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ORIGINAL PAPER

# From Compliance to Commitment: Examining the Influence of Corporate Governance and Social Performance on Firms' Circular Economy Initiatives

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**Abstract**
This study examines how corporate governance and social performance drive the adoption of Circular Economy (CE) among UK non-financial firms, addressing a critical gap in understanding the organisational mechanisms that facilitate sustainable business model transitions. Using panel data from 2013 to 2022 and guided by stakeholder-agency theory, we develop a comprehensive CE index that captures recycling, product eco-design, and resource utilisation practices. Through robust econometric methods, including panel data analysis, 2SLS, and quantile regression, we show that firms with strong governance practices and social responsibility commitments demonstrate significantly higher CE engagement. This relationship supports stakeholder-agency theory, suggesting that effective governance mechanisms align managerial decisions with diverse stakeholder interests, promoting sustainable resource management. Our analysis identifies key determinants of CE adoption, focussing on specific board characteristics. Notably, gender diversity, director busyness, and the presence of ex-CEO chairs play significant roles. Also, there is some evidence suggesting that board size and independence also contribute to CE adoption. These results appear consistent under different analytical conditions and checks. The study contributes to theory by extending stakeholder-agency perspectives to CE implementation, offering both ethical and practical insights. Managers can leverage governance structures and social responsibility initiatives to accelerate CE adoption, while policymakers can design targeted regulations that harness these governance-performance linkages to promote economy-wide circularity transitions.

**Keywords** Board structure · Circular economy · Corporate governance · Social performance · Stakeholder-agency theory · UK

## Introduction

In recent years, the shift towards sustainable business practices has garnered significant attention, particularly through the Circular Economy (CE)—a paradigm that replaces the traditional "*take–make–dispose*" linear model with closed-loop systems that prioritise resource efficiency and environmental sustainability (Agrawal et al., 2021; Alkaraan et al., 2023; Esposito et al., 2017). This transformative framework resonates with global sustainability targets, including the United Nations' Sustainable Development Goals (SDGs), by emphasising waste minimisation, product reuse, and resource regeneration (De Jesus & Mendonça, 2018; MacArthur et al., 2016; Moreau et al., 2017; Schroeder et al., 2019). While existing research has extensively explored the economic and environmental dimensions of CE implementation (Antonioli et al., 2022; Di Maio et al., 2017; Geissdoerfer et al., 2017), a critical knowledge gap remains regarding the organisational factors that drive adoption. Specifically, the interplay between corporate governance structures, corporate social performance (CSP), and the actual implementation of CE initiatives remains underexplored. This study addresses this gap by examining how corporate governance structures and CSP influence firms' adoption and implementation of CE initiatives, thereby strengthening the theoretical

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understanding of CE drivers and offering practical insights for sustainable business transformation.

The transition from linear to circular economic models represents not merely a technical shift but a profound ethical reorientation in how businesses conceptualise their relationship with resources, stakeholders, and future generations. As Moreau et al. (2017) argue, current CE approaches often lack crucial social and institutional dimensions necessary for meaningful implementation. This study responds to this critique by investigating the governance mechanisms and social performance metrics that enable firms to move beyond superficial compliance towards genuine commitment to circular principles. By examining these relationships through the lens of stakeholder-agency theory, we provide novel insights into how organisational structures and social performance can align with broader environmental goals, thereby contributing to the ethical discourse surrounding corporate responsibility and sustainability.

As organisations increasingly recognise the imperative to transition towards sustainable business models, the role of corporate governance in driving CE adoption has emerged as a critical area of inquiry. CSP also plays a particularly influential role in CE implementation because firms with strong CSR precedence develop organisational cultures and capabilities that support resource efficiency and waste reduction. Research shows that companies with positive CSR track records are more inclined to reduce natural resource use and emissions while performing better in CE practices such as renewable energy consumption, water recycling, and waste recycling (Zhang & Li, 2025). Furthermore, CSR investments have been recognised as a top criterion for enhancing CE performance, as circular economy practices provide tangible mechanisms for firms to transform their social responsibility commitments into operational actions. This study is conceptually interesting and important because it bridges the gap between theoretical frameworks of corporate governance and social responsibility with the practical implementation challenges of the circular economy, offering a timely and relevant examination of how firms can effectively integrate sustainability into their core operations in an era of increasing environmental and social scrutiny. The interplay between circular economy initiatives, corporate governance, and social performance reflects broader concerns in business ethics, where firms are expected to engage in responsible decision-making that balances financial goals with environmental sustainability and social accountability.

This study addresses the primary research question: How do corporate governance mechanisms and corporate social performance influence firms' adoption and implementation of circular economy initiatives? We specifically examine how key board structure factors—including gender diversity, board size, independence, director busyness, and former CEOs serving as chairpersons—shape firms' engagement with CE practices, while exploring how social performance metrics relate to circular economy commitment. Our investigation is anchored in stakeholder-agency theory (Freeman, 2010; Hill & Jones, 1992; Jensen & Meckling, 1976), which provides a particularly robust framework for understanding CE adoption decisions. This theoretical lens recognises managers as agents serving multiple principals and acknowledges the inherent challenge of balancing diverse stakeholder interests—environmental concerns, economic efficiency, social impact, and shareholder returns—that circular economy initiatives entail.

From this stakeholder-agency perspective, effective governance mechanisms serve as critical tools for aligning managerial actions with these diverse interests. Board diversity and independence enhance monitoring of environmental decisions, while diverse boards bring varied expertise that recognises CE value beyond short-term financial considerations. Governance structures that balance power reduce pressure for short-term results, enabling longer-term CE infrastructure investments. Similarly, corporate social performance—the measurable outcomes of CSR orientation—signals commitment to stakeholder concerns, develops engagement capabilities, builds legitimacy, and may reduce agency costs through enhanced trust and reputation. Despite this clear theoretical applicability, stakeholder-agency theory remains significantly underutilised in empirical research linking governance structures, social performance, and CE practices. While existing studies have examined these relationships in isolation (Bear et al., 2010; Walls & Hoffman, 2013), this study addresses the critical gap by providing a comprehensive framework that integrates these dimensions to understand how governance and social performance interact to influence firms' circular economy commitment, thereby offering a novel theoretical contribution by extending stakeholder-agency theory to the context of CE implementation.

