distinguished by higher citation counts and stable partnerships, while the majority of publications remain scattered in smaller research clusters. Meanwhile, the spread of articles across multiple journal outlets underscores the diverse disciplinary perspectives shaping research on environmental certifications and their financial implications—ranging from journals with a core focus on sustainability (*Journal of Cleaner Production*) to broader venues (*Management Science*) that nevertheless publish influential studies on the subject.

## 6 | Systematic Review Discussion

### 6.1 | Introduction and Selection Methodology

This systematic review examines the relationship between environmental certifications and firm performance by analyzing a set of key contributions on EMSs/ISO 14001 and eco-labels (including green and sustainability certifications, as well as B-Corp). To ensure both influence and recency are adequately represented, we selected the five most cited papers in each stream (based on total citation count, TC) and complemented them with the five most cited per year (citations normalized by year of publication, CPY). When overlaps occurred, articles appearing in both rankings were treated as doubly central.

Following this procedure, the final sample includes seven EMS/ISO 14001 papers and eight eco-label/B-Corp papers. This asymmetry results from overlaps between the two rankings: three EMS studies and two eco-label studies appear in both lists, highlighting their prominence across selection criteria.

The citation profiles further reflect differences in the maturity of the two research streams. EMS/ISO 14001 studies exhibit higher absolute citation counts (e.g., 1850, 474, 321, 285, and 183 citations for the top-cited set) and also lead in terms of citations per year, consistent with their earlier diffusion and longer consolidation in academic debates. By contrast, eco-label papers, although less cited overall and on average, include several recent contributions that achieve competitive citation rates relative to their younger age.

The combined use of total citation count (TC) and citations per year (CPY) as selection criteria therefore provides a balanced identification of both historically influential and more recent, high-impact studies. These two indicators are widely recognized in bibliometric and systematic reviews as effective measures for capturing the most representative and visible contributions within a research field (e.g., Donthu et al. 2021; Paltrinieri et al. 2023).

To further strengthen the assessment of representativeness, we complemented this approach with two additional analyses (un-tabulated results): a keyword co-occurrence-based evaluation of thematic representativeness and an author co-citation-based evaluation of theoretical representativeness. These additional

checks provide an independent validation that the selected studies align with the main research areas and conceptual foundations identified in the broader literature.

(i) Thematic representativeness—keyword co-occurrence. Building on the co-occurrence network discussed in Section 5.2 (Figure 2), each paper in both the full corpus ( $n = 216$ ) and the review sample ( $n = 15$ ) was assigned to the cluster containing the highest number of its associated keywords. Papers with an equal number of keywords across two or more clusters were classified as hybrid and excluded from this specific comparison to avoid duplication.

The three clusters correspond to the research strands previously identified in the bibliometric analysis:

Blue cluster—Environmental management, ISO 14001, competition, innovation, and supply chain: the dominant strand integrating organizational and regulatory implications of EMS with performance and competitiveness.

Green cluster—EMS, finance, and firm performance: a focused strand that directly investigates the financial and environmental outcomes of EMS adoption.

Red cluster—Certification, eco-labeling, sustainability, and environmental policy: a more peripheral but distinct stream examining certifications as policy tools and market signals.

In the full corpus, these clusters account for 22% (red), 52% (blue), and 26% (green) of documents, while the review sample shows 20%, 47%, and 33%, respectively. The close correspondence across distributions confirms that the selected papers adequately reflect the thematic composition of the literature.

(ii) Theoretical representativeness—author co-citation analysis. To assess theoretical representativeness, we conducted an author co-citation analysis on the full sample ( $n = 216$ ). Since this network aggregates citations at the author level, it reveals the conceptual foundations and recurrent theoretical schools of thought that structure the field.

Within each of the three clusters identified in the network, we focused on the 15 most central authors (based on PageRank and closeness centrality) and manually examined whether their most cited contributions discussed or developed explicit theoretical frameworks, excluding those who were primarily authors of highly cited empirical works without clear theoretical anchoring.

This procedure allowed us to identify the dominant theoretical orientations characterizing each cluster:

Cluster 1 —Strategic and institutional foundations. This cluster reflects a conceptual convergence between resource-based and institutional perspectives. Authors such as Dellmas (e.g., Delmas and Toffel 2008), Russo (e.g., Russo and Fouts 1997), Porter (Porter and van der Linde 1995), King (King et al. 2005), and Bansal (Bansal and Hunter 2003) examine how firms build environmental capabilities that enhance efficiency and competitiveness, while simultaneously responding to institutional

and societal pressures. The emphasis is on the dual nature of environmental strategies—as both internal resources that generate advantage and external signals of legitimacy. The cluster also embeds innovation-oriented views, drawing on the idea that environmental improvement and competitive performance can reinforce each other.

**Cluster 2** —Dynamic capabilities and eco-innovation. Here the focus shifts to the mechanisms through which organizations adapt and learn in dynamic contexts. Central authors such as Teece (Teece et al. 1997), Aragón-Correa (Aragón-Correa and Sharma 2003), Sarkis (Sarkis 2003), and Chen (Chen 2008) conceptualize sustainability-oriented practices as enablers of technological innovation, inter-firm collaboration, and supply-chain transformation. The theoretical core lies in the dynamic-capabilities framework, where environmental strategies are interpreted as manifestations of learning, reconfiguration, and innovation processes that sustain long-term competitiveness.

**Cluster 3** —Institutionalization, signaling, and quality management. This cluster gathers contributions from Boiral (Boiral 2007), Castka (Castka and Prajogo 2013), and Bernardo (Bernardo 2014), emphasizing the institutional and communicative roles of formalized management systems. These studies explore how standardized practices and quality frameworks create legitimacy, coordination, and credibility, functioning as mechanisms that convey reliability and commitment to stakeholders.

We then compared these theoretical domains with the frameworks reported in Tables 4 and 5 for the 15 papers included in the systematic review. The theoretical domains identified through the author co-citation analysis are all represented within the review sample. Papers aligned with Cluster 1 (strategic and institutional foundations) include Klassen and McLaughlin (1996), Heras-Saizarbitoria et al. (2011), Younis and Sundarakani (2019), and Duque-Grisales et al. (2020). Studies corresponding to Cluster 2 (dynamic capabilities and eco-innovation) comprise Iraldo et al. (2009), Miroshnychenko et al. (2017), Dangelico (2017), Rennings et al. (2006), Wen and Lee (2020), and Bianco et al. (2023). Finally, Cluster 3 (institutionalization, signaling, and quality management perspectives) includes Amacher et al. (2004), Hamilton and Zilberman (2006), Esparon et al. (2014), Ibanez and Blackman (2016), and Hayat et al. (2020).

