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Beyond symbolism: revisiting the ESG–performance relationship through operational excellence

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Abstract

Purpose – This study addresses the inconsistent evidence on whether environmental, social, and governance (ESG) hinders or enhances performance. Drawing on the practice-based view (PBV) and the competitive progression theory (CPT), we argue that this inconsistency stems from how firms approach sustainability, prioritizing ESG reporting over the operational foundation for ESG integration. We conceptualize this foundation as Operational Excellence (OE), a firm-wide commitment to excellence through the persistent adoption of multiple practices and theorize that OE results in ESG adoption and effectiveness. We also hypothesize about the mediating effect of OE-driven ESG adoption on performance.

Design/methodology/approach – Using a longitudinal panel of 3,394 U.S. manufacturing firm-year observations (2010–2023), we apply System Generalized Method of Moments (GMM) to test the role of OE in ESG adoption and effectiveness. To capture the key elements of our OE conceptualization, we consider the breadth (number of practices) and persistence (the consistency of adoption over time). Several robustness tests are conducted to ascertain the findings.

Findings – OE facilitates sustainability engagement and the adoption of a broad range of ESG practices. It also enhances ESG effectiveness, as performance gains occur when ESG practices are grounded in prior OE. Results reveal a sequential pattern: firms first adopt OE practices, then ESG practices, leading to improved performance. This reflects temporal mediation, where OE influences performance through ESG practices.

Originality/value – We conceptualize OE as a firm-wide commitment to excellence that underpins ESG effectiveness—enabling ESG to improve performance by being fully integrated into core operations and aligned with other practices.

Keywords Operational excellence, ESG, Performance

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1. Introduction

Firms face increasing stakeholder pressures to become more sustainable (Klassen and McLaughlin, 1996), evidenced by tighter environmental regulation and heightened media

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scrutiny of corporate sustainability (Pu *et al.*, 2025; Flammer, 2013). Firms are responding by adopting sustainability practices and voluntarily disclosing environmental, social, and governance (ESG) practices: by September 2024, over 82% of S&P 500 companies publicly disclosed workforce diversity data, up from 5.3% in 2019, and greenhouse gas emissions reporting among large-cap U.S. firms surged from 54% to 85% between 2019 and 2023 (Kerber, 2024). ESG has therefore become a central managerial concern, and operations management (OM) scholars increasingly view it as an area requiring deeper examination (Roehrich *et al.*, 2025), particularly because ESG efforts directly interact with supply chain management decisions (Yan *et al.*, 2025). Recent studies reflect this growing interest, highlighting the operational implications of ESG adoption, such as the role of ESG transparency in reducing supply chain inefficiencies, i.e. the bullwhip effect (Wu *et al.*, 2024), the effect of nexus-supplier transparency in lowering buyers' ESG risk exposure (Diego and Montes-sancho, 2025), the role of supplier risk-taking in enhancing client ESG performance (Zhou *et al.*, 2026), and the impacts of ESG on the Sustainable Development Goals (López-Cabarcos *et al.*, 2025).

Despite this growing attention, the impact of ESG on firm performance remains widely debated (Yan *et al.*, 2025; Roehrich *et al.*, 2025), reflecting the inherent complexity of the sustainability–performance relationship (He *et al.*, 2023; Hull and Rothenberg, 2008). This complexity stems from firms' varying abilities to effectively address sustainability while maximizing performance benefits (de Menezes *et al.*, 2021; Longoni and Cagliano, 2015). Sancha *et al.* (2022) note that pursuing sustainability goals is not always straightforward, causing many firms to struggle with ESG adoption. Empirical research reflects this complexity, with studies reporting both positive effects—arguing that firms can "do well by doing good" (Sun *et al.*, 2024; Kaul and Luo, 2018; Orlitzky *et al.*, 2003)—and negative effects, characterizing sustainability as a financial burden (Duque-Grisales and Aguilera-Caracuel, 2021; Hull and Rothenberg, 2008).

While methodological factors such as different measures, statistical methods, and industry characteristics partially explain these mixed findings (Awaysheh *et al.*, 2020; Dixon-Fowler *et al.*, 2013), we propose that a critical yet overlooked factor drives this inconsistency: the extent to which ESG practices are integrated into a firm's operations. Prior research suggests that outcomes depend on how ESG practices are embedded within a broader operational context and aligned with other practices, which collectively shape ESG effectiveness (López-Cabarcos *et al.*, 2025; Awaysheh *et al.*, 2020; Song *et al.*, 2022). This lack of integration is evident in practice: many firms approach ESG through a "disclosure-prioritized orientation", devoting disproportionate attention to external reporting and compliance at the expense of strengthening internal operations (Duque-Grisales and Aguilera-Caracuel, 2021; Pil and Rothenberg, 2003). When ESG remains disconnected from core operations, it risks becoming symbolic, undermining its potential to improve performance.

We argue that ESG effectiveness depends on the operational foundation that embeds ESG practices into core operations rather than treating them as discrete add-ons. We conceptualize this foundation as operational excellence (OE): a firm-wide commitment to systematically managing and improving operations through the persistent adoption of multiple practices, such as Lean, Total Quality Management (TQM), Six Sigma, and ISO 9000.

Prior research linking OE to sustainability remains limited. One research stream focuses on individual practices, such as ISO 9000 (Wang and Liu, 2023), TQM (Sila, 2018), or Lean (Yu *et al.*, 2020; King and Lenox, 2001), providing only a partial view of how firms manage operations in relation to sustainability. A second stream emphasizes synergies between practices (e.g. Lean-Six Sigma), demonstrating that complementarities can yield stronger sustainability outcomes (Skalli *et al.*, 2024) but still focuses on specific pairings rather than a firm-wide commitment to excellence. Crucially, existing research often examines practices in binary terms (presence or absence at a single point in time), overlooking whether firms sustain them over extended periods—a limitation that obscures OE as an enduring commitment.

We address these limitations by conceptualizing OE as having two dimensions: breadth (the extent to which firms adopt multiple practices) and persistence (the degree to which firms consistently maintain adoption over time). This dual-dimensional view incorporates insights from the complementarities literature, which highlights synergies among practices, but addresses its static and selective orientation by capturing whether practices persist over time. By combining both dimensions, we view OE as a firm-wide commitment to excellence necessary for ESG effectiveness, distinguishing firms that embed excellence systematically from those that adopt practices superficially.

Drawing on the practice-based view (PBV) (Bromiley and Rau, 2016) and competitive progression theory (CPT) (Roth, 1996; Rosenzweig and Roth, 2004), we theorize that OE plays a dual role: it enables ESG adoption and serves as the foundation that determines whether ESG translates into performance gains (ESG effectiveness). The distinction between ESG adoption and ESG effectiveness is critical because a higher number of adopted practices may still be symbolic unless they lead to meaningful performance gains. Using a longitudinal panel of 3,394 firm-year observations from U.S. manufacturing firms (2010–2023), we show that OE positively influences ESG adoption and that ESG adoption mediates the OE–performance link, supporting our theorized sequence: established OE enables subsequent ESG adoption, which in turn enhances performance. Subsample analyses further reveal that the ESG–performance relationship is significantly stronger among high-OE firms, indicating that ESG generates benefits when supported by a strong foundation.