Du et al. (2023) advocate for theory-driven CSR research that addresses grand societal challenges, calling for a fundamental shift from business-centric approaches focused primarily on financial performance towards society-centric research that examines social and environmental outcomes. They emphasise the need for quantitative CSR research to investigate cause–effect relationships between corporate initiatives and societal outcomes, including workers' health, equality and inclusion, and environmental resilience. This perspective emphasises the importance of developing impactful, ethically grounded research that helps businesses navigate complex contemporary challenges while creating meaningful social impact. Similarly, Hockerts and Searcy (2023) stress that corporate sustainability research must be explicitly framed within business ethics discourse, providing definitional clarity and ethical grounding. Our study responds to these calls by examining how

governance and social performance can drive meaningful CE implementation, thereby enabling organisations to respond more effectively to pressing societal demands, and contributing to the ethical imperative of sustainable business practices.

This study makes several important contributions that differentiate it from existing literature. While Esposito et al. (2023) examined how corporate governance mechanisms affect the disclosure of CE information in integrated reports, our study investigates how governance and social performance influence the actual implementation of CE initiatives. Esposito et al. (2023) acknowledged two primary limitations: a single-year timeframe that restricts understanding of how CE disclosure policies evolve, and analysis covering only a limited set of board characteristics. Our research directly addresses these constraints by employing a panel spanning 2013–2022 to capture the temporal evolution of CE initiatives and investigating an expanded range of board attributes. Similarly, while Moreau et al. (2017) provided a conceptual critique of CE approaches for lacking social and institutional dimensions, our study takes an empirical approach. We examine how specific governance mechanisms and social performance metrics influence CE adoption. Rather than offering broad principles, we develop a targeted theoretical framework explaining how these factors drive CE implementation. Our research provides empirical evidence and practical implications for both managers and policymakers, offering a significant advancement over prior conceptual work and addressing critical methodological limitations in the existing literature.

Methodologically, our investigation employs a panel data model to capture firm and year effects, controlling for firm-level characteristics (size, liquidity, leverage, systematic risk, return on assets) and pandemic-related factors. To address biases and endogeneity concerns, we apply a two-stage least squares (2SLS) approach. Additionally, we control for the COVID-19 and post-COVID periods to account for potential time-specific effects. Using this refined econometric design, our findings elucidate how specific governance attributes catalyse or impede CE adoption. This study introduces a pioneering CE index that goes beyond conventional accounting disclosures, capturing firms' commitments to waste management, eco-design, and recycling policies. Our novel CE index comprises eight items: waste reduction initiatives, sustainable packaging, energy efficiency, reduction targets, eco-design products, environmentally responsible product use, renewable/clean energy products, and take-back and recycling initiatives. This approach offers a more nuanced appraisal of sustainable business practices than previous studies that have relied on broader environmental metrics or disclosure practices.

An important conceptual clarification in our study concerns the distinction between corporate social responsibility (CSR) and corporate social performance (CSP). While our research question initially referred to examining how "corporate governance structures and corporate social responsibility (CSR) can support such initiatives", our empirical analysis focuses on corporate social performance (CSP). This distinction is not merely semantic but reflects an important conceptual refinement. CSR refers to the ethical principles and normative framework guiding corporate behaviour—the philosophical orientation towards social and environmental responsibility. CSP, in contrast, refers to the measurable outcomes and observable actions resulting from these CSR principles—the actual performance metrics that can be empirically assessed. Throughout this paper, we consistently use CSP when referring to measurable performance metrics and CSR when discussing the broader ethical framework, ensuring conceptual clarity and methodological precision.

Guided by stakeholder-agency theory, the findings demonstrate that firms with robust governance practices (measured by the Corporate Governance Index) and strong social performance (measured by the Social Pillar Index) are significantly more inclined to engage in CE initiatives, supporting both main hypotheses. The analysis reveals that specific board characteristics matter: board gender diversity and board independence positively influence CE adoption, while board busyness negatively affects CE engagement. Additionally, the study finds that ex-CEOs serving as board chairs positively influence CE initiatives, and larger firms with lower leverage ratios demonstrate higher CE engagement. Board size shows some evidence of a positive association with CE initiatives. Notably, the 2020–2022 period shows a positive impact on CE practices, suggesting that despite the COVID-19 pandemic, firms maintained or enhanced their CE efforts. These relationships remain consistent across a range of analytical methods and robustness, indicating that effective governance structures and social accountability align managerial decisions with diverse stakeholder interests, thereby fostering sustainable resource management.

The findings from this study yield essential insights for policymakers, demonstrating that stronger regulatory frameworks and supportive regulations can encourage broader CE adoption at the organisational level. For corporate leaders and managers, the results emphasise the necessity of leveraging sound governance measures and socially responsible strategies to advance CE objectives within strategic decision-making. Specifically, managers should consider appointing independent and female directors, engaging experienced ex-CEO chairs, and minimising external directorships to ensure sufficient focus on CE endeavours, as these board characteristics indicate potential positive associations with CE initiatives across different econometric approaches. The negative association between board busyness and CE initiatives offers concrete guidance for optimising board composition to maximise

sustainability outcomes. By revealing that governance quality and social performance significantly influence CE adoption across different quantiles of firms, policymakers can design targeted interventions that leverage governance mechanisms to accelerate circular economy transitions.

From an ethical standpoint, this research highlights how governance mechanisms facilitate corporate behaviours prioritising sustainability over minimal compliance, advocating a shift from perfunctory adherence to genuine dedication to sustainable practices, a transition the study frames as moving "*From Compliance to Commitment*". This alignment strengthens a firm's moral stature and positions it as an active contributor to societal and environmental welfare, particularly relevant during crisis periods as evidenced by firms' sustained CE efforts during 2020–2022 despite the pandemic. The study's robust findings across different econometric models provide managers with empirically validated strategies for embedding sustainability into corporate governance structures. The study's comprehensive eight-item CE index—encompassing waste reduction initiatives, sustainable packaging, energy efficiency, reduction targets, eco-design products, environmentally responsible product use, renewable/clean energy products, and take-back and recycling initiatives—provides a practical framework for regulatory standards and assessment criteria.

By illuminating the intricate linkages between governance practices, social performance, and CE initiatives through this pioneering eight-item CE index, this study contributes significantly to both corporate governance and CE research. It transcends traditional governance theories focussing solely on financial outcomes, emphasising the strategic importance of inclusive, well-structured leadership that aligns managerial decisions with diverse stakeholder interests through the stakeholder-agency theory framework. The synthesis of this novel CE index, influential governance practices, and robust social performance metrics provides managers and policymakers with an empirically grounded blueprint for embedding sustainability in core strategic decisions, reinforcing the imperative to harmonise economic and ethical goals in modern business.