Taken together, the co-citation network and the theoretical frameworks of the reviewed papers show a strong overlap: every theoretical domain identified in the full corpus is covered within the review sample, and no framework adopted in the selected studies falls outside the three clusters emerging from the co-citation analysis. This supports the conclusion that our selection criteria (TC + CPY), complemented by the additional checks, yield a thematically and theoretically representative sample of the literature on environmental certifications and firm performance.

A detailed overview of the selected papers is presented in two separate tables: Table 4 summarizes studies on EMS (ISO 14001), while Table 5 focuses on eco-labels and related certifications. Each table reports the selection criteria (total citations, CPY, or both),

certification type, theoretical framework, data and sample, methodology, financial variables, and main findings.

## 6.2 | Comparison of Theoretical Frameworks

The literature on EMS/ISO 14001 and eco-labels is underpinned by distinct theoretical perspectives that reflect their different institutional and market functions. Research on EMS, particularly ISO 14001, has traditionally been framed within institutional theory, stakeholder theory, and the resource-based view (RBV), while eco-labels and related market-facing certifications are more often interpreted through signaling theory, industrial organization economics, and consumer behavior approaches. These frameworks not only explain why firms adopt certifications but also shape the expectations of researchers regarding their potential financial and strategic outcomes.

In the EMS domain, institutional and stakeholder theories dominate the early literature. They argue that adoption is frequently motivated by regulatory pressure, investor demands, and societal expectations, making certification a tool for maintaining legitimacy and avoiding reputational or compliance risks (Heras-Saizarbitoria et al. 2011). From this perspective, certification represents a response to external coercive, normative, or mimetic pressures, where demonstrating conformity is essential to sustain a firm's "license to operate." Stakeholder theory complements this view, highlighting how EMS adoption serves to reassure regulators, customers, and communities by demonstrating commitment to environmental responsibility. This dual lens situates EMS as a means of aligning organizational behavior with institutionalized norms while simultaneously managing stakeholder relationships.

Beyond these external drivers, EMS adoption has also been examined through the RBV and its environmental extension, the natural RBV (NRBV). These frameworks emphasize that ISO 14001 can be more than symbolic compliance: when effectively implemented, it enhances resource efficiency, reduces waste, and generates innovation capabilities that can create lasting competitive advantages (Iraldo et al. 2009; Miroshnychenko et al. 2017). The NRBV extends this logic by proposing that environmental capabilities become strategic assets only when they are rare, valuable, and inimitable, thus supporting long-term financial resilience. Recent studies reinforce this capability-based view: Younis and Sundarakani (2019) show that ISO 14001 delivers efficiency and cost benefits only when embedded in wider supply chain practices, while Duque-Grisales et al. (2020) emphasize that substantive adoption can stimulate innovation-led advantages, contrasting with superficial or symbolic certification. These findings highlight that outcomes are not uniform: while RBV suggests potential efficiency gains, institutional theory anticipates cases of adoption driven by legitimacy-seeking rather than substantive performance. The tension between symbolic and substantive adoption is therefore central to explaining heterogeneous empirical results.

Critical perspectives explicitly warn against assuming universal benefits. Heras-Saizarbitoria et al. (2011) demonstrate that financial advantages attributed to ISO 14001 are often subject

**TABLE 4** | Summary of top-cited studies on EMS included in the analysis.

Reference	Inclusion criteria	Certification type	Theoretical framework	Data and sample	Methodology	Key hypotheses	Financial variable	Main findings
Klassen and McLaughlin (1996)	TC+ CPY	EMS (general environmental management)	Ems linked to performance via risk reduction, process efficiency and market expectations	US publicly traded firms with environmental “events”	Event study	Does environmental management yield improved market valuation?	Stock market returns	Environmental awards improve stock returns; environmental crises hurt them
Rennings et al. (2006)	TC+ CPY	EMS—EMAS (EU Eco-Management and Audit Scheme)	Ecological modernization theory and “double dividend” logic	Survey of German EMAS-certified facilities (~1277 respondents)	Survey and linear regressions	More mature EMS implementations drive environmental innovation and economic performance	Self-reported economic performance improvements	More mature EMS firms show innovation and higher economic performance
Iraldo et al. (2009)	TC	EMS – EMAS (EU)	Resource-based view (RBV); competitive advantage through EMS	Survey of firms in EU (70 EMAS adopters vs. 31 nonadopters)	Survey and linear regressions	EMS adoption improves environmental performance and financial performance	Market share, sales growth, innovation, brand image	Environmental gains mediate competitive benefits, but no automatic market gain
Heras-Saizarbitoria et al. (2011)	TC	EMS – ISO 14001	Trade-off hypothesis and stakeholder theory	Spanish firms (2000–2005), 98 certified vs. 98 noncertified	Panel regression	ISO 14001 firms already have higher performance before certification	Return on assets (ROA) and sales growth	ISO 14001 firms do not gain financial performance post-certification
Miroshnychenko et al. (2017)	TC+ CPY	Mixed “green practices” (including ISO 14001)	Integrative framework using natural resource-based view (NRBV)	Global sample of 3490 listed companies	Linear regression	Pollution prevention and ISO 14001 adoption positively impact CFP	Return on Equity (ROE) and Tobin’s Q	Internal green practices drive profitability; ISO 14001 itself had no financial effect
Younis and Sundarakani (2019)	CPY	EMS (general environmental management)	Stakeholder, institutional, and RBV integration	Survey of 117 UAE firms implementing green supply chain management	Survey and linear regressions	EMS certification enhances economic, operational, environmental and social performance	Multiple financial metrics (profitability, growth, costs)	EMS-certified firms show positive impact on all performance outcomes
Duque-Grisales et al. (2020)	CPY	ISO 14001	NRBV with institutional influences	86 Multinationals listed on the Latina American stock market (2013–2017)	Panel regression	ISO 14001 strengthens green innovation—performance link	Return on assets (ROA)	ISO 14001 do not improve financial performance nor moderate green innovation