Our study makes several contributions. First, we advance the conceptualization of OE by moving beyond individual practices such as Lean (Csiki *et al.*, 2023; Yu *et al.*, 2020) or Six Sigma (Mast *et al.*, 2022), selective pairings like Lean-Six Sigma (Cherrafi *et al.*, 2017), and general quality-based frameworks (de Menezes *et al.*, 2021). We instead emphasize breadth and persistence as the defining dimensions of OE, positioning it not as a set of isolated tools but as an integrative operational foundation that embeds ESG into core operations. Second, we clarify the contested sustainability–performance relationship by identifying OE as the foundation for ESG effectiveness and extend debates on symbolic versus substantive sustainability (Xu *et al.*, 2025; Freitas *et al.*, 2025). Our findings show that ESG improves performance only when adopted substantively—grounded in OE, holistic in scope, and supported by long-term commitment—otherwise remaining symbolic with limited benefits. Third, we offer a more comprehensive view of sustainability by treating ESG as an aggregated construct spanning ESG dimensions, moving beyond the environmental focus that dominates prior OM research (Yan *et al.*, 2025; Sancha *et al.*, 2022). Methodologically, our use of a large-scale longitudinal panel and multiple analytical techniques strengthens the robustness of the results and mitigates common limitations of cross-sectional survey designs (e.g. common method bias).

The paper is structured as follows: Sections 2 and 3 outline the theoretical framework and hypotheses, Section 4 details the methodology, Section 5 presents the results with robustness checks in Section 6, Section 7 discusses the main findings, and Section 8 concludes with contributions and directions for future research.

2. Theoretical development

2.1 ESG-performance link: a contested relationship

The relationship between firm performance and sustainability, whether framed as ESG, Corporate Social Responsibility (CSR), or specific initiatives such as environmental supply chain practices, is widely studied, yet findings regarding the relationship remain contested (Sun *et al.*, 2024; Awaysheh *et al.*, 2020; Mishra and Modi, 2016).

One perspective views ESG as externally driven, a response to pressures from stakeholders, such as regulators, investors, and customers, to maintain legitimacy (Sodhi and Tang, 2018; Marquis *et al.*, 2016). From this perspective, ESG is a financial burden (Schrettle *et al.*, 2014) or a source of economic disadvantage due to the associated costs or the diversion of resources from core operations (Duque-Grisales and Aguilera-Caracuel, 2021; Pil and Rothenberg,

2003; Klassen and McLaughlin, 1996). Empirical studies support this view: Servaes and Tamayo (2013) find CSR negatively related to firm value in firms with low customer awareness, and Mishra and Modi (2016) show that CSR without complementary capabilities can reduce shareholder wealth. Similarly, Duque-Grisales and Aguilera-Caracuel (2021) report a negative ESG–Return on Assets (ROA) link in Latin American markets, suggesting that weak institutional support and inefficient implementation can turn ESG into a resource constraint.

The alternative perspective sees ESG as a performance catalyst (Schrettle *et al.*, 2014), supporting the notion that firms can achieve superior financial outcomes by acting responsibly toward society and the environment (Kaul and Luo, 2018). Some studies describe this as a "win–win" scenario where environmental/social and financial goals are mutually reinforcing and jointly achievable (Montabon *et al.*, 2007; Zhu and Sarkis, 2007). ESG can improve firm efficiency (Sun *et al.*, 2024; Golicic and Smith, 2013), enhance productivity (Klassen and McLaughlin, 1996), and strengthen corporate reputation and stakeholder trust (Sun *et al.*, 2024). From this perspective, ESG represents a competitive resource that can differentiate firms and generate sustained advantage (Porter and Kramer, 2006; Flammer, 2013). Kaul and Luo (2018) argue that CSR creates financial benefits when it is closely related to the firm's core business, thus highlighting the economic case for CSR. Orlitzky *et al.* (2003), in a meta-analysis, provide further evidence of a generally positive ESG–performance link, with stronger effects for accounting-based outcomes.

These inconsistent performance effects and divergent views on ESG contribute to a fragmented landscape in which some firms deepen their ESG commitments while others pull back (Roehrich *et al.*, 2025). Given ESG's operational implications (Diego and Montes-sancho, 2025; Wu *et al.*, 2024) and its interactions with supply chain decisions (Yan *et al.*, 2025), this contested relationship warrants deeper examination within OM research.

2.2 Addressing the ESG–performance complexity through operational excellence

One limitation in much of the existing research is the treatment of ESG as independent of a firm's broader operations. Yet ESG practices do not operate in isolation but interact with other practices that collectively shape their effectiveness (López-Cabarcos *et al.*, 2025; Song *et al.*, 2022). Hence, viewing ESG practices disconnected from a broader operational context and overlooking their interactions provides only a partial understanding of the complex ESG-performance link.

This lack of ESG integration is also evident in practice. Many firms adopt a "disclosure-prioritized orientation", emphasizing external reporting and legitimacy rather than embedding ESG into day-to-day operations. As enthusiasm for ESG grows, resources once devoted to process improvement are increasingly redirected toward reporting and compliance (Duque-Grisales and Aguilera-Caracuel, 2021; Pil and Rothenberg, 2003), weakening the operational foundation for effective ESG integration. Sustainability teams often find their focus diverted toward tasks related to materiality and disclosure, which can come at the expense of actual implementation work (Balch, 2025). This pattern reflects a broader form of decoupling, wherein firms' ESG promises exceed actual implementation. Such symbolic adoption—and, in its most severe form, greenwashing—can damage relationships with stakeholders and trigger negative stock market reactions (Xu *et al.*, 2025; He *et al.*, 2023).

We propose that OE addresses this ESG–operations disconnect by embedding ESG within the firm's core operations through systematic execution and continuous improvement. Prior research supports this view: Eccles *et al.* (2014) note that "high-sustainability firms" exhibit integrated governance and stakeholder engagement. Siltaloppi *et al.* (2021) emphasize the need for an integrated approach to CSR, where sustainability practices are embedded into core activities and organizational structures. Accordingly, we argue that OE provides the operational foundation for integrating ESG, transforming these practices from symbolic or compliance-driven initiatives into substantive, performance-enhancing practices.

2.3 Conceptualizing operational excellence

OE is defined as "a systematic approach to improving processes and operational systems, aiming to enhance long-term performance and achieve a competitive advantage" (Sunder and Linderman, 2024, p. 2). Naik *et al.* (2024) see OE as the systematic management of operations in pursuit of continuous improvement. OE is often examined through the lens of specific quality management practices such as Lean, TQM, Six Sigma, or ISO 9000 (Wiengarten and Pagell, 2012) or through general quality-based frameworks such as European Foundation for Quality Management (EFQM) (de Menezes *et al.*, 2021). While research consistently shows that such practices support effective operations (Al Hasan and Micheli, 2025; Naik *et al.*, 2024; Nair, 2006), focusing on single practices provides a narrow view—particularly in the sustainability context, where ESG practices should be embedded in, and aligned with, a broader operational context (Longoni and Cagliano, 2015).

We integrate insights from a research stream that focuses on practice complementarities, demonstrating that certain combinations create synergies that support multiple performance objectives simultaneously. Examples include synergies between Lean and Six Sigma (Skalli *et al.*, 2024; Cherrafi *et al.*, 2017), among quality management practices (Sila and Ebrahimpour, 2005; Flynn *et al.*, 1995), and between TQM and other Lean bundles, e.g. JIT (Furlan *et al.*, 2011). This stream highlights the value of adopting multiple complementary practices—what we refer to as "OE breadth". However, research in this stream typically examines the binary state of selective practice combinations at a single point in time, without considering whether firms sustain them over extended periods.

We therefore introduce "persistence" as the second dimension of OE, capturing the extent to which firms consistently maintain adoption over time. Both dimensions are essential: breadth without persistence reflects superficial adoption, while persistence without breadth signals narrow excellence in a single domain. Their intersection defines OE as a firm-wide commitment to systematically managing and improving operations.