The remainder of this paper is organised as follows. Section 2 reviews the literature and develops hypotheses grounded in stakeholder-agency theory. Section 3 explains the methodology, outlining the panel data analysis, two-stage least squares (2SLS) approach, and quantile regression techniques. Section 4 presents the empirical findings, while Sect. 5 discusses their implications for theory, ethics, and practice. Finally, Sect. 6 concludes by offering policy and managerial recommendations and pinpointing avenues for future research.

## Theoretical Background and Hypotheses Development

### Theoretical Background

The transition from compliance-based to commitment-driven CE initiatives represents a fundamental shift in how organisations approach sustainability, requiring a robust theoretical foundation that explains not only why firms adopt CE practices but also how governance structures facilitate this adoption. As Bliese et al. (2024) emphasise, "*theory, methods, and data are inexorably intertwined in science*" (p. 893), and strengthening these linkages is essential for advancing our understanding of complex organisational phenomena, such as CE adoption. This perspective emphasises the need for theoretical frameworks that can effectively bridge corporate governance mechanisms with sustainability outcomes, moving beyond superficial compliance towards genuine organisational commitment.

Chen and Roberts (2010) contend that organisations frequently engage in social initiatives to maintain legitimacy and meet stakeholder expectations—two sides of the same coin—and emphasise the need for researchers to choose theories aligned with their focal questions. Building on this foundation, societal pressures shape business practices and guide theoretical frameworks, paving the way for understanding how agency, stakeholder, and stakeholder-agency theories elucidate firms' transitions "From Compliance to Commitment" in the CE. This shift highlights an imperative for organisations to move beyond legal requirements and pursue intentional sustainability innovations, where corporate governance and sustainable practices critically influence whether firms remain compliant or adopt proactive commitments to CE initiatives.

Following Sparrowe and Mayer's (2011) guidance that "*using multiple theories can be a very effective way to create strong theory*" (p. 1100), particularly when the integration "*offers new questions and new insights to each theory and its respective literature*" (p. 1100), we develop an integrated theoretical framework that synthesises agency, stakeholder, and stakeholder-agency theories. This integration provides a coherent explanatory framework for understanding how governance mechanisms and corporate social performance facilitate the adoption of CE initiatives. Rather than treating these theoretical perspectives as separate or competing frameworks, our approach demonstrates how they complement each other to explain the complex dynamics between the investigated relationships.

### Corporate Governance and Circular Economy

*Agency Theory Foundational Insights and Contextual Limitations:* Agency theory (Fama & Jensen, 1983; Jensen & Meckling, 1976) provides a foundational perspective on

corporate governance by addressing the principal–agent relationship between shareholders and managers. This theory explains how governance mechanisms—such as board oversight, incentive structures, and monitoring systems—can align managerial actions with the interests of shareholders. The theory's core insight lies in understanding how incentives, monitoring, and oversight can align managerial objectives with shareholder wealth, addressing the fundamental challenge that managers (agents) may prioritise personal gain over shareholder (principal) value. However, when applied to CE contexts, traditional agency theory reveals significant limitations that must be acknowledged and addressed. The core challenge lies in the temporal and stakeholder dimensions of CE initiatives. A singular focus on shareholder interests can constrain applicability in CE contexts, characterised by extended time horizons, complex stakeholder networks, and uncertain returns (Du et al., 2023). Traditional agency prescriptions—centred on short-term financial incentives—may inadvertently disincentivise longer-term sustainability strategies (Donaldson, 1990), leaving firms at a minimal compliance threshold rather than fostering genuine commitment.

As Sparrowe and Mayer (2011) note in their guidance on theory development, effective theoretical frameworks must address the question of "*why these variables (and only those variables*) were selected" (p. 1100). The limitations of agency theory in CE contexts do not invalidate its contributions; rather, they highlight the need for theoretical extension. Moreover, as CE initiatives often span multiple years and require extensive cross-sector collaboration, purely finance-driven governance structures may fail to motivate resource efficiency or closed-loop investments, which are critical to circular transformation (Ogden, 1993).

*Stakeholder Theory —Expanding the Governance Perspective*: Stakeholder theory (Dmytriyev et al., 2021; Freeman, 1984, 2010; Jensen, 2002) expands the focus beyond shareholders, recognising the legitimate claims of employees, customers, suppliers, governments, communities, and future generations. By emphasising long-term success and social licence to operate, it emphasises the importance of aligning diverse interests and mitigating stakeholder conflicts (Deegan, 2000). This theoretical lens is particularly relevant for CE initiatives, which often involve complex collaborations across organisational boundaries and consideration of long-term environmental impacts.

The stakeholder perspective suggests that effective governance should balance diverse interests rather than prioritise shareholders exclusively. However, this approach introduces its own challenges, particularly in determining how managers should prioritise competing stakeholder claims with limited resources. While this perspective clarifies the benefits of broader social and environmental integration, its wide-ranging inclusivity can pose dilemmas for managers contending with limited resources and competing demands. These challenges intensify in CE's multi-actor arena, where regulators, communities, and markets shape environmental outcomes. Nonetheless, firms adopting stakeholder-oriented principles can reap deeper collaboration, trust, and reputational gains, moving beyond mere compliance towards proactive sustainability initiatives. Following Sparrowe and Mayer's (2011) guidance on theoretical integration, we position stakeholder theory not as a replacement for agency theory but as a complementary perspective that enriches our understanding of governance dynamics.

*Stakeholder-Agency Theory: A Synthesised Framework for CE Governance*: Stakeholder-agency theory (Hill & Jones, 1992) provides a synthesised framework that addresses the limitations of both agency and stakeholder theories when applied independently. While stakeholder theory generally aims to balance the interests of all stakeholder groups, Hill and Jones's (1992) stakeholder-agency theory places special emphasis on the contractual connections between managers and these groups, in addition to shareholders, viewing managers as agents not only for shareholders but also for diverse resource holders (employees, customers, communities, and others), each exchanging resources or services for outcomes aligned with their interests (Donaldson & Preston, 1995; Hill & Jones, 1992; Kyaw et al., 2021).This integrated perspective recognises managers as agents not only for shareholders but for all stakeholder groups that provide resources to the firm. By acknowledging the contractual relationships between managers and diverse stakeholders, stakeholder-agency theory offers a more comprehensive explanation of how governance mechanisms can facilitate CE adoption. The key insight from stakeholder-agency theory is that agency costs arise not only in shareholder–manager relationships but across all stakeholder–manager relationships.