**TABLE 5** | Summary of top-cited studies on eco-labels included in the analysis.

Reference	Inclusion criteria	Certification type	Theoretical framework	Data and sample	Methodology	Key hypotheses	Financial variable	Main findings
Amacher et al. (2004)	TC	Green certification—eco-labeling (theoretical)	Industrial organization economics—duopoly model	No empirical data (analytical model)	Theoretical analysis (game theory model)	How does eco-labeling affect market competition and welfare?	Firm profit and market outcomes	Eco-labeling can reduce excessive investment and increase environmental quality
Hamilton and Zilberman (2006)	TC	Green certification—eco-certification and fraud	Environmental economics of information—credence goods	No empirical data (analytical model)	Theoretical modeling (equilibrium analysis)	How do market structure and policy affect green fraud and profits?	Firm profits, output, and fraud levels	Eco-certifications can reduce fraud and raise firm profits with the right policies
Esparon et al. (2014)	TC	Green certification—ECO certification (tourism)	Sustainable tourism management perspective	610 tourists in Australia's World Heritage area	Survey (descriptive statistics)	Do tourists perceive certified operators as better?	Customer-perceived performance	Certified tourism firms perceived as better but unclear financial impact
Ibanez and Blackman (2016)	TC + CPY	Green certification—organic (eco-label for coffee)	Win-Win sustainable agriculture premise	382 coffee farmers in Colombia (56 certified vs. 168 noncertified)	Difference-in-differences model	Does organic certification improve farm sustainability and financial performance?	Yield, coffee income, net revenue per hectare	Organic certification improves sustainability but not net farm income
Dangelico (2017)	TC + CPY	Green certification—eco-labeled green products	Sustainable product innovation literature	188 Italian companies with eco-labeled products	Survey and linear regressions	What drives green product development and its market success?	Market performance of green products	Market-driven green innovation has the greatest impact; performance improves
Hayat et al. (2020)	CPY	Green certification—organic (eco-label for textile)	Environmental economics; eco-labels as voluntary sustainability tools	128 textile firms listed on Pakistan Stock Exchange (2009–2015)	Panel regressions with 3SLS simultaneous equations	Eco-labels enhance environmental and financial performance of textile firms	Return on equity (ROE), return on capital employed (ROCE), and the net profit margin	Eco-label adoption improves both financial returns and environmental outcomes

(Continues)

TABLE 5 | (Continued)

Reference	Inclusion criteria	Certification type	Theoretical framework	Data and sample	Methodology	Key hypotheses	Financial variable	Main findings
Wen and Lee (2020)	CPY	Green certification—environmental labeling (China ELC)	Asymmetric information, resource-based view (RBV), and dynamic competition	408 Chinese A-share manufacturers, 2004–2018, (102 certified vs. 306 noncertified)	Difference-in-differences model	Environmental labels improve profitability and market value	Return on assets (ROA), Tobin's Q, and total factor productivity (TFP)	Labels increase profitability and market value, mainly through price premiums
Bianco et al. (2023)	CPY	Green certification (Florida Green Lodging Program)	RBV and action–reaction framework of competitive dynamics	251 certified hotels in Florida, panel of 51,625 monthly observations (2000s–2021)	Panel regressions	Green certification improves hotel KPIs; early adopters gain stronger advantages	Occupancy rate, average daily rate, revenue per available room	Certification improves hotel KPIs, with early adopters gaining stronger advantages

to self-selection: firms already performing better may be those most likely to certify, making it difficult to disentangle causality. Similarly, Duque-Grisales et al. (2020) show that in Latin American multinationals, EMS adoption yields benefits only when supported by complementary resources, underscoring the RBV proposition that certifications create value only under specific organizational and contextual conditions. Overall, these insights stress that the financial implications of EMS must be interpreted through a dual theoretical lens: institutional theory explains symbolic or legitimacy-driven adoption with limited financial returns, whereas RBV and NRBV explain value creation when certification is embedded as a capability-enhancing practice.

Other contributions emphasize EMS as a driver of innovation and strategic positioning. Rennings et al. (2006) argue that environmental investments motivated by EMS can generate “double dividends”: pollution reduction combined with productivity gains. Klassen and McLaughlin (1996) show that environmental awards and EMS-related recognition can also function as signals of managerial quality and reduced operational risk, creating value beyond efficiency improvements. Collectively, these perspectives depict EMS as a multifaceted mechanism: a compliance tool, a resource-enhancing process, and, at times, a signal to markets of organizational quality.

In contrast, the literature on eco-certifications, including eco-labels, organic standards, and B-Corp, is more firmly rooted in signaling theory and market-oriented perspectives. Here the central issue is the reduction of information asymmetry in markets for “credence goods,” where consumers cannot directly verify environmental quality. Hamilton and Zilberman (2006) conceptualize eco-labels as market signals whose effectiveness depends on credibility, third-party monitoring, and enforcement. Their analysis demonstrates that without credible verification, eco-labels lose their signaling power, eroding differentiation advantages and limiting financial gains. This insight has become a cornerstone for subsequent eco-label research, where credibility and consumer trust are treated as critical boundary conditions for financial impact.

Building on signaling theory, industrial organization economics frames eco-labels as competitive strategies. Amacher et al. (2004) illustrate, through duopoly models, that certification choices depend on market structures and cost dynamics: in some cases, both firms adopt eco-labels to remain competitive, while in others, certification is used by a single firm as a differentiation tool to capture niche segments. This strategic framing emphasizes that eco-labels are not only reputational signals but instruments of market positioning. Yet, empirical results reveal that financial outcomes are highly context dependent. Ibanez and Blackman (2016) show that in sustainable agriculture, certifications improve environmental practices but do not always yield net financial benefits due to cost increases and market constraints. Similarly, evidence from Pakistan's textile sector indicates that profitability depends on the interplay between certification costs and export-market demand (Hayat et al. 2020).

Recent contributions expand this perspective, linking eco-certifications to branding and innovation strategies.

Dangelico (2017) argues that firms integrate eco-labels into long-term product development and brand positioning, where financial benefits may materialize gradually through consumer loyalty and reputational capital. Esparon et al. (2014), focusing on sustainable tourism, show that eco-certifications influence consumer perceptions, reinforcing legitimacy and trust in industries where direct consumer interaction is crucial. Wen and Lee (2020) provide further evidence that eco-certifications enhance profitability in Chinese listed firms only under supportive institutional and consumer awareness conditions, underscoring the contingent nature of signaling effectiveness. Finally, Bianco et al. (2023) highlight that while eco-certifications can differentiate firms and attract green consumers, their market value is conditional on maintaining credibility over time.