This conceptualization offers several advantages. First, it functions as a compensatory mechanism against the limitations of relying on any single practice. Firms can adopt practices reactively—such as ISO 9000 in response to customer demands rather than a commitment to improvement (Sroufe and Curkovic, 2008)—or mimic visible elements of, e.g. Lean due to institutional isomorphism without embracing their underlying philosophy (Bromiley and Rau, 2016; Ketokivi and Schroeder, 2004). Therefore, a multi-practice approach offsets these shortcomings. Second, consistent with the complementarities literature, OE enables synergistic interactions among practices that support multiple performance goals (Drohomeretski *et al.*, 2014). These synergies arise from shared principles, including standardization, problem solving, and waste elimination (Al Hasan and Micheli, 2025; Naik *et al.*, 2024).

Recent work supports this perspective. Al Hasan and Micheli (2025) argue that OE (understood as process improvement) should be viewed as a holistic bundle of interdependent practices rather than isolated tools. In line with this insight, and consistent with the focus of OE on systematic execution and continuous improvement (Sunder and Linderman, 2024; Naik *et al.*, 2024), we conceptualize OE as the operational foundation that enables the substantive embedding of ESG practices rather than symbolic adoption.

2.4 Theoretical lens

2.4.1 Practice-based view. We draw on the PBV, originally developed by Bromiley and Rau (2016). This view positions practices, i.e. sets of activities that a range of firms can implement, as central drivers of firm performance. Unlike the resource-based view, which emphasizes firm-specific, rare, and inimitable resources (Barney, 1991), the PBV recognizes that practices are not inherently unique. Instead, performance differences stem from how firms adopt, combine, and execute these practices (Bromiley and Rau, 2016). While OE practices are widely accessible, it is the firm's persistent adoption of multiple practices that enables meaningful differentiation and superior performance.

A critical PBV insight is that the impact of any single practice on performance may be indirect, operating through its interaction with other practices. Practices reinforce and enable one another, and their effectiveness depends on the presence (or absence) of complementary practices (Song *et al.*, 2022). Applying the PBV, we propose that the persistent adoption of multiple OE practices establishes an operational foundation for ESG effectiveness. Therefore, OE not only contributes directly to performance but also shapes the firm's readiness to integrate complementary practices into its operations.

The PBV also explains why firms with similar ESG practices can achieve different outcomes. Performance differences stem not from ESG adoption alone but from whether such practices are supported by the foundation of OE. This framing clarifies the mixed empirical findings on the sustainability–performance link. As Song *et al.* (2022) argue, the performance impact of sustainability depends critically on its interaction with supporting practices—an insight central to our argument that OE provides the basis for effective ESG integration.

2.4.2 Competitive progression theory. Our argument for the fundamental role of OE also draws on CPT (Roth, 1996; Rosenzweig and Roth, 2004), which explains how firms develop capabilities in a path-dependent, sequential manner. CPT provides the empirical validation for Ferdows and De Meyer's (1990) observed "sand cone" model, which describes the sequential progression of competitive capabilities, beginning with quality and extending through delivery, flexibility, and cost. Empirical work supports this sequential logic: Powell *et al.* (2024) show that digital transformation in lean manufacturing firms depends on the cumulative development of prior capabilities—firms succeed in digitalization only after establishing a strong operational base. In the sustainability context, Molinaro *et al.* (2024) find that sustainability performance dimensions also develop cumulatively.

Central to CPT is the notion that capability development follows a learning-based trajectory (Rosenzweig and Roth, 2004): quality is the initial foundation, generating operational know-how about process improvement, and providing the necessary basis for benefiting from subsequent value-creating practices. We extend this logic by proposing that OE is the initial foundation that enables effective ESG integration. OE generates the operational know-how, systematic execution, and continuous improvement routines necessary to integrate ESG practices substantively. Firms with established OE already possess the know–how to identify waste, standardize processes, and distinguish value–adding from non–value–adding activities, enabling them to embed ESG practices into core operations rather than treating them as peripheral compliance activities. While CPT describes sequential capability accumulation, our focus is on the practice-based foundation enabling this progression. We conceptualize OE as this foundation, captured through the persistent adoption of multiple practices, analogous to quality as the foundational capability in CPT.

3. Hypothesis development

3.1 Operational excellence and ESG adoption

We theorize that well-established OE enhances a firm's readiness to adopt a broader set of ESG practices. ESG adoption refers to the firm's decision to implement ESG activities. Rooted in quality management, OE supports systematic and continuous improvement (Al Hasan and Micheli, 2025; Sunder and Linderman, 2024; Naik *et al.*, 2024), enabling firms to execute practices consistently while progressively embedding sustainability standards and expanding their ESG adoption.

Customer focus, a central tenet of OE practices (Sroufe and Curkovic, 2008; Nair, 2006), further strengthens this link. As sustainability becomes increasingly valued by customers, operationally excellent firms are better equipped to respond to these expectations by aligning their operations with customers' sustainability demands.

Each ESG dimension benefits from OE. In the environmental dimension, strong conceptual and empirical links exist between OE and environmental management (Molina-Azorín *et al.*, 2009), stemming from shared principles like proactive management, continuous

improvement, and waste reduction—central to Lean, TQM, and Six Sigma (Wang and Liu, 2023; Sila, 2018; Wiengarten and Pagell, 2012; Pil and Rothenberg, 2003). For instance, Lean's emphasis on eliminating waste aligns with the environmental goals of green practices (King and Lenox, 2001). Historical precedence also supports this connection, as environmental efforts are often built upon existing OE practices, evidenced by firms typically adopting ISO 9001 before ISO 14001 (Ivanova *et al.*, 2014).

In the social dimension, OE fosters employee engagement, empowerment, training, and safety through TQM and Lean principles (Sila, 2018; Piercy and Rich, 2015), which align with social sustainability goals such as inclusion and workplace well-being (Knol *et al.*, 2022; Bortolotti *et al.*, 2015). Finally, OE strengthens governance by promoting transparency, accountability, and trust-based relationships with stakeholders (Sila, 2018; Sroufe and Curkovic, 2008). These practices reinforce governance mechanisms such as disclosure, board oversight, and stakeholder protection (Jo and Harjoto, 2011; Eccles *et al.*, 2014).

In sum, OE provides the readiness that enables sustainability engagement and supports the adoption of a broad set of ESG practices. Therefore, we hypothesize:

H1. OE, i.e. the persistent adoption of multiple operational excellence practices, positively affects ESG adoption, leading firms to adopt a broader set of ESG practices.

3.2 The role of OE for ESG effectiveness

While we hypothesize that OE enhances ESG adoption, adopting more ESG practices alone may remain symbolic unless they are effectively implemented and lead to performance improvements (ESG effectiveness). Our second hypothesis, therefore, examines whether ESG practices become effective in enhancing performance when grounded in established OE.

Among the two opposing viewpoints on whether ESG hinders or enhances performance (Sun *et al.*, 2024; Song *et al.*, 2022; Awaysheh *et al.*, 2020), our study builds on the positive view but adds an important qualification: the performance benefits of ESG practices are not automatic—they materialize when ESG practices are enabled by prior OE. ESG practices are more likely to deliver positive outcomes when they are not pursued in isolation but strategically integrated into a firm's core operations (López-Cabarcos *et al.*, 2025; Sancha *et al.*, 2022; Schrettle *et al.*, 2014; Etzion, 2007). As emphasized by Longoni and Cagliano (2015), achieving this integration requires aligning sustainability standards with a firm's operations. Similarly, Siltaloppi *et al.* (2021) argue that managing tensions between short-term business imperatives and long-term sustainability goals demands an integrated approach that embeds CSR into daily activities and ensures alignment across units.