CE principles resonate with diverse stakeholders in ways that traditional financial metrics alone cannot capture. Customers are increasingly demanding sustainable products and a reduced environmental impact. Investors are growing interested in Environmental, Social, and Governance (ESG) investments, including CE practices. Employees want to work for companies that firmly commit to environmental and social issues. Additionally, communities are concerned about environmental pollution and the depletion of resources. Managers positioned at the centre of a nexus of contracts may prioritise short-term profits over long-term sustainability, potentially hindering the adoption of CE practices. Effective corporate governance can mitigate these agency problems by overseeing managers and ensuring they address divergent stakeholder interests (Kyaw et al., 2021). Recognising that agency costs arise not only between shareholders and managers but also across various stakeholder

relationships, stakeholder-agency theory moves beyond the conventional principal-agent model (Zaman et al., 2021).

*Connecting Theory to Circular Economy Implementation*: In the context of the CE, where long-term investments, cross-disciplinary collaboration, and acceptance of short-term risks are often prerequisites for future sustainability benefits, stakeholder-agency theory is especially relevant. It suggests that incorporating diverse stakeholder interests into governance structures—through transparency, oversight, and incentive mechanisms—can drive firms beyond perfunctory compliance and towards active engagement in recycling, eco-design, and resource efficiency (European Union, 2015). Such inclusive governance arrangements mitigate conflicts across multiple principals and ensure that managers have the motivation to embrace circular strategies. There is empirical evidence indicating that board-level characteristics such as size and independence—commonly associated with protecting shareholder interests—are positively related to CSR disclosure (Jizi et al., 2014), while gender diversity and the presence of a CSR committee have been shown to enhance CE disclosure and stakeholder engagement (Esposito et al., 2023).

These governance attributes provide practical mechanisms by which firms can move beyond short-term financial returns and commit to genuine, longer-term sustainability initiatives. This approach reduces conflicts impeding CE initiatives through robust governance mechanisms that align managerial and stakeholder goals. Consequently, stakeholder-agency theory offers a subtle framework that reconciles broader stakeholder perspectives with the unique challenges of agency relationships in corporate governance.

*Hypothesis Development*: We now articulate the specific mechanisms through which governance structures influence the adoption of CE. Building on our integrated theoretical framework, we identify three primary mechanisms linking corporate governance to CE initiatives.

First, effective governance mechanisms can reduce information asymmetries between managers and diverse stakeholders regarding the potential benefits and costs of CE initiatives. By enhancing transparency and accountability, these mechanisms enable stakeholders to better monitor managerial decisions related to sustainability investments. This reduction in information asymmetries is particularly important for CE initiatives, which often involve complex technical considerations and long-term impacts that may be difficult for stakeholders to evaluate independently.

Second, governance structures that incorporate diverse stakeholder perspectives—such as board diversity—can help align managerial incentives with broader sustainability goals. This alignment is crucial for CE initiatives, which may necessitate managers to make decisions that strike a balance between short-term financial performance and long-term environmental benefits. Strengthening the theory–methods–data links (Bliese et al., 2024) requires careful consideration of how theoretical constructs are operationalised and measured, ensuring that empirical tests accurately reflect the underlying theoretical relationships.

Third, effective governance can facilitate the resource allocation and coordination necessary for successful CE implementation. CE initiatives often require cross-functional collaboration, supply chain integration, and significant resource investments. Governance mechanisms that clarify decision rights, establish clear accountability, and provide appropriate incentives can help overcome the organisational barriers to such complex initiatives.

Based on this theoretical reasoning grounded in our integrated framework, we propose that firms with stronger corporate governance will demonstrate greater commitment to CE initiatives. This hypothesis reflects a logical progression from our theoretical development, connecting governance structures to sustainability outcomes through specific mechanisms.

**H1**: There is a positive relationship between corporate governance quality and the adoption of circular economy initiatives.

This hypothesis reflects our theoretical expectation that effective governance mechanisms—by addressing multiple agency relationships, incorporating diverse stakeholder perspectives, and facilitating resource allocation—will lead to greater organisational commitment to CE practices. The hypothesis is grounded in a coherent theoretical framework that integrates agency and stakeholder perspectives, providing a clear explanatory logic for the proposed relationship.

## Corporate Social Performance and Circular Economy

*Corporate Social Performance and Circular Economy Initiatives: Extending the Theoretical Framework:* Building on our integrated theoretical framework, we now examine how corporate social performance (CSP) influences circular economy (CE) initiatives. While corporate governance mechanisms establish the formal structure for managing stakeholder relationships, CSP represents the substantive manifestation of how effectively a firm addresses diverse stakeholder expectations and builds trust-based connections. Effective theory development necessitates creating a coherent understanding of the relationships among variables and processes within the proposed model. In line with this approach, we explain how CSP logically extends our theoretical framework and offers a complementary pathway to CE adoption.

*CSP Within the Stakeholder-Agency Framework:* Corporate social performance represents a firm's demonstrated capacity to identify, respond to, and balance diverse stakeholder interests beyond immediate financial returns. Within our integrated theoretical framework,

CSP serves as a critical mechanism through which firms operationalise stakeholder–agency relationships. A strong CSP orientation—emphasising employee well-being, community engagement, supplier fairness, and consumer satisfaction—complements stakeholder-agency alignment by reducing suspicion, enhancing goodwill, and building reputational capital (Ortiz-de-Mandojana et al., 2019). While governance structures provide the formal architecture for stakeholder engagement, CSP reflects the substantive actions and outcomes that demonstrate a firm's commitment to addressing stakeholder concerns. The stakeholder-agency perspective suggests that managers serve as agents for multiple principals, including not only shareholders but also employees, customers, communities, and other resource providers (Hill & Jones, 1992). This multi-principal relationship creates the potential for agency conflicts when the interests of stakeholders diverge. CSP directly addresses these conflicts by demonstrating a firm's commitment to balancing diverse stakeholder interests, thereby reducing information asymmetries and building trust across stakeholder groups.

By aligning stakeholder expectations, mitigating agency conflicts, and strengthening resource access, high CSP can create an environment conducive to implementing CE initiatives (Donaldson & Preston, 1995; Hill & Jones, 1992). This alignment is particularly critical in CE contexts, where multi-stakeholder collaboration, extended time horizons, and significant investment risks frequently challenge conventional governance frameworks (Geissdoerfer et al., 2017; Ghisellini et al., 2016; Kirchherr et al., 2017, 2018).