On balance, these studies reveal a clear divergence in theoretical underpinnings between EMS and eco-labels. EMS frameworks emphasize internal governance, compliance, and efficiency, where financial benefits are mediated by capabilities, institutional contexts, and authenticity of implementation. Eco-labels, by contrast, operate in consumer-facing markets, where signaling, credibility, and differentiation drive potential financial value, but where outcomes are contingent on consumer awareness, market conditions, and cost structures. Importantly, these differences also mirror their temporal development and audience: EMS frameworks became prevalent earlier, reflecting the introduction of ISO 14001 in the mid-1990s and addressing primarily regulators, investors, and supply-chain partners, whereas eco-labels gained traction more recently, targeting consumers and sustainability-conscious buyers. This temporal and audience-based divergence partly explains why the two streams of literature rely on different theoretical lenses, and why their financial implications are framed in such distinct ways.

### 6.3 | Comparison of Methodological Approaches

The reviewed EMS studies and green certification studies employ notably different methodologies, reflecting their distinct research questions and data availability. EMS/ISO 14001 studies often rely on firm-level quantitative data over time. For example, two EMS papers used panel data with before-and-after comparisons: Heras-Saizarbitoria et al. (2011) analyze five-year financial panels with matched control firms to isolate ISO 14001 effects, and Miroshnychenko et al. (2017) harness a large international panel (3490 firms) with fixed-effects regressions. These designs aim to control for confounding factors and identify causal links (or lack thereof) between EMS adoption and performance.

More recent EMS work has continued along this line, while also modeling moderating mechanisms: Duque-Grisales et al. (2020) used hierarchical panel regressions on 86 Latin American multinationals to test how ISO 14001 conditions the relationship between green innovation and performance, adopting a natural resource-based view and institutional theory framing.

Other EMS studies use cross-sectional surveys combined with econometric modeling: Rennings et al. (2006) and Iraldo et al. (2009) surveyed managers about innovations and performance, then ran regression analyses, Younis and Sundarakani (2019) followed a similar survey-based design in

the UAE, applying multiple regressions to show how EMS certification, alongside firm size and age, interacts with green supply-chain practices and different performance dimensions. Klassen and McLaughlin (1996) took a different empirical tack by doing a stock-market event study, capturing investors' real-time valuation of environmental management events. In general, EMS studies emphasize quantitative metrics like ROA, productivity, stock returns, or self-reported cost/turnover changes, and they often attempt to address endogeneity (through matching, panel models, or instrumental logic).

By contrast, green certification (eco-label) studies in this set are more heterogeneous in method. Two of these papers are purely theoretical models rooted in economics (Amacher et al. 2004; Hamilton and Zilberman 2006). They use game theory and mechanism design to predict firm behavior and market outcomes under different certification scenarios. These yield insights on policy and strategic dynamics (like fraud, investment incentives) but do not use data. On the empirical side, Ibanez and Blackman (2016) applied a quasi-experimental design at the micro level (farm-level matching & diff-in-diff)—a rigorous approach to pin down causal impacts of certification on farmers. This resembles program evaluation methods common in development economics. Recent empirical work has expanded these approaches: Wen and Lee (2020) also use a quasi-experimental strategy, combining propensity-score matching with difference-in-differences to evaluate China's environmental labeling program, thereby strengthening causal inference on certification impacts. Other designs apply structural econometrics to address simultaneity, as in Hayat et al. (2020), who estimate simultaneous-equation models (3SLS) on textile firms to account for the joint determination of environmental and financial outcomes. Finally, Bianco et al. (2023) take a competitive-dynamics perspective, using panel data on the hotel industry to assess how certification affects revenue performance in relation to rivals, thereby illustrating how market reactions shape certification outcomes.

Another empirical approach is survey-based perception analysis, as in Dangelico (2017) and Esparon et al. (2014). Dangelico's survey gathered managers' views on motivations and outcomes of eco-labeled product launches, using statistical techniques like factor analysis and structural equation modeling to infer relationships. Esparon et al. (2014) surveyed tourism consumers, employing Importance-Performance Analysis—a technique from marketing research—to understand consumer attitudes toward certification attributes. These studies are more qualitative/attitudinal in nature compared to the hard financial metrics in many EMS papers. They capture stakeholder perceptions and self-reported performance rather than objective profit measures.

In sum, EMS studies lean towards longitudinal and quantitative designs focusing on internal performance metrics, whereas green certification studies vary widely: some are conceptual, others quasi-experimental in field settings, and others survey-based focusing on market perceptions. The newer evidence shows a gradual convergence: eco-label studies increasingly adopt quantitative panel approaches (e.g., Bianco et al. 2023; Hayat et al. 2020; Wen and Lee 2020), mirroring the methodological rigor long typical of EMS research. This shift enhances

comparability between the two streams, though survey- and theory-based designs remain more common in consumer-facing certification contexts. This difference stems from the phenomena examined—EMS is an internal management tool (with data available on firm performance), while green product certifications interface with customers and markets (often requiring different data like surveys or theoretical modeling of market behavior). The variety of methods on the green certification side means findings there are drawn from both analytical predictions and observational insights, which sometimes makes direct comparison challenging.

#### 6.4 | Differences in How EMS vs. Eco-Labels Impact Financial Performance

Despite a shared general goal of improving environmental and business outcomes, EMS and eco-labels affect financial performance through distinct mechanisms and with varying robustness. EMS (ISO 14001, EMAS) primarily enhance internal efficiencies, risk management, and process innovation, with financial benefits typically arising from cost reductions, improved compliance, and productivity gains. Studies linking EMS to positive outcomes often attribute these effects to efficiency improvements. Rennings et al. (2006) found that well-implemented EMS stimulate both process and product innovations, leading to productivity growth, while Iraldo et al. (2009) observed that competitive benefits emerge only when adoption translates into genuine environmental improvements rather than symbolic compliance. Klassen and McLaughlin (1996) suggest that EMS signals (e.g., environmental awards) can create value by indicating strong management quality and reduced risk exposure, though their evidence focuses on short-term market reactions rather than long-term financial trajectories. Not all studies find benefits: Heras-Saizarbitoria et al. (2011) show that ISO 14001 alone does not boost performance when already-efficient firms self-select into certification, and Miroshnychenko et al. (2017) document investor skepticism when adoption appears superficial. More recent contributions refine this picture. Younis and Sundarakani (2019) show that EMS adoption strengthens supply-chain efficiency and resilience—linking environmental practices to operational continuity and cost discipline—while Duque-Grisales et al. (2020) highlight that in Latin American multinationals, certification can improve legitimacy but does not automatically deliver efficiency or financial gains if not embedded in wider strategies. Taken together, the financial impact of EMS depends less on “having” a certificate and more on the depth of integration into operations, value-chain configuration, and industry cost structures.