This alignment, we argue, depends on the prior establishment of OE, which ensures consistent execution and facilitates integration with existing practices. Firms with strong OE embed ESG into daily operations as part of their broader pursuit of excellence, enhancing efficiency, reducing costs, and preventing ESG from remaining operationally disconnected and ineffective. This logic aligns with CPT. We position OE as the base layer that generates the operational know-how and learning necessary for ESG effectiveness. Firms with such know–how can distinguish value–adding (substantive) activities from non–value–adding (symbolic) adoption and are therefore more likely to adopt ESG as part of an excellence-driven trajectory. This sequential progression (OE→ ESG→ performance) represents a temporal mediating logic: OE provides the operational foundation that supports effective ESG adoption, ultimately translating into performance gains.

While prior research links individual OE practices to performance through quality improvements (Fullerton and Wempe, 2009), efficiency (Swink and Jacobs, 2012), and customer satisfaction (Nair, 2006), we extend this view by proposing that OE enables firms to capture additional benefits through integrated ESG practices. Firms with established OE are better positioned to adopt ESG in ways that reinforce resource efficiency, cost control, and continuous improvement. Thus, ESG practices become a complementary pathway through

which OE translates into enhanced firm performance—but only when OE is already established. Therefore, we hypothesize:

H2. ESG practices mediate the relationship between OE and firm performance, such that firms with higher OE are better able to translate ESG practices into improved performance.

4. Research method

4.1 Sample and data

This study employed data from Thomson Reuters Eikon (Refinitiv ASSET4) covering U.S. publicly traded manufacturing firms (SIC, 2000–3999) from 2010 to 2023. This database is widely used in sustainable OM research (Hardcopf *et al.*, 2019; Eccles *et al.*, 2014) as it provides comprehensive and standardized ESG and financial information. Initial extraction yielded 46,445 financial and 9,898 ESG firm-year observations. Sample construction followed a systematic filtering process: (1) removing invalid entries and duplicates, (2) retaining only firms with complete OE and ESG data, (3) requiring at least three consecutive years of observations, and (4) a final quality check. The resulting unbalanced panel included 3,394 firm-year observations from 542 unique firms.

Using panel data offers key advantages over a cross-sectional design, as it allows examination of temporal structures and the mediation pathway in which ESG practices transmit the effect of OE on performance over time (OE → ESG → Performance). As noted by Aguinis *et al.* (2017), longitudinal data are essential for tracing causal pathways (X → M → Y) and addressing endogeneity concerns such as reverse causality (Ketokivi and McIntosh, 2017), in which high-performing firms may be more likely to adopt OE or ESG practices.

4.2 Measures

OE was operationalized using a persistence-weighted composite score derived from two measures: ISO 9000 certification and Six Sigma/Quality Management Systems. These measures are coded as binary variables (1 = adopted, 0 = not adopted), based on responses to questions such as: *"Does the company claim to apply Six Sigma, Lean Manufacturing, Lean Sigma, TQM, or other similar quality principles?"*. Both variables fall under the Social pillar of Refinitiv's ESG framework in the *Product Responsibility* category. Persistence was calculated as the ratio of cumulative adoption years to total years since first adoption. For example, a firm that adopted ISO 9000 in 2015 and maintained it through 2023 would have a persistence score of 1.0. If the firm discontinued the practice in 2020 but resumed it in 2022, the cumulative years would be 7, yielding a score of 0.78 (7/9). ISO 9000 showed a mean persistence of 0.32 (SD = 0.46), while Six Sigma showed a mean of 0.37 (SD = 0.47). The final OE variable combined both dimensions: OE = (ISO 9000 × Persistence $_{\text{ISO9000}}$) + (Six Sigma/Quality Management Systems × Persistence $_{\text{Six Sigma/Quality Management Systems}}$). This variable is a proxy for firm-wide commitment to excellence, ranging from 0 to higher values reflecting stronger OE.

ESG adoption was assessed using Refinitiv's ESG Score, a composite metric ranging from 0 to 100, derived from standardized indicators verified by third-party sources. This score provides a comprehensive measure of a firm's ESG practices and is used here as a proxy for ESG adoption. ESG effectiveness, in turn, is evidenced by the translation of ESG adoption into firm performance within the lagged path.

Firm performance was measured using ROA, calculated as net income divided by total assets. Values were used directly in the analysis, as the System GMM estimator is robust to skewness through its differencing transformation.

We included several firm-level controls that may affect ESG adoption and performance. Firm size (full-time employees) captures resource availability (Hardcopf *et al.*, 2019). Capital

slack or current ratio (assets/liabilities) reflects financial flexibility for ESG investments (Hardcopf *et al.*, 2019). Leverage (net debt to total capital) accounts for financial risk, as less-levered firms are better positioned to pursue ESG practices (Molinaro *et al.*, 2024). R&D intensity (R&D/revenue) indicates innovation commitment linked to strategic initiatives such as ESG adoption (Tong *et al.*, 2025). Table 1 presents descriptive statistics, and Table 2 reports the correlation matrix.

4.3 Empirical setting and research method

To mitigate potential endogeneity concerns (reverse causality, omitted variable bias, and dynamic endogeneity), we employed several methodological strategies. Lagged independent variables (IVs) ensured temporal ordering and reduced reverse causality. Firm and year fixed effects with time-varying controls addressed omitted variable bias. Also, lagged dependent variables (DVs) accounted for dynamic endogeneity and the persistence of outcomes over time.

For estimation, we applied the two-step System GMM (Blundell and Bond, 1998; Arellano and Bond, 1991). This estimator is particularly suited to our panel structure with a large cross-sectional dimension relative to the time dimension. System GMM complements and consolidates our endogeneity-related strategies by simultaneously: (1) addressing reverse causality through internal instruments derived from lagged IVs, (2) mitigating omitted variable bias via firm and year fixed effects, and (3) handling dynamic endogeneity through lagged DVs to capture outcome persistence. System GMM further provides consistent estimates while avoiding the Nickell bias typical of fixed-effects models with short time dimensions (Wintoki *et al.*, 2012).

We estimated three interconnected regression models following a temporal sequence. Model 1 (Eq.1) tested H1 by regressing ESG adoption on lagged OE. Model 2 (Eq.2) examined the total effect of OE on ROA (without ESG), and Model 3 (Eq.3) included ESG to separate the direct and indirect effects of OE on performance. This sequential design tested whether ESG mediates the OE–performance relationship over time (H2: $OE_{(t-2)} \rightarrow ESG_{(t-1)} \rightarrow ROA_{(t)}$). Examining the direct OE–performance link was essential to determine whether OE independently improves performance or primarily acts as the foundation that enables ESG to do so. Consistent with Maxwell *et al.* (2011), who caution against biased mediation estimates when timing is ignored, we explicitly modeled time-lagged relationships.