*Hypothesis Development:* Effective hypothesis development requires developing a clear, logical argument explaining why the core variables or processes are related in the proposed fashion. Following this guidance, we articulate three specific mechanisms through which CSP influences CE adoption within the stakeholder-agency framework.

First, CSP reduces stakeholder-manager information asymmetries by demonstrating a firm's genuine commitment to stakeholder interests. When firms consistently demonstrate strong social performance—through initiatives that promote employee well-being, community engagement, supplier fairness, and consumer satisfaction—they build credibility with diverse stakeholders. This credibility reduces the monitoring costs that stakeholders would otherwise incur to ensure their interests are represented, thereby strengthening stakeholder relationships and reducing potential conflicts between managerial actions and stakeholder expectations (Donaldson & Preston, 1995). In CE contexts, where initiatives often require significant upfront investments with uncertain returns, this enhanced stakeholder trust and reduced monitoring burden is particularly valuable for securing stakeholder support.

Second, CSP enhances a firm's reputational capital and legitimacy among stakeholders, creating what we term "stakeholder reciprocity". When firms demonstrate genuine commitment to stakeholder interests through strong social performance, stakeholders are more likely to reciprocate with their own commitments to the firm's strategic initiatives (Ortiz-de-Mandojana et al., 2019). This reciprocity is especially important for CE initiatives, which often require stakeholders to accept short-term adjustments (e.g. product redesigns, supply chain modifications) for long-term sustainability benefits. Moreover, effective CSP-driven governance clarifies responsibilities and incentives, helping managers reconcile varied interests (Kyaw et al., 2021; Zaman et al., 2021).

Third, CSP strengthens a firm's capacity for multi-stakeholder collaboration, which is essential for CE initiatives. CE approaches typically require coordination across organisational boundaries, involving suppliers, customers, regulators, and communities (Geissdoerfer et al., 2017; Kirchherr et al., 2018). Firms with strong CSP have developed the stakeholder engagement capabilities and cross-boundary relationships necessary for such collaboration. These capabilities help address what Hill and Jones (1992) identify as coordination challenges in stakeholder–management relationships—specifically, the difficulties diffused stakeholders face in achieving collective action and the institutional structures needed to economise on the costs of coordination when stakeholders must act together to monitor and enforce their implicit contracts with management.

Through this lens, stakeholder-agency theory emphasises that robust CSP—coupled with appropriate governance structures—facilitates the sustainable adoption and implementation of circular strategies. When organisations cultivate enduring ties with diverse stakeholder groups, managers are more likely to secure the internal and external support necessary for long-term CE initiatives that may not yield immediate financial returns but advance broader social and environmental objectives (Freeman, 1984, 2010; Hall & Vredenburg, 2003; Kirchherr et al., 2018; Lozano, 2015).

The integration of CSP within our stakeholder-agency framework provides a more comprehensive explanation of how firms move from compliance to commitment in CE adoption. This theoretical integration addresses the challenge of combining theories to provide a more comprehensive understanding of an organisational phenomenon. By demonstrating how CSP complements governance structures within the stakeholder-agency framework, we offer a more nuanced understanding of the pathways to CE adoption.

Consequently, firms with higher CSP are more inclined to adopt circular processes, such as recycling, sustainable sourcing, and waste minimisation, as part of their strategic agenda. This outcome emphasises the importance of examining how CSP-driven governance practices support CE

implementation, demonstrating that amplifying stakeholder voices and upholding ethical standards enables companies to transcend superficial sustainability claims and achieve genuine commitment.

Our theoretical framework suggests that firms with stronger CSP will demonstrate greater commitment to CE initiatives through three specific mechanisms: reduced information asymmetries, enhanced stakeholder reciprocity, and strengthened collaborative capacity. This theoretical expectation is consistent with empirical evidence showing that firms with stronger social performance tend to adopt more proactive environmental strategies (Kyaw et al., 2021; Zaman et al., 2021). Based on this theoretical reasoning, we propose

**H2**: There is a positive relationship between corporate social performance and the adoption of circular economy initiatives.

This hypothesis reflects our theoretical expectation that firms demonstrating a more substantial commitment to addressing diverse stakeholder interests through CSP will be more likely to adopt CE initiatives. The hypothesis is grounded in a coherent theoretical framework that integrates CSP within the stakeholder-agency perspective, providing clear explanatory logic for the proposed relationship.

*Theoretical Synthesis and Hypotheses Implications*: By integrating corporate governance (**H1**) and corporate social performance (**H2**) within a unified stakeholder-agency framework, we address criticisms that traditional governance models lack distinction in contexts requiring multi-stakeholder collaboration and long-term investment, such as CE (Du et al., 2023). Agency theory, along with its short-term financial focus, can limit firms to mere compliance. Stakeholder theory broadens the lens to encompass multiple obligations, but it does not always provide concrete governance tools for managing the stakeholder–manager interface. Stakeholder-agency theory reconciles these gaps by illustrating how governance can reduce agency costs across diverse principals, fostering genuine sustainability commitments.

This integrated approach explains how formal governance structures and substantive social performance jointly influence CE adoption through complementary mechanisms. The theoretical framework specifies how governance structures establish the formal architecture for stakeholder engagement (H1), while CSP demonstrates the substantive commitment to stakeholder interests (H2), both contributing to CE adoption through distinct but complementary pathways.

Empirical evidence from Esposito et al. (2023) supports this unified perspective, showing that board composition, CSR committees, and stakeholder-centred governance can heighten CE disclosure and tangible sustainability outcomes. This theoretical synthesis provides a stronger foundation for empirical testing by clearly articulating the mechanisms through which governance and CSP influence CE adoption, enabling more precise empirical tests of these relationships and strengthening the overall contribution of our study.

To recap, in developing these hypotheses, we have followed the guidance of Sparrowe and Mayer (2011) and Bliese et al. (2024) on strengthening theory–methods links by ensuring that our theoretical constructs are clearly defined and logically connected. This approach enhances the validity of our empirical tests and strengthens the theoretical contribution of our study. By integrating multiple theoretical perspectives and articulating specific mechanisms, we provide a more nuanced understanding of how governance structures and social performance influence sustainability outcomes in organisational contexts.