By contrast, eco-labels and consumer-facing certifications primarily affect financial performance through revenue generation, market differentiation, and reputational gains. These certifications are designed to signal superior environmental performance to consumers, allowing firms to enhance demand, charge premium prices, and strengthen brand value. Several studies confirm these advantages: Dangelico (2017) finds that eco-labels are often pursued for market-driven motives and that well-differentiated green products can achieve superior sales and margins; Esparon et al. (2014) show that eco-certified

tourism businesses are perceived more favorably, fostering loyalty and willingness to pay. Yet, benefits are far from universal. Ibanez and Blackman (2016) highlight that organic coffee farmers, despite price premiums, face higher costs and lower yields, resulting in no net financial gain. Amacher et al. (2004) similarly demonstrate that eco-label investments are financially viable only when willingness to pay exceeds compliance costs. Credibility is critical: Hamilton and Zilberman (2006) emphasize that certification must function as a credible signal to retain market value, while Wen and Lee (2020) show empirically that weak monitoring or ambiguous standards undermine trust and erode financial benefits; where institutional support and consumer awareness are strong, profitability improvements are more likely. Sectoral evidence from services corroborates these dynamics: in hospitality, Bianco et al. (2023) find that sustainability certifications can enhance occupancy and revenue (RevPAR, ADR), especially for first movers, with advantages that attenuate as certification diffuses. In export-oriented manufacturing, Hayat et al. (2020) show that profitability hinges on balancing elevated compliance costs with buyer-driven demand and market-access conditions.

Although EMS and eco-labels follow different primary pathways—internal efficiency versus market differentiation—they are not mutually exclusive. In practice, many firms pursue hybrid strategies, and the underlying mechanisms can interact and reinforce each other. First, EMS-driven cost reductions (energy savings, scrap minimization, yield improvements, fewer disruptions) expand the margin space within which firms can credibly offer eco-labeled products without eroding competitiveness—a precondition for sustaining price premiums when compliance costs are nontrivial. Second, successful eco-labeling that secures demand and premium acceptance often creates organizational pressure to deepen EMS so that external claims are backed by robust routines, audits, and supply-chain controls; this protects credibility and mitigates premium erosion. The literature offers converging signals: Rennings et al. (2006) link EMS-based process innovation to greener product development (a bridge to market differentiation); Dangelico (2017) frames eco-labels as most effective when embedded in broader innovation and branding strategies; Younis and Sundarakani (2019) show how EMS-based supply-chain efficiency underpins reliable fulfillment and cost control—capabilities that strengthen a green market position; Wen and Lee (2020) indicate that credibility and payoffs are higher when labels are supported by substantive practices rather than symbolic gestures; Bianco et al. (2023) suggest that in hospitality, external certification gains traction when reinforced by strong internal routines. In short, efficiency- and market-based mechanisms can form a reinforcing loop: cost savings provide room for premium strategies, and credible labels amplify reputational, and revenue returns to substantive environmental improvements. The extent to which such complementarities materialize depends strongly on context, which helps explain why findings remain mixed.

A primary distinction concerns timescale and scope. EMS benefits often yield near-term cost savings (reduced energy use, waste minimization, improved throughput), whereas eco-label advantages typically require longer-term brand building and consumer education before premiums materialize. Heras-Saizarbitoria et al. (2011) caution that short-horizon designs can underestimate

EMS benefits, particularly where selection effects bias adoption toward already efficient firms. Conversely, eco-label advantages may accumulate gradually as awareness and credibility develop. More recent evidence is consistent with these dynamics: Wen and Lee (2020) stress that sustained credibility and enforcement are necessary to preserve profitability in consumer markets, while Duque-Grisales et al. (2020) show that EMS-related legitimacy effects may emerge early but only translate into sustained financial outcomes when supported by complementary investments.

Additionally, EMS tends to generate stronger benefits in industries where process efficiency directly lowers costs (e.g., energy- and materials-intensive manufacturing), but has weaker effects in service sectors with lower environmental cost exposure (Heras-Saizarbitoria et al. 2011). Eco-labels perform better in markets where sustainability is salient in purchase decisions and where consumer awareness and trust are high (Dangelico 2017; Wen and Lee 2020). In commodity or cost-sensitive contexts, premiums can be offset by compliance costs (Hayat et al. 2020; Ibanez and Blackman 2016). Institutional quality and enforcement also matter: robust auditing and clear standards protect label credibility (Hamilton and Zilberman 2006; Wen and Lee 2020), while stricter environmental policies and disclosure regimes can raise the marginal value of EMS (via risk reduction and supply-chain access). Firm size and resources further condition outcomes—large firms can absorb certification costs and invest in complementary capabilities, whereas SMEs face tighter trade-offs (Miroshnychenko et al. 2017). Across these dimensions, alignment—between certification type, market structure, institutional setting, and the firm’s capability base—largely determines whether “green pays.”

Motivation and implementation quality are likewise pivotal. Firms that embed EMS or eco-labels into strategy—using them as foundations for process improvement or product differentiation—are more likely to see financial gains; symbolic or compliance-only adoption tends to yield negligible or negative effects (Iraldo et al. 2009; Miroshnychenko et al. 2017). The newer evidence sharpens this distinction: Wen and Lee (2020) show that ambiguous standards and weak monitoring depress market willingness to reward labels (a signaling failure), while Younis and Sundarakani (2019) indicate that EMS benefits materialize when integrated into supply-chain routines (inventory, logistics, supplier coordination), not as stand-alone manuals.