Model 1 : ESG Adoption Model

$$ESG(i,t) = \alpha 0 + \beta 1 ESG(i,t-1) + \beta 2 ESG(i,t-2) + \gamma 1 OE(i,t-1) + Controls(i,t-1) + \varepsilon(i,t) \quad \text{Eq.(1)}$$

Model 2 : ROA Model (without ESG)

$$ROA(i,t) = \alpha 0 + \beta 1 ROA(i,t-1) + \gamma 1\, OE(i,t-2) + Controls(i,t-1) + \varepsilon(i,t) \quad \text{Eq.(2)}$$

Table 1. Descriptive statistics

Variable	N	Mean	SD	Min	Q1	Q2	Q3	Max
ESG score	6,171	38.099	18.958	0.652	23.071	34.582	51.078	92.542
ROA	3,560	1.888	22.152	−292.24	2.56	6.76	11.612	151.639
ISO 9000	6,148	0.356	0.479	0	0	0	1	1
Six sigma/quality	6,146	0.31	0.463	0	0	0	1	1
#Employees (thousands)	6,661	7.011	2.193	0	5.403	6.995	8.507	12.838
Leverage	6,571	−0.098	0.477	−8.035	−0.451	−0.031	0.246	3.583
Current ratio	6,623	1.444	0.631	0	0.997	1.292	1.773	4.567
R&D intensity	5,384	2.898	2.147	−3.537	1.43	2.358	3.581	13.522

Table 2. Correlation matrix

	ESG score	ROA	ISO 9000	Six sigma	Employees	Leverage	Current ratio	R&D intensity
ESG score	1.000	0.317***	0.389***	0.344***	0.395***	0.021	−0.251***	−0.058***
ROA		1.000	0.254***	0.090***	0.166***	0.345***	−0.279***	−0.145***
ISO 9000			1.000	0.110***	0.174***	0.014	−0.163***	−0.060***
Six sigma/quality				1.000	0.237***	0.009	−0.060***	−0.021
#Employees					1.000	0.010	−0.195***	−0.034*
Leverage						1.000	−0.010	−0.001
Current ratio							1.000	0.050***
R&D intensity								1.000

Note(s): *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$

$$Model\,3: ROA\,Model(with\,ESG)$$
$$ROA_{(i,t)} = \alpha_0 + \beta_1 ROA_{(i,t-1)} + \beta_2 ESG_{(i,t-1)} + \gamma_1 OE_{(i,t-2)} + Controls_{(i,t-1)} + \varepsilon_{(i,t)} \quad \text{Eq.(3)}$$

Where.

(1) $ESG_{(i,\,t)}$: ESG score for firm i at time t

(2) $ROA_{(i,\,t)}$: ROA for firm i at time t

(3) Lagged terms $_{(t\text{-}1,\,t\text{-}2)}$: Prior values of ESG, ROA, and OE

(4) $Controls_{(i,\,t\text{-}1)}$: Control variables lagged by one year

(5) α_0: Intercept

(6) β, γ: Estimated coefficients

(7) $\varepsilon_{(i,\,t)}$: Error term

All models included two-way fixed effects (firm and year) and used internally generated instruments from deeper lags (*t*–2 and beyond), with the instrument matrix collapsed to prevent over-identification. We applied a lag-difference transformation and Windmeijer's (2005) finite-sample correction to obtain robust standard errors. Model validity was evaluated using standard GMM diagnostics. The Arellano–Bond AR(1) test assesses first-order autocorrelation in differenced residuals. A significant negative AR(1) is expected and indicates serial correlation in levels that GMM corrects. The absence of significance does not necessarily indicate misspecification but may reflect data characteristics or variable dynamics. The key diagnostic is the AR(2) test, which should be insignificant, confirming no second-order autocorrelation and the validity of deeper lags as instruments. Finally, a non-significant Sargan J-test supports instrument validity.

To further test our proposed mediation, we employed a multi-method approach combining dynamic panel GMM estimation with complementary tests, following Rungtusanatham *et al.* (2014), who advocate for explicit procedures for reliable mediation inference. This triangulation mitigates single-method limitations by evaluating indirect effects across different estimation techniques and assumptions.

4.4 Primary GMM-based mediation analysis

Following the popular mediation framework by Baron and Kenny (1986) and the extended methodological recommendations by MacKinnon *et al.* (2002), we used the three GMM models specified in Section 4.3 to estimate the mediation pathway. Model 1 captured the *a-path*, Model 2 the direct effect (*c-path*), and Model 3 the mediated model including both ESG and OE (*b*- and *c′-paths*). The indirect effect (a×b), representing the portion of OE'seffect on performance transmitted through ESG, was tested for significance using the Sobel test (Sobel, 1982) with GMM-robust standard errors (Eq.4).

$$Z = \frac{(a \times b)}{\sqrt{a^2 SE_b^2 + b^2 SE_a^2}} \quad \text{Eq.(4)}$$

4.5 Monte Carlo simulations

We conducted 10,000 Monte Carlo simulations to construct confidence intervals for the indirect effect without assuming normality. Following MacKinnon *et al.* (2004), this approach provides a more robust alternative to the Sobel test by resampling coefficient estimates (from GMM with robust standard errors) to generate an empirical distribution and derive percentile-based 95% confidence intervals.

4.6 Firm-clustered block bootstrap

We employed a firm-clustered block bootstrap with 500 replications, resampling the entire firm time series to preserve within-firm temporal dependence (Cameron *et al.*, 2008). Each resample re-estimated the three GMM models to compute indirect effects, accounting for estimation uncertainty across the mediation pathway. Percentile and bias-corrected accelerated 95% confidence intervals were then derived.

4.7 Structural equation modeling (SEM)

We estimated SEM with a Maximum Likelihood Robust (MLR) estimator, which accommodates non-normality and provides robust standard errors. Following Cole and Maxwell (2003), SEM is suitable for mediation analysis with longitudinal data because it models relationships among variables measured at different time points and accounts for measurement error. We tested two temporal specifications: Specification 1 employed $OE_{(t-1)} \rightarrow ESG_{(t)} \rightarrow ROA_{(t+1)}$ with firm-level clustering. Specification 2 used the identical pathway with year-level clustering to account for time-specific shocks.

4.8 OLS-based mediation

Finally, we implemented a classical OLS-based mediation analysis with firm and year fixed effects, maintaining the same temporal structure. We computed Sobel test statistics with 1,000 bootstrap replications to obtain robust confidence intervals for the indirect effect.

5. Research results and findings

5.1 Sequential relationships between OE, ESG, and performance

Table 3 presents System GMM results examining the sequential relationship between OE, ESG score, and performance. Model 1 showed that OE significantly enhanced subsequent ESG adoption ($\beta = 2.618$, $p = 0.026$), supporting H1. Model 2 established a significant direct effect of $OE_{(t-2)}$ on $ROA_{(t)}$ ($\beta = 1.098$, $p = 0.010$). Model 3 complemented Model 2 for the mediation analysis (H2). When both OE and ESG were included, ESG positively influenced ROA ($\beta = 0.046$, $p = 0.005$) while OE'scoefficient decreased to 0.808 ($p = 0.044$), indicating partial mediation through ESG.

All models met model diagnostics: non-significant Sargan J-tests (Model 1: J = 33.72, $p = 0.292$; Model 2: J = 15.91, $p = 0.530$; Model 3: J = 20.32, $p = 0.315$) confirmed instrument validity. Non-significant AR(2) tests ($p > 0.10$) indicated correct dynamic specification, and highly significant Wald tests confirmed model robustness.

5.2 Complementary mediation analysis results

GMM models with time lags provided initial evidence of mediation. Complementary tests confirmed these findings across multiple specifications (Table 4). The primary GMM-based using the Sobel test indicated an indirect effect of 0.119 ($p = 0.079$, Sobel $z = 1.759$, 95% CI [–0.014, 0.252]), suggesting that 10.9% of OE'seffect operated through ESG. Although marginally significant and with a confidence interval narrowly including zero, the estimate supported a positive indirect effect.

Distribution-free methods provided stronger evidence for the indirect effect. Monte Carlo simulation (10,000 draws) confirmed the indirect effect of 0.119 ($p = 0.033$, 95% CI [0.007, 0.281]). Likewise, firm-clustered block bootstrap (500 replications) yielded 0.124 ($p = 0.008$, 95% CI [0.026, 0.253]).