## Data and Research Method

### Data

Having established our theoretical framework grounded in stakeholder-agency theory and developed testable hypotheses regarding the relationships between corporate governance, social performance, and circular economy initiatives, we now turn to the empirical examination of these theoretical propositions. The translation of abstract theoretical constructs into measurable empirical indicators represents a critical juncture in management research. The robustness of findings depends fundamentally on the alignment between theoretical conceptualisation and methodological operationalisation (Bliese et al., 2024).

Our empirical strategy is designed to capture the multifaceted nature of the governance-sustainability nexus, as articulated in our hypotheses, employing a comprehensive dataset of UK non-financial firms and a novel circular economy index that extends beyond traditional environmental metrics. By utilising multiple econometric approaches—including panel data analysis, instrumental variables, and quantile regression—we ensure that our empirical tests adequately address the complex, multi-stakeholder dynamics inherent in our theoretical framework.

This methodological pluralism not only strengthens the validity of our findings but also responds to recent calls in the literature for more rigorous approaches to examining cause–effect relationships between corporate initiatives and societal outcomes (Du et al., 2023). The following discussion details our data sources, variable construction, and analytical procedures, demonstrating how each methodological choice flows logically from our theoretical foundations and enables a nuanced examination of how governance mechanisms facilitate the transition from compliance-based to commitment-driven circular economy practices.

Our sample includes all non-financial, publicly listed firms in the FTSE 350 index from 2013 to 2022, totalling

217. Due to strict data requirements, only 212 firms (1786 firm-year observations) provided sufficient information for our baseline model. To mitigate survivorship bias, we allowed firms to enter and exit the sample freely during the study period, ensuring the analysis was not skewed towards entities that remained in the market throughout. Data were collected from the Refinitiv Eikon/LSEG database. This sampling approach facilitates meaningful conclusions about non-financial firms' corporate governance and CE initiatives in the FTSE 350. Descriptive statistics are presented in Table 1.

Table 1 presents the descriptive statistics. The circular economy (CE) ratio has a mean value of 0.56, indicating moderate engagement in CE initiatives across the sample, with some firms reaching a maximum of 100% coverage across all CE index dimensions. Similarly, the recycling waste ratio averages 0.68, denoting substantial commitment to waste recycling, and a maximum of 100% indicates complete waste recycling in specific firms.

Regarding the key independent variables, the Corporate Governance Index (CGI) exhibits a mean of 0.623, suggesting relatively strong governance practices, with a maximum of 0.89 reflecting extensive adherence to sound governance principles. The social index (SOCI) averages 0.58, implying generally robust social performance, with a maximum of 0.972. Concerning board structure, the average board comprises nine members, with approximately 61% independent directors and 25% female directors. On average, board members hold one overlapping business engagement; only 7% of the sample includes ex-CEOs acting as board chairs.

Furthermore, 57% of the boards include members with specialised expertise. Regarding firm-specific factors, the average leverage ratio is relatively low (0.24), and the liquidity position is strong (mean of 2). The sample also exhibits comparatively low systematic risk (1.3) and low profitability (0.06). Overall, these findings indicate that the non-financial firms analysed demonstrate solid environmental and waste management practices, as well as adherence to sound governance and CSR principles.

Table 2 presents the correlation matrix, which shows no high correlations among the independent variables, indicating that the models do not suffer from multicollinearity. The Variance Inflation Factor (VIF) values corroborate this, confirming the absence of multicollinearity concerns in our analyses.

**Table 1** Descriptive statistics for all variables (2013–2022)

| Variable | Mean | Std. dev. | Min | Max |
|---|---|---|---|---|
| CE-ratio | 0.562418 | 0.268079 | 0 | 1 |
| Waste-ratio | 0.680085 | 0.285907 | 0 | 1 |
| CGI (%) | 62.31504 | 20.06637 | 0.891015 | 98.59904 |
| SOCI (%) | 58.77628 | 21.10152 | 2.055756 | 97.28934 |
| B.size | 9.161707 | 2.417101 | 2 | 23 |
| B.indep | 61.69445 | 13.75441 | 0 | 100 |
| B.diversity | 25.75051 | 12.20553 | 0 | 66.66666 |
| B.busy | 1.142271 | 0.623825 | 0 | 3.666667 |
| Ex-CEO-chair | 0.072431 | 0.259273 | 0 | 1 |
| B.skills | 57.187 | 16.65556 | 0 | 100 |
| Size | 21.89288 | 1.533785 | 17.46731 | 26.81689 |
| Liq | 2.01156 | 10.69379 | 0.078067 | 419.8201 |
| Lev | 0.247444 | 0.166613 | 0 | 1.304463 |
| Beta | 1.315703 | 0.714832 | -0.3639 | 3.519553 |
| ROA | 0.065994 | 0.114083 | -0.99 | 0.99 |

This table presents descriptive statistics for our variables. CE-ratio represents the Circular Economy index comprising eight policy dimensions. CGI and SOCI are the Corporate Governance and Social Performance indices from Refinitiv Eikon/LSEG. Board structure variables include size, independence, gender diversity, busyness, ex-CEO chair presence, and skills. Firm-level controls include size (log of total assets), liquidity, leverage, systematic risk (Beta), and return on assets (ROA)

## Research Method

In order to investigate the influence of corporate governance and social performance on CE initiatives, we employ a panel data model controlling for both firm and year effects. Our main specification is

$$CE_{i,t} = \beta_0 + \beta_1 CGI_{i,t} + \beta_2 \text{SOCI}_{i,t} + \beta_3 \text{FirmSpecific}_{i,t} + \varepsilon_{it} \quad (1)$$

The Circular Economy (CE) Index captures the extent to which firms adopt sustainable practices across eight policy dimensions. We construct this index by assigning a value of 1 when a firm has a relevant policy or initiative in each of the following areas and 0 otherwise:

1. *Waste Reduction Initiatives*—e.g. recycling, reducing, reusing, treating, or phasing out waste.
2. *Sustainable Packaging*—policies to enhance the use of sustainable packaging materials.
3. *Energy Efficiency*—policies to improve energy efficiency.
4. *Reduction Targets*—measurable goals for resource efficiency improvements.
5. *Eco-Design Products*—development of products intended to reduce environmental impacts through reuse, recycling, or lower resource use.
6. *Environmentally Responsible Product Use*—disclosure of product features or services that promote responsible and environmentally efficient usage.
7. *Renewable/Clean Energy Products*—creation of products or technologies for clean and renewable energy.