Time lags and performance measurement also contribute to discrepancies. Some benefits—especially for EMS—take years to materialize (learning-by-doing, continuous improvement), whereas short-term designs may fail to capture their full impact (Heras-Saizarbitoria et al. 2011). Conversely, eco-label effects may appear first in market-based indicators (price–cost margins, revenue growth, share gains) before percolating to accounting returns, particularly in consumer goods. Heterogeneity in outcome variables (market vs. accounting) and event windows (short-window stock responses vs. multiyear operating metrics) can therefore lead to different conclusions about effectiveness (Klassen and McLaughlin 1996). Future designs that align measures with mechanisms—cost/productivity metrics for EMS pathways; demand-side/brand metrics for eco-label pathways; and joint operating plus market metrics when complementarities are expected—should yield clearer inferences.

Lastly, external enabling factors shape outcomes. For eco-labels, consumer awareness, credible monitoring, and marketing/channel investment are crucial—without them, willingness-to-pay remains low and signals fade (Esparon et al. 2014; Hamilton and Zilberman 2006; Wen and Lee 2020). EMS-driven gains rely more on R&D, training, analytics, and supplier development—without these complements, firms may comply procedurally but fail to capture meaningful efficiency improvements (Rennings et al. 2006; Younis and Sundarakani 2019). In global value chains, buyer standards and procurement policies can amplify both mechanisms by rewarding credible labels and favoring suppliers with robust EMS (Hayat et al. 2020). Overall, evidence increasingly points to bundles of practices, rather than single certifications, as the configuration most likely to deliver durable financial value.

Bringing the evidence together, we outline a conditional framework for when and how certifications translate into financial returns. At the firm level, EMS tend to “pay” when they are substantively embedded in routines and complemented by process capabilities, generating durable efficiency and resilience (Duque-Grisales et al. 2020; Iraldo et al. 2009; Rennings et al. 2006; Younis and Sundarakani 2019). Eco-labels tend to “pay” when firms possess differentiation and branding capabilities that convert environmental claims into willingness-to-pay (Dangelico 2017), and do not when adoption is symbolic (Heras-Saizarbitoria et al. 2011) or when costs outweigh consumer premiums (Ibanez and Blackman 2016). At the industry/market level, EMS effects are stronger in process-intensive sectors where efficiency gains directly lower unit costs, whereas eco-label returns are stronger in consumer-facing categories and weaker in commodity markets (Bianco et al. 2023; Hayat et al. 2020). At the institutional level, EMS benefits are amplified by regulatory scrutiny and supply-chain requirements, while eco-label premiums hinge on credible monitoring and enforcement that sustain consumer trust (Hamilton and Zilberman 2006; Wen and Lee 2020). Crucially, synergies arise when internal capabilities and institutional credibility jointly support both mechanisms: EMS-driven efficiency expands the economic space for premium strategies, and credible eco-labels magnify reputational returns to substantive internal practices (Dangelico 2017; Rennings et al. 2006; Younis and Sundarakani 2019). Conversely, mismatches (e.g., weak capabilities with high label costs, or bold claims without credible enforcement) erode margins and nullify signals.

This perspective also clarifies measurement and timing. Studies converge more when metrics are aligned to mechanisms—cost/productivity indicators for EMS; price–cost margins, product mix, and revenue growth for eco-labels; and joint operating plus market metrics when complementarities are expected. Because EMS benefits and eco-label credibility accumulate over multiyear horizons, short windows risk underestimating effects (Heras-Saizarbitoria et al. 2011; Wen and Lee 2020). In sum, certifications are neither automatic guarantees of financial returns nor empty symbols: they are tools whose payoff depends on fit and integration—between organizational capabilities, market structure, and institutional credibility. Framed this way, the question shifts from whether certifications “pay” to under what configurations and through which channels they do so, offering a clearer agenda for research and a more actionable playbook for managers and policymakers.

## 6.5 | Gaps and Opportunities for Future Research

Although this review has highlighted valuable insights on how EMS and eco-labels affect firm performance, several important areas remain underexplored. One pressing need is to use longer time horizons in studying these certifications. Much of the current research relies on a handful of post-adoption years or on cross-sectional data, which may overlook slower-evolving benefits—like a gradual reputational boost—or costs that appear only after competitive advantages erode (Heras-Saizarbitoria et al. 2011). Future studies could track firms for a decade or more, observing how ISO 14001, EMAS, or eco-labels perform during different economic cycles and whether certifications retain their value over time (Miroshnychenko et al. 2017). Because certification payoffs are also reshaped by market learning and competitive imitation, designs should explicitly follow diffusion phases, not only adoption, so as to capture whether the initial signal advantage attenuates as schemes become commonplace (Bianco et al. 2023; Wen and Lee 2020). Such a longitudinal approach would also reveal how early movers fare once other companies catch up, clarifying whether the advantage of being certified diminishes in more mature markets. These considerations suggest that future analyses should not only assess average outcomes but also examine the boundary conditions that may amplify or dampen them over time.

At the same time, several mechanisms can limit or even nullify these benefits, making outcomes highly contingent on implementation depth and governance conditions. Certifications can generate heterogeneous or even null effects when adoption remains symbolic rather than substantive. In such cases, reputational gains tend to be short-lived, especially when audit quality or enforcement mechanisms are weak. Several potential mechanisms may undermine certification effectiveness. First, greenwashing occurs when firms use certifications primarily as legitimacy signals without implementing meaningful environmental improvements (Ferrón Vilchez 2017; Iatridis and Kesidou 2018). Second, signal dilution arises from the proliferation of overlapping schemes that confuse stakeholders and create “label fatigue” (Brécard 2014). Third, weak governance can lead to assurance capture, where auditors face conflicts of interest or lack independence (Dogui et al. 2014; Kouakou et al. 2013). Fourth, the emphasis on uniform procedures can trigger institutional isomorphism—firms converge toward the same templates—resulting in organizational lock-in and checkbox behavior, whereby compliance replaces continuous improvement (Boiral 2007). Fifth, metric gaming, often linked to Goodhart’s Law (“when a measure becomes a target, it ceases to be a good measure”), may redirect managerial effort toward easily auditable indicators rather than genuine impact (Micheli and Mari 2014). Finally, there can be impact displacement along the supply chain, as certified firms transfer environmental burdens to upstream suppliers or unmeasured scopes (Garrett and Pfaff 2019).

These mechanisms are context-dependent, varying with sectoral exposure, institutional quality, market structure, stakeholder salience, and the diffusion stage of each scheme—early movers often benefit from stronger reputational returns that decline as certifications become mainstream. Fixed and administrative

costs can also be regressive, placing a heavier relative burden on SMEs and smaller suppliers.