SEM with MLR estimator and 5,000 bootstrap replications following the $OE_{(t-1)} \rightarrow ESG_{(t)} \rightarrow ROA_{(t+1)}$ pathway showed a consistent indirect effect of 0.047 ($p < 0.001$) with acceptable fit (CFI = 0.92, RMSEA = 0.06, SRMR = 0.01) across both firm- and year-clustered specifications. Finally, OLS with year fixed effects yielded an Average Causal

Table 3. System GMM results

Predictors	Dependent variable ESG Model (1)	ROA Model (2)	ROA Model (3)
$ESG_{(t-1)}$	0.609 (0.080)*** $p = 0.000$		0.046 (0.016)*** $p = 0.005$
$ESG_{(t-2)}$	0.263 (0.060)*** $p = 0.00002$		
$OE_{(t-1)}$	2.618 (1.170)** $p = 0.026$		
$ROA_{(t-1)}$		0.479 (0.057)*** $p = 0.000$	0.490 (0.057)*** $p = 0.000$
$OE_{(t-2)}$		1.098 (0.421)*** $p = 0.010$	0.808 (0.400)** $p = 0.044$
$Leverage_{(t-1)}$	0.600 (1.801) $p = 0.739$	2.922 (1.117)*** $p = 0.009$	2.762 (1.003)*** $p = 0.006$
$\#Employee_{(t-1)}$	0.007 (0.027) $p = 0.807$	−0.021 (0.007)*** $p = 0.002$	−0.024 (0.008)*** $p = 0.002$
Current $ratio_{(t-1)}$	−0.158 (0.409) $p = 0.700$	−0.664 (0.206)*** $p = 0.002$	−0.567 (0.200)*** $p = 0.005$
R&D $intensity_{(t-1)}$	−0.001 (0.052) $p = 0.982$	−0.011 (0.017) $p = 0.527$	−0.009 (0.020) $p = 0.658$
Wald χ^2 (coefficient)	100.01	265.97	352.55
Wald *p*-value (coefficient)	<2e−16	<2e−16	<2e−16
Wald χ^2 (time)	54.02	41.54	43.96
Wald *p*-value (time)	1.17e−07	1.94e−05	7.40e−06
Sargan J-test	33.72	15.91	20.32
Sargan *p*-value	0.292	0.530	0.315
AR(1) *p*-value	4.82e−08	0.0175	0.0192
AR(2) *p*-value	0.277	0.390	0.443
#Firms	456	456	456
#Observations	2,829	2,829	2,829

Note(s): *$p < 0.1$; **$p < 0.05$; ***$p < 0.01$ (Robust standard errors in parentheses)
Firm and year fixed effects are included

Mediation Effect (ACME = 0.080, $p < 0.001$, 95% CI [0.064, 0.096]), Average Direct Effect (ADE = 0.1, $p < 0.001$), and total effect = 0.180 ($p < 0.001$).

Overall, convergence across methods with significant indirect effects and confidence intervals excluding zero provides strong multi-method support for the temporal mediation pathway.

6. Robustness checks

To ensure the validity of our findings, we conducted several robustness analyses addressing measurement, methodological, and model specification concerns.

Table 4. Summary of mediation effects using different methods

	Estimate	Statistical inference Std. Error	Test stat	*p*-value	95% CI
System GMM (Sobel test)					
Path a: $OE_{(t-1)} \rightarrow ESG_{(t)}$	2.618*	1.17	2.236	0.025	[0.323, 4.912]
Path b: $ESG_{(t-1)} \rightarrow ROA_{(t)}$	0.046**	0.016	2.847	0.004	[0.014, 0.077]
Path c: $OE_{(t-2)} \rightarrow ROA_{(t)}$	1.098**	0.421	2.611	0.009	[0.274, 1.923]
Path c′: $OE_{(t-2)} \rightarrow ROA_{(t)} \mid ESG_{(t-1)}$	0.808*	0.4	2.018	0.044	[0.023, 1.593]
Indirect Effect: $a \times b$	0.119	0.068	1.759	0.079	[–0.014, 0.252]
Monte Carlo Simulation (10,000 draws)					
Path a: $OE_{(t-1)} \rightarrow ESG_{(t)}$	2.6176*	1.1705		0.025	[0.323, 4.911]
Path b: $ESG_{(t-1)} \rightarrow ROA_{(t)}$	0.0455**	0.0160		0.004	[0.014, 0.076]
Indirect Effect	0.119*	0.071		0.033	[0.007, 0.281]
Firm Cluster Bootstrap (500 replications)					
Indirect Effect	0.124**	0.06		0.008	[0.026, 0.253]
SEM: $OE_{(t-1)} \rightarrow ESG_{(t} \rightarrow ROA_{(t+1)}$					
Indirect Effect (clustered by firm)	0.047***	0.012	3.807	<0.001	[0.023, 0.072]
Indirect Effect (clustered by year)	0.047***	0.009	5.237	<0.001	[0.030, 0.065]
OLS: $OE_{(t-2)} \rightarrow ESG_{(t-1)} \rightarrow ROA_{(t)}$					
ACME (Indirect)	0.080***	0.008	9.931	<0.001	[0.064, 0.096]
ADE (Direct)	0.100***	0.019	5.413	<0.001	[0.064, 0.136]
Total Effect	0.180***	0.017	10.358	<0.001	[0.146, 0.214]

Note(s): *, **, *** denote $p < 0.1, 0.05, 0.01, 0.001$ respectively
GMM includes firm and time fixed effects
Test Stat. Column contains z-values from GMM robust estimates and the Sobel z-value for the indirect effect
SEM uses bootstrap CIs
SEM Model Fit: RMSEA = 0.066, CFI = 0.928, SRMR = 0.015
OLS uses $OE_{(t-2)} \rightarrow ESG_{(t-1)} \rightarrow ROA_{(t)}$ with year controls

6.1 Alternative performance measure

We re-estimated the mediation pathway using Return on Capital Employed (ROCE = EBIT/(total assets–current liabilities)) as an alternative outcome. ROCE captures return to all capital providers and is less sensitive to capital structure decisions. ROCE provides a comprehensive assessment of how effectively firms deploy their total capital base to generate operating returns—a measure commonly used in OM research to assess capital efficiency and operational effectiveness (Gutierrez *et al.*, 2022). Results (Appendix, Table A1) closely mirrored the ROA findings: $OE_{(t-2)}$ significantly affected ROCE, with ESG $adoption_{(t-1)}$ reducing OE'sdirect impact while showing positive effects, confirming the mediation pathway.

6.2 Alternative ESG measure: separating environmental and governance scores

To address potential overlap between OE and social indicators in Refinitiv's ESG framework (ISO 9000, Six Sigma/Quality Management), we decomposed the aggregate ESG score into environmental and governance dimensions. For the environmental dimension (Appendix, Table A2), OE significantly influenced the environmental score ($\beta = 2.920$, $p = 0.012$). The environmental score positively affected ROA ($\beta = 0.035$, $p = 0.005$), while the direct effect of OE declined to $\beta = 0.616$ ($p = 0.092$). Compared with the baseline model, where the OE coefficient for ROA was $\beta = 1.098$ ($p = 0.010$), this reduction indicated partial mediation through the environmental score. For governance (Appendix, Table A3), OE showed

significance in predicting the governance score (β = 3.425, $p = 0.058$). The governance score positively affected ROA (β = 0.034, $p = 0.012$), while the direct effect of OE remained significant (β = 1.003, $p = 0.017$), indicating mediation through governance.