**Table 2** Pearson correlation matrix and variance inflation factors

| | CGI | SOCI | B.size | B.indep | B.diversity | B.busy | Ex-CEO-chair | B.skills | Size | Liq | Lev | Beta | ROA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CGI | 1 | | | | | | | | | | | | |
| SOCI | 0.3772 | 1 | | | | | | | | | | | |
| B.size | 0.2214 | 0.4199 | 1 | | | | | | | | | | |
| B.indep | 0.3989 | 0.2007 | 0.0143 | 1 | | | | | | | | | |
| B.diversity | 0.3613 | 0.2925 | 0.0762 | 0.3291 | 1 | | | | | | | | |
| B.busy | 0.2548 | 0.3586 | 0.239 | 0.305 | 0.2233 | 1 | | | | | | | |
| Ex-CEO-chair | − 0.1491 | − 0.0872 | − 0.0554 | − 0.1424 | − 0.1166 | − 0.1031 | 1 | | | | | | |
| B.skills | − 0.0731 | − 0.2052 | − 0.2529 | − 0.2142 | − 0.187 | − 0.1304 | 0.1497 | 1 | | | | | |
| Size | 0.3772 | 1 | 0.4199 | 0.2007 | 0.2925 | 0.3586 | − 0.0872 | − 0.2052 | | | | | |
| Liq | 0.3654 | 0.5695 | 0.5538 | 0.3108 | 0.1549 | 0.4536 | − 0.1093 | − 0.2497 | 1 | | | | |
| Lev | 0.03 | 0.0088 | − 0.0883 | 0.0772 | 0.0623 | 0.0057 | 0.008 | − 0.0052 | − 0.0333 | 1 | | | |
| Beta | 0.0625 | 0.2386 | 0.1693 | − 0.0086 | 0.1122 | 0.0988 | − 0.0919 | − 0.1929 | 0.2961 | − 0.0797 | 1 | | |
| ROA | − 0.0843 | − 0.0973 | − 0.0533 | − 0.0916 | − 0.0397 | − 0.146 | − 0.0338 | 0.1056 | 0.0099 | − 0.0666 | − 0.0234 | 1 | |
| roa1 | − 0.0017 | 0.008 | 0.0112 | − 0.0612 | 0.0279 | 0.0867 | 0.0344 | − 0.0065 | − 0.0008 | − 0.0191 | 0.0607 | − 0.0967 | 1 |
| VIF | 1.56 | 1.77 | 1.67 | 1.63 | 1.41 | 1.58 | 1.13 | 1.2 | 2.74 | 1.18 | 1.28 | 1.12 | 1.05 |

This table presents pairwise correlations between all independent variables and variance inflation factors (VIF) to assess multicollinearity. VIF values below 10 indicate no serious multicollinearity concerns. Variables are defined in Table 1

8. *Take-Back and Recycling Initiatives*—programmes aimed at minimising environmental product risks through take-back or recycling schemes.

We then sum these eight items to form the CE Index and compute the CE Ratio by dividing this sum by the total number of items. We assign equal weights to all items because the Refinitiv Eikon/LSEG data only report whether such policies or initiatives exist (rather than their magnitude). This approach ensures that no single initiative disproportionately shapes the index, offering a balanced measure of a firm's overall CE engagement.

Our primary independent variables are the Refinitiv Eikon/LSEG Corporate Governance Pillar Index (CGI) and the Social Pillar Index (SOCI). The CGI reflects the extent of adherence to sound governance practices, while the SOCI measures the level of social performance engagement. Higher values in these indices indicate stronger performance in their respective domains.

We employ both the Corporate Governance Index (CGI) and individual board characteristics to present a comprehensive view of how governance influences circular economy initiatives. The CGI, obtained from the LSEG database, is a composite metric that captures overall governance quality including shareholder rights, audit and risk oversight, transparency, and accountability mechanisms and thus serves as a broad indicator of firm-level governance effectiveness. By contrast, board characteristics such as size, independence, and expertise represent specific structural elements that shape strategic decision-making. Using both the CGI and board-level variables therefore allows us to capture general governance attributes alongside the board's structural features, providing a fuller picture of how different dimensions of corporate governance affect engagement with circular economy practices. A similar dual approach is adopted by Abed et al. (2025), who include a governance index as an overarching metric while analysing board characteristics in a sustainability context.

Additionally, we control for various firm-specific characteristics, including Size (the natural logarithm of total assets), Liquidity (current assets divided by current liabilities), Leverage (total debt to total assets), Beta (the firm's systematic risk), and ROA (net income to total assets). We also include COVID and post-COVID dummy variables in select models to capture the pandemic's potential effects on CE initiatives and ensure our findings accurately reflect both the pandemic and its aftermath.

To address possible endogeneity, we re-estimate our models using a two-stage least squares (2SLS) panel approach, employing lagged corporate governance, social performance, and financial performance as instruments (Al-Najjar & Salama, 2022). This approach isolates the exogenous variation in our independent variables, thereby strengthening the causal interpretation of their impact on CE outcomes and enhancing the validity of our findings. The Sargan test confirms the suitability of our instruments. We further employ the Generalised Method of Moments (GMM), Propensity Score Matching (PSM), and lagged independent variables to address reverse causality. As Hill et al. (2021) note, endogeneity remains a critical threat to robust causal inference in management research. Du et al. (2023) similarly highlight that there is no one-size-fits-all solution to endogeneity, but multiple valid approaches—such as dynamic panel techniques, instrumental variables, exogenous events, or lagged variables—can alleviate simultaneity concerns (Du et al., 2023). This perspective aligns with the methods adopted by Hill et al. (2021). Nonetheless, Eckert and Hohberger (2023) point out that identifying suitable instruments can be challenging, prompting researchers to rely on non-instrumental methods. Hence, we incorporate the PSM method as an additional robustness check.

Moreover, we conduct quantile regression analyses at the 20th, 50th, 75th, and 95th quantiles to determine whether the relationships between corporate governance, social performance, and CE initiatives differ across varying levels of CE engagement. This allows for a more refined examination of how governance and social performance may drive CE under different conditions.

Finally, we explore the effects of various board structure factors on CE initiatives by replacing the Corporate Governance Index (CGI) with specific board structure variables and estimating both panel and 2SLS panel models. Our aim is to provide a comprehensive understanding of the mechanisms through which governance, social performance, and board composition jointly influence corporate engagement in circular economy practices.

$$CE_{i,t} = \beta_0 + \beta_1 \text{BoardStructure}_{i,t} + \beta_2 \text{SOCI}_{i,t} + \beta_3 \text{FirmSpecific}_{i,t} + \beta_{i,t} \quad (2)$$

where the board structure is captured by multiple variables: Board size (B.size)—total number of executive and non-executive directors; Board independence (B.indep)—percentage of independent directors; Board gender diversity (B.diversity)—percentage of female directors in the board; Board busyness (B.busy)—average number of directorships or affiliations per board member; CEO-ex-chair—an indicator denoting whether the chair is a former CEO; and Board skills (B.skills)—percentage of directors with specific skills and expertise deemed essential for effective board oversight. All remaining variables are defined as previously discussed.