Taken together, these dynamics provide a more nuanced understanding of why empirical results remain mixed and why symbolic adoption may coexist with substantive improvement in the same domain.

From a methodological standpoint, future studies should move beyond dichotomous views of “effective vs. ineffective” certification and instead focus on the mechanisms and contingencies that shape outcomes. To distinguish substantive from symbolic effects, research designs could: (i) broaden performance metrics beyond profitability to include risk reduction, financing access, and operational flexibility; (ii) explicitly model mediators such as innovation, learning, or brand equity; (iii) incorporate moderators capturing governance features (audit frequency, third-party independence, scheme stringency), market conditions (consumer awareness, competitive density), and internalization depth (integration into management systems, employee training, environmental investments, or non-conformity rates).

Building on these boundary conditions, a key direction involves broadening the performance metrics and understanding the intermediate steps that connect certification to financial results. While many studies focus on ROA or short-term stock market fluctuations, additional measures—like risk management, access to new financing, or operational flexibility—may capture subtler benefits (Rennings et al. 2006). For instance, EMS adoption can produce incremental cost savings or reduce volatility in earnings if better environmental practices limit the likelihood of accidents or regulatory penalties (Iraldo et al. 2009). Eco-labels might help a firm break into consumer segments that are willing to pay more, yet these gains might not show up immediately in accounting data. This points to the importance of modeling certification as part of a broader capability bundle—where complements such as innovation, brand equity and learning curves condition value creation and appropriation—rather than as a stand-alone lever (Duque-Grisales et al. 2020). By examining mediators such as brand equity or innovation rates, researchers could pinpoint the “why” behind positive outcomes. In other words, a study might demonstrate that improved environmental performance—achieved through certification—reduces compliance costs, fosters community goodwill, and eventually translates into higher profitability.

Contextual factors also warrant attention, particularly among smaller firms and in emerging regions. Scholars have traditionally centered on larger corporations in developed countries, partly because these organizations have more resources and are more visible in databases (Hillary 2004). Yet, small- and medium-sized enterprises (SMEs) may face different pressures and have fewer capabilities to handle certification requirements, making the balance between upfront costs and potential rewards more delicate (Miroshnychenko et al. 2017). Evidence from Gulf economies similarly indicates that certification’s contribution to performance is mediated by basic firm characteristics—such as size and age—and by institutional support, reinforcing the need for designs that stratify samples by resource endowments and governance settings (Younis

and Sundarakani 2019). Likewise, in emerging markets with lower consumer awareness or weaker enforcement, the financial payoff of certifications may be limited, or conversely, they may act as a crucial passport for exporting to stricter countries. Studying diverse contexts would clarify whether widely reported modest impacts reflect certain Western markets or if there are unique patterns elsewhere.

There is also a need for comparative studies that explicitly contrast multiple certification schemes rather than evaluating them in isolation (Rennings et al. 2006). For instance, one might compare outcomes between ISO 14001 and EMAS for firms in the same sector and region, or between different eco-labels targeting similar product categories. Variations in transparency requirements (like EMAS's mandatory reporting) or the stringency of audits could systematically shape financial returns (Iraldo et al. 2009). Comparative assessments conducted within common sectors and using harmonized outcomes would help attribute effects to program design rather than sample composition; analyses of national labeling programs already suggest that scheme features—not only context—can make a difference (Wen and Lee 2020). Similarly, investigating how purely private eco-labels stack up against government-endorsed standards would help managers and policymakers decide which approach encourages stronger performance benefits. Better understanding these differences would also inform design choices for future certification programs, indicating which elements—e.g., public disclosure, rigorous compliance checks—tend to yield more consistent advantages.

In addition, consumer behavior remains a somewhat underexplored piece of the puzzle. While some studies analyze the perceived value of eco-labels (Esparon et al. 2014), fewer research designs measure actual consumer purchasing over the long run or how consumer trust may evolve, especially if instances of greenwashing or fraud come to light (Hamilton and Zilberman 2006). Because markets reprice signals as rivals respond, demand-side evidence should be interpreted together with competitive dynamics to understand how long any price premium or occupancy uplift can be sustained in actice (Bianco et al. 2023). A deeper dive into how eco-label credibility builds or wanes over time could reveal whether certain label features—like frequent third-party audits or strong marketing campaigns—lead to more stable price premiums and brand loyalty. In addition, the proliferation of schemes with partly opaque criteria can reduce the informational content of labels and weaken consumers' willingness to pay. The credibility of third-party assurance—including audit frequency/rigor and safeguards against conflicts of interest—emerges as a key moderator of long-run trust and price premium. Furthermore, event studies could evaluate how revelations of certification fraud (or poor enforcement) affect stock prices, providing robust evidence of how critical trust in certifications is to a firm's bottom line.

Lastly, there is a methodological gap in how studies integrate environmental and financial performance data. Few articles attempt to quantify, for instance, the precise economic return of each improvement in environmental metrics. Future research could construct models that examine both sets of outcomes together, identifying which organizational processes or capabilities produce genuine “win-win” benefits. Another option is to

conduct broader quantitative syntheses (e.g., meta-analyses) across different industries and certifications, assessing which moderating variables—such as region, firm size, or competitive intensity—most strongly influence whether green certifications pay off (Heras-Saizarbitoria et al. 2011). Work that already treats environmental and financial outcomes within a unified lens indicates that this integration is feasible and informative for isolating value pathways (Hayat et al. 2020).

Tackling these issues would greatly enrich our understanding of when and how environmental certifications yield financial benefits. Longer-term studies expanded performance measures with explicit mediators, deeper exploration of smaller firms and new markets, direct scheme-to-scheme comparisons, closer attention to consumer dynamics in competitive settings, and integrated environmental-financial metrics are all needed to move the debate beyond conditional or mixed findings. Addressing these gaps would not only support more concrete guidance for managers and investors but also help policymakers refine certification programs to promote robust environmental outcomes alongside sustainable economic gains.