6.3 Alternative OE measures

To address concerns that ISO 9000 may reflect compliance rather than commitment to excellence, we re-estimated the models using only Six Sigma/Quality Management (excluding ISO 9000). While ESG continued to positively affect ROA (β = 0.05, $p < 0.005$) and Six Sigma significantly predicted ESG (β = 2.228, $p = 0.078$), the indirect effect (0.11) was not significant ($p = 0.13$), indicating that mediation did not hold under this restricted operationalization.

This suggests that ISO 9000 plays a complementary role when combined with other OE practices. Although ISO certification can be compliance-driven, research shows firms achieve substantial improvements through ISO adoption (Prajogo *et al.*, 2022), particularly when internalized (Nair and Prajogo, 2009). We suggest that firms adopting multiple practices—captured by both ISO 9000 and Six Sigma/Quality Management—move beyond documentation, internalizing OE practices for superior performance.

6.4 Differential effects across OE levels: high vs. low OE

To further assess whether OE strengthens ESG'sperformance impact (ESG effectiveness), we classified firms into "High" and "Low" OE groups using a median split and estimated the models. Results (Appendix, Table A4) showed ESG'seffect on ROA was stronger and significant for High-OE firms (β = 0.540, $p = 0.082$) but weaker and non-significant for low-OE firms (β = 0.197, $p = 0.171$).

6.5 OE profile analysis: disentangling breadth and persistence

To assess how OE breadth (number of practices) and persistence (consistency over time, >75th percentile) shape outcomes, firms were grouped into four categories: High OE (high breadth–high persistence), Intermediate OE (high breadth), Intermediate OE (low breadth), and Low OE.

ANOVA results showed significant variation across categories for ROA (F = 5.629) and ESG (F = 92.465) (Appendix, Table A5). To identify which profiles differed, we continued with pairwise comparisons using Tukey's honestly significant difference (HSD) test (Abdi and Williams, 2010; Tukey, 1949). The test (Appendix, Table A6) revealed that High-OE firms achieved significantly higher ROA than Intermediate low-persistence (mean difference = −2.47, $p = 0.003$) and Low-OE firms (mean difference = −5.48, $p = 0.028$). For ESG, Intermediate breadth-focused firms scored approximately 10 points lower than High-OE firms ($p < 0.001$), demonstrating that both dimensions are necessary for superior outcomes.

Category-specific mediation analysis (Appendix, Table A7) compared each profile with the High-OE benchmark. Relative to High OE firms, Low-OE firms showed no significant indirect effect through ESG, suggesting that limited OE is insufficient for ESG-driven performance improvements. Among Intermediate profiles, results diverged: firms with low breadth (high persistence) exhibited a negative indirect effect, implying that narrow yet sustained adoption constrains ESG development. Most notably, firms with high breadth (low persistence) displayed a positive indirect effect, indicating that broader but less sustained implementation still supports ESG and performance, albeit less strongly than in High-OE firms.

6.6 Placebo testing

To validate causal interpretation and rule out spurious correlation (Angrist and Pischke, 2009; Bertrand *et al.*, 2004), we conducted placebo tests with 100 iterations that randomly reassigned

OE across firms within years. Placebo coefficients consistently centered near zero, with 95% confidence intervals including zero and significance rates matching expected Type I error levels. These null results, contrasted with our significant actual estimates, indicate that model misspecification or omitted variable bias is unlikely and support a causal interpretation.

7. Discussion

The relationship between sustainability (e.g. CSR, ESG) and firm performance remains ambiguous, with studies reporting both positive and negative effects (Sun *et al.*, 2024; He *et al.*, 2023; Song *et al.*, 2022; Golicic and Smith, 2013; Orlitzky *et al.*, 2003). This ambiguity is heightened by today's fragmented ESG landscape, where some firms retreat from ESG commitments while others intensify them (Roehrich *et al.*, 2025). Understanding when ESG constitutes a viable business case is therefore critical. We argue that one cause of this inconsistency is how sustainability is approached. Prior research often treats ESG practices in isolation rather than within the operational context in which they function (López-Cabarcos *et al.*, 2025; Song *et al.*, 2022), oversimplifying an inherently complex relationship (He *et al.*, 2023).

We suggest that ESG effectiveness depends on the operational foundation on which ESG practices are built, conceptualized as OE with two dimensions: breadth (adopting multiple practices) and persistence (sustaining them over time). Together, these dimensions reflect a firm-wide commitment to excellence that supports effective ESG integration. To explain why this foundation matters, we draw on CPT and PBV. CPT posits that advanced practices yield benefits only when built on a strong foundation, emphasizing sequential improvements. PBV complements CPT by emphasizing that the development of one set of practices depends on the prior establishment of others. Together, these theories explain how interconnected practices collectively shape performance outcomes.

Our findings suggest that OE improves ESG adoption, indicating that firms with a strong operational foundation are better positioned to engage with sustainability and adopt a broad range of ESG practices. This extends prior research examining the effects of individual practices—such as Lean (Yu *et al.*, 2020; Nath and Agrawal, 2020), TQM (Sila, 2018), or ISO 9000 (Wang and Liu, 2023) on sustainability outcomes, by highlighting the importance of a firm-wide, two-dimensional commitment to excellence. However, simply adopting ESG practices does not necessarily guarantee effectiveness, challenging the notion that "more is better" unless these practices lead to tangible improvements. Our study clarifies when and how ESG adoption translates into performance gains.

First, ESG practices exhibit lagged effects on performance (Schrettle *et al.*, 2014; Zhu and Sarkis, 2007), reinforcing the need for long-term rather than short-term commitments. Second, performance benefits are more likely when ESG practices are adopted comprehensively across ESG dimensions, as synergies among ESG practices (Song *et al.*, 2022) reinforce the "win–win" logic (Sun *et al.*, 2024). Third, and most importantly, these benefits depend on the presence of OE. Firms lacking OE may adopt ESG symbolically, driven by regulatory or normative pressures (Zhu and Sarkis, 2007; Dimaggio and Powell, 1983), and may focus on external disclosure rather than integrating ESG practices into the firm's operations. Such symbolic adoption provides little operational value and is often perceived as a financial burden (Schrettle *et al.*, 2014), exposing firms to hidden costs and unintended consequences (Matos *et al.*, 2020).

The foundational role of OE for ESG effectiveness is confirmed through the temporal mediation effect at the core of our model. ESG adoption mediates the OE-performance relationship, supporting our theorized sequence in which $OE_{(t-2)}$ enables $ESG\ adoption_{(t-1)}$, which subsequently contributes to $performance_{(t)}$. This pattern is further reinforced by comparing the effects of ESG on performance across high- and low-OE firms: ESG significantly improves ROA among high-OE firms, whereas the effect is weak and non-significant among low-OE firms. Moreover, when disaggregating OE into its two dimensions,

high OE firms (high breadth–high persistence) outperform all other profiles (low or intermediate OE) in both ESG adoption and ROA, exhibiting the strongest indirect effects of OE on performance through ESG. Together, these findings reinforce the cumulative improvement logic of CPT (Rosenzweig and Roth, 2004). By highlighting the role of OE, our study moves beyond general calls for ESG integration (Longoni and Cagliano, 2015; Tate *et al.*, 2010) and identifies a concrete pathway through which firms can substantively embed ESG into their operations and achieve performance outcomes.