## 7 | Conclusions

This review set out to clarify when and how environmental certifications influence firm financial performance, focusing on EMSs (ISO 14001, EMAS) and consumer-facing eco-labels (including B-Corp in its outward-facing dimension). To address a fragmented body of evidence, we combined a bibliometric analysis—to capture the structural evolution and intellectual patterns of the field—with a systematic review of its most influential contributions, enabling both breadth and depth in assessing the financial implications of certification. Overall, the financial and reputational payoff of certifications appears contingent on implementation depth, audit credibility, and market trust; in their absence, effects may be temporary or largely symbolic.

The bibliometric analysis reveals a literature that is at once maturing and fragmenting. EMS-related studies have accumulated a longer trajectory, higher average citations, and a more consolidated intellectual structure, reflecting their earlier institutionalization. Eco-label and B-Corp research is more recent but shows faster growth rates, greater international co-authorship, and a dynamic expansion across disciplines, signaling an emerging frontier. Yet, the field as a whole remains decentralized, with dispersed author clusters and contributions spread across sustainability, management, and economics outlets rather than concentrated in a narrow core. This distribution underscores both the multidisciplinary character of the domain and the challenge of consolidating cumulative knowledge. Conceptual mapping confirms this picture: EMS research anchors the field, while eco-labels occupy a more peripheral but increasingly vibrant position, suggesting different stages of academic maturity and integration.

The systematic review complements this structural perspective with three substantive findings. First, EMS and eco-labels operate through distinct channels. EMS tends to enhance efficiency, risk management, and process innovation, where financial payoffs depend on the depth of implementation rather than

symbolic compliance. Eco-labels primarily function as signals in consumer markets, potentially enabling revenue premium and reputational gains, but only when credibility and monitoring are strong and consumer awareness is high. Second, these channels can be mutually reinforcing. Efficiency gains from EMS adoption expand the economic space for differentiation strategies, while credible eco-labels amplify the reputational and market benefits of substantive environmental practices. Third, outcomes are highly context dependent. Sectoral cost structures, firm size and resources, institutional quality, and the type of performance indicators employed (accounting, market-based, or event-study) all influence whether and to what extent certifications “pay off.” A universal claim of financial advantage is therefore untenable; a configuration-specific view better reflects the evidence.

At the same time, this study is subject to limitations. Our evidence base is restricted to Scopus and WoS, to peer-reviewed, English-language journal articles in business, economics, and environmental sciences. Within each certification stream, the systematic component emphasized influential papers by combining Total Citations (TC) with Citations-per-Year (CPY); while this balances historical and recent contributions, it may still under-represent methodologically rigorous but less-cited studies and remains vulnerable to citation-related biases. In addition, most of the available literature concerns listed firms in developed economies, which constrains the transferability of conclusions to SMEs and to emerging markets where institutional conditions differ. Finally, the heterogeneity of financial metrics and research designs—ranging from ROA and productivity to Tobin's Q and event-study market reactions—limits comparability and likely contributes to mixed findings. These limitations do not invalidate the insights offered, but they do define the boundary conditions within which our conclusions should be interpreted.

From these limitations arise several directions for future research. Longer observation windows would help capture lagged effects, the dynamics of market diffusion, and the potential erosion of first-mover advantages. Comparative designs across certification schemes—such as ISO 14001 versus EMAS, or private versus public labels—would clarify how program design features (audit stringency, disclosure requirements, enforcement) shape financial outcomes. Greater attention should be directed toward SMEs and firms in emerging economies, where certification can act as both a constraint and a passport to international markets. Future work should broaden performance assessment beyond profitability to include risk, financing access, and operational flexibility, and explicitly model mediating processes such as innovation and brand equity. In consumer-facing contexts, more evidence is needed on trust dynamics, competitive interactions, and the consequences of greenwashing or fraud, as these factors can decisively affect willingness-to-pay and brand value over time. Finally, integrated approaches that connect environmental and financial outcomes, complemented by meta-analyses, could generate cumulative insights and identify consistent moderators—such as sector, firm size, and institutional quality—of certification impacts.

In conclusion, by integrating bibliometric structure and systematic evidence, this review advances understanding of both the intellectual landscape and the substantive mechanisms linking certifications to financial performance. Its contribution is twofold:

it demonstrates the different stages of maturity and fragmentation that characterize EMS and eco-label research, and it identifies the channels, complementarities, and contingencies that determine when certifications deliver economic benefits. For scholars, this framework sets out a clear agenda for future work that is longitudinal, comparative, and context sensitive. For managers and policymakers, the implication is that certification is not a guarantee of financial advantage, but a strategic lever whose payoff depends on fit—between program design, organizational capabilities, market structures, and institutional credibility.

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## Appendix A

Search strings:

### 1. Web of Science

TS=((“eco label\*” OR “eco-label\*” OR “ecolabel\*” OR “eco certification\*” OR “eco-certification\*” OR “green label\*” OR “green certification\*” OR “environmental label\*” OR “sustainability label\*” OR “green product certification\*” OR “carbon label\*” OR “sustainability certification\*” OR “eco-friendly certification\*” OR “environmentally friendly certification\*” OR “green award\*” OR “sustainability award\*” OR “environmental award\*” OR “ISO 14001” OR “ISO14001” OR “EMAS” OR “eco-management and audit scheme” OR “environmental management system” OR “bcorp\*” OR “b-corp\*” OR “sustainable certification\*”) AND (“financial performance\*” OR “economic performance\*” OR “firm performance\*” OR “profitability\*” OR “market value\*” OR “competition\*” OR “cost of equity” OR “cost of debt” OR “financial benefit\*” OR “equity cost\*” OR “debt cost\*”).

### 2. Scopus

TITLE-ABS-KEY ((“eco label\*” OR “eco-label\*” OR “ecolabel\*” OR “eco certification\*” OR “eco-certification\*” OR “green label\*” OR “green certification\*” OR “environmental label\*” OR “sustainability label\*” OR “green product certification\*” OR “carbon label\*” OR “sustainability certification\*” OR “eco-friendly certification\*” OR “environmentally friendly certification\*” OR “green award\*” OR “sustainability award\*” OR “environmental award\*” OR “ISO 14001” OR “ISO14001” OR “EMAS” OR “eco-management and audit scheme” OR “environmental management system” OR “bcorp\*” OR “b-corp\*” OR “sustainable certification\*”) AND (“financial performance\*” OR “economic performance\*” OR “firm performance\*” OR “profitability\*” OR “market value\*” OR “competition\*” OR “cost of equity” OR “cost of debt” OR “financial benefit\*” OR “equity cost\*” OR “debt cost\*”).