8. Conclusion

8.1 Study contribution

Our work offers several contributions. First, we advance the understanding of OE by moving beyond the traditional view that treats OE as isolated practices or selectively synergistic pairs. We conceptualize OE as a firm-level commitment to excellence characterized by two dimensions: breadth and persistence, shifting the focus from a binary state (presence or absence) of practices to their sustained application. Our reconceptualization captures both compensatory effects (addressing single-practice shortcomings) and synergistic effects. This contribution is particularly relevant to ongoing conversations in OM, where OE is often examined through a single-practice lens—such as Lean (Csiki *et al.*, 2023; Powell *et al.*, 2024), ISO 9000 (Wang and Liu, 2023), or Six Sigma (Mast *et al.*, 2022)—or through selective pairings like Lean–Six Sigma (Cherrafi *et al.*, 2017) or general quality frameworks (de Menezes *et al.*, 2021). Our findings demonstrate that OE can be better understood as a broad and persistent set of complementary practices, aligning with a recent study by Al Hasan and Micheli (2025), who conceptualize OE as a holistic bundle of interdependent (process improvement) practices.

Second, we advance the understanding of the complex sustainability–performance relationship (He *et al.*, 2023; Awaysheh *et al.*, 2020; Hull and Rothenberg, 2008), which remains empirically inconsistent. We address this inconsistency by clarifying when and how ESG adoption translates into performance gains, thereby explaining why ESG enhances performance in some firms but not in others (Sancha *et al.*, 2022) and when ESG constitutes a viable business case amid divergent adoption patterns (Roehrich *et al.*, 2025). Despite calls to integrate sustainability into operations for tangible outcomes (Sancha *et al.*, 2022; Longoni and Cagliano, 2015; Tate *et al.*, 2010), limited guidance exists on how such integration can be achieved. We advance this conversation by identifying three factors that shape effective ESG integration.

(1) The foundational role of OE: Without OE, ESG practices risk remaining symbolic, disconnected from core operations, and unlikely to generate performance improvements.

(2) The temporal nature of ESG practices: ESG effects unfold gradually rather than immediately. By incorporating temporal lags, we show that ESG requires long-term commitment, clarifying why short-term commitments often yield negative results.

(3) A holistic ESG approach: Firms benefit most when adopting a broad portfolio of ESG practices. This holistic approach enables synergies and complementarities across practices that enhance performance.

We suggest that the "win–win" or "doing well by doing good" scenario (Sun *et al.*, 2024) is not automatic but materializes when these factors are in place, echoing critiques that sustainability trade-offs are often ignored and that the business-case logic is frequently oversimplified (Matos *et al.*, 2020). We show that ESG leads to performance gains only when adopted substantively—that is, when it is grounded in OE, pursued holistically, and supported by long-term commitment. We therefore contribute to the ongoing conversation on symbolic versus substantive sustainability (Xu *et al.*, 2025; Freitas *et al.*, 2025). We challenge the view that

frames sustainability solely as a cost (Duque-Grisales and Aguilera-Caracuel, 2021; Agyabeng-Mensah *et al.*, 2020), and instead position it as a performance catalyst (Schrettle *et al.*, 2014) when adopted substantively.

Third, our findings connect to research linking excellence, resilience, and sustainability (Holgado *et al.*, 2024). While Holgado *et al.* (2024) highlight resilience as essential for a sustainable future, our conceptualization of OE presents a firm-wide commitment to excellence that supports the development of such resilience. The persistent adoption of multiple practices such as Lean and Six Sigma cultivates efficiency, stability, agility, flexibility, and strong supplier relationships, thereby enabling firms to advance resilience and sustainability together.

Fourth, we contextualize CPT (Rosenzweig and Roth, 2004) by positioning OE as the operational foundation for effective ESG adoption. While CPT emphasizes the sequential buildup of capabilities, we extend this logic by highlighting the practice-based foundation that enables ESG integration to translate into performance gains.

Fifth, we offer a comprehensive view of sustainability by treating ESG as an aggregated construct rather than focusing solely on the environmental dimension, as often seen in prior research. This approach highlights the multidimensional nature of sustainability and emphasizes the importance of giving equal attention to social and governance aspects (Yan *et al.*, 2025; Sancha *et al.*, 2022; Sodhi and Tang, 2018).

8.2 Managerial implications

This study provides several actionable insights for managers. First, firms should persistently adopt multiple OE practices to build a strong foundation for effective ESG integration. Rather than relying on single practices, adopting a variety of complementary practices and sustaining their implementation over time fosters a firm-wide commitment to excellence essential for effective OM, including sustainability efforts. What matters here is not the label of a single practice, a particular pairing, or a general quality framework, but the underlying firm-wide commitment that embeds excellence into daily operations. We view this commitment as reflected in the persistent adoption of multiple practices.

Second, managers should avoid prioritizing ESG disclosure at the expense of strengthening internal operations. Transparency matters, but without a solid foundation, ESG efforts risk remaining symbolic and costly. A more effective approach is to first establish OE practices and ensure their persistence. With this foundation, ESG practices can be more effectively embedded into daily operations in pursuit of excellence, leading to measurable performance gains. Managers should therefore allocate resources strategically, directing them first toward strengthening internal operations rather than external reporting to avoid premature or symbolic ESG investments.

Third, sustainability should be approached holistically rather than through isolated initiatives. Managers should design ESG strategies that balance ESG dimensions and integrate them with existing practices. This holistic ESG strategy allows firms to exploit synergies across ESG practices for greater impact.

Fourth, managers should recognize that ESG benefits unfold over time, requiring firms to maintain long-term commitment and resist abandoning ESG practices due to short-term pressures. Establishing clear time horizons and monitoring systems can help track ESG integration, maintain visibility, and sustain organizational momentum.

Finally, managers should treat ESG as a core component of operations strategy rather than a peripheral or compliance-driven activity. Embedding ESG practices into the firm's operations helps transform ESG from a short-term, reputational exercise into a lever for long-term value creation. Firms that align ESG practices with their broader pursuit of excellence are well-equipped to realize the *"doing well by doing good"* logic, improving both sustainability and financial performance.

8.3 Limitations and directions for future studies

This study has several limitations that open pathways for future research. First, ESG adoption was measured using Refinitiv's aggregated pillar scores, which rely on publicly disclosed information. Although widely used in OM research and supported by rigorous validation procedures, these scores are derived from publicly available disclosures.

Second, the ESG score was primarily binary, capturing the presence rather than the intensity of the practices. Future research could leverage primary data (e.g. interviews) or complementary secondary sources (e.g. sustainability reports) to provide a more accurate picture of a firm's sustainability engagement.

Third, this study focused on firm-level attributes (OE, R&D, and financial stability) but did not consider industry-level factors such as environmental dynamism, regulatory pressure, or competitive intensity. Future research could explore how such contextual factors shape the ESG-performance relationship, especially in industries with distinct sustainability challenges and institutional demands.

Fourth, some overlap exists between the ESG score and the OE measures (ISO 9000 and Six Sigma). Although robustness tests separating the dimensions yielded consistent results, this overlap remains a limitation.

Fifth, our study highlights the role of OE in integrating ESG practices into a firm's operations. Future research could extend this by applying a core–peripheral perspective (Siltaloppi *et al.*, 2021; Martignoni *et al.*, 2020) to distinguish deeply integrated ESG practices (core) from peripheral, compliance-driven ones, clarifying why some practices enhance performance while others remain symbolic.

Sixth, while we emphasize the internal foundation for ESG effectiveness, recent research highlights the role of external mechanisms (e.g. supplier transparency or supplier risk-taking) in shaping ESG outcomes (Zhou *et al.*, 2026; Diego and Montes-Sancho, 2025). Future research could examine how OE interacts with these external mechanisms in enhancing ESG effectiveness.

AI disclosoure

Generative AI was used solely for wording, editing, and language checks.

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Supplementary material

The supplementary material for this article can be found online.

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