Our selection of board structure variables is grounded in both theoretical considerations and empirical evidence regarding their influence on sustainability outcomes. These variables capture distinct dimensions of board composition and functioning that stakeholder-agency theory suggests are critical for balancing diverse stakeholder interests. Board

size affects the breadth of expertise and monitoring capacity available for overseeing complex CE initiatives (De Villiers et al., 2011). Larger boards provide access to more diverse resources and expertise, with De Villiers et al. (2011) finding that environmental performance is higher in firms that have larger boards, consistent with resource dependence theory. Board independence is fundamental to effective monitoring and reduces managerial entrenchment, enabling directors to advocate for long-term sustainability investments that may conflict with short-term financial pressures (Jizi et al., 2014). Jizi et al. (2014) demonstrate that independent boards promote the interests of both shareholders and other stakeholders regarding CSR disclosure, suggesting their importance for sustainability governance.

Gender diversity brings varied perspectives and has been linked to enhanced social performance, as female directors often demonstrate greater stakeholder orientation (Al-Najjar & Salama, 2022; Bear et al., 2010). Bear et al. (2010) find that the number of women on boards is positively associated with CSR strength ratings, while Al-Najjar and Salama (2022) provide evidence of a positive relationship between female directors and environmental performance in high-tech firms. Director busyness (multiple board appointments) captures the time and attention constraints that may limit directors' ability to engage with complex CE strategies, representing a critical resource limitation in governance effectiveness (Cashman et al., 2012; Jiraporn et al., 2009). Ex-CEOs possess unique operational expertise and leadership experience that can facilitate CE implementation, although their presence may also impact board dynamics and independence (Quigley & Hambrick, 2012).

We focus exclusively on these observable board characteristics rather than process variables (such as board meetings or committees) because they represent relatively stable governance features that firms can directly modify to enhance CE adoption. This parsimonious set of variables captures the key dimensions of board human capital, monitoring capacity, and diversity that theory suggests are most relevant for sustainability governance while avoiding multicollinearity issues that would arise from including highly correlated governance measures.

We further assess the robustness of our models by introducing an alternative waste ratio, which measures the proportion of recycled waste relative to total waste. Due to limited data availability, this supplementary analysis draws on 820 firm-year observations from 127 non-financial UK firms. We estimate both panel and 2SLS specifications:

$$\text{WasteRatio}_{i,t} = \beta_0 + \beta_1 CGI_{i,t} + \beta_2 SOCI_{i,t} + \beta_3 \text{FirmSpecific}_{i,t} + \varepsilon_{it} \quad (3)$$

$$\text{WasteRatio}_{i,t} = \beta_0 + \beta_1 \text{BoardStructure}_{i,t} + \beta_2 \text{SOCI}_{i,t} + \beta_3 \text{FirmSpecific}_{i,t} + \varepsilon_{it} \quad (4)$$

Finally, we include an industry dummy to account for firms in potentially higher-polluting sectors (Energy, Materials, Industrials, High Technology, or Utilities). This dummy variable takes "1" for firms in these sectors and "0" otherwise, enabling us to explore any sector-specific influence on the relationships among CE initiatives, corporate governance, and social performance.

## Results

Table 3 presents the results for our baseline model, comprising eight variations. Models 1–4 include the Corporate Governance Index (CGI), while Models 5–8 include both CGI and the Social Pillar Index (SOCI). Models 3, 4, 7, and 8 additionally control for COVID and post-COVID effects.

The findings consistently show that good corporate governance practices (CGI) significantly influence CE initiatives across all models, confirming our main expectation (**H1**). Firms with stronger governance structures appear more actively involved in CE initiatives, emphasising the relevance of examining CE efforts through a corporate governance lens. These results are consistent with broader environmental studies (e.g. Albitar et al., 2023; Al-Najjar & Salama, 2022) and contribute fresh insights into the CE context. From the perspective of stakeholder-agency theory, these findings indicate that stronger governance mechanisms promote accountability not only to shareholders but also to a broader range of stakeholders who demand responsible environmental practices. When directors and managers are effectively held accountable for meeting these diverse demands, they are more likely to prioritise CE initiatives, enhance resource efficiency, and adopt sustainable business strategies.

We also observe a positive relationship between social performance (SOCI) and CE initiatives in Models 5–8 (H2). This finding aligns with prior research (e.g. Morea et al., 2021) and emphasises connecting social performance with CE efforts. Consistent with stakeholder-agency theory, socially engaged firms tend to satisfy the broader interests of employees, communities, and customers—leading to a corporate culture that supports proactive CE policies (Leandro & Paixao, 2018). Such firms may view resource stewardship not merely as a cost but as an ethical and strategic imperative, reinforcing stakeholder trust and long-term resilience.

Regarding firm-level characteristics, larger firms and those with lower leverage ratios demonstrate higher engagement in CE initiatives. Additionally, the years 2020–2022 positively impact CE practices, suggesting that, despite the COVID-19 pandemic, many firms intensified their CE

**Table 3** Panel regression analysis of corporate governance and social performance on CE initiatives

| Variables | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 |
|---|---|---|---|---|---|---|---|---|
| CGI | 0.00156*** | 0.00115*** | 0.000696*** | 0.000576*** | 0.00107*** | 0.000977*** | 0.000590*** | 0.000542** |
| | (0.000193) | (0.000208) | (0.000216) | (0.000220) | (0.000199) | (0.000208) | (0.000215) | (0.000219) |
| SOCI | | | | | 0.00228*** | 0.00177*** | 0.00172*** | 0.00135*** |
| | | | | | (0.000278) | (0.000307) | (0.000304) | (0.000318) |
| Size | | 0.0523*** | | 0.0226** | | 0.0306*** | | 0.0121 |
| | | (0.00922) | | (0.0102) | | (0.00988) | | (0.0104) |
| Liq | | 0.000224 | | 0.000263 | | 0.000185 | | 0.000241 |
| | | (0.000297) | | (0.000293) | | (0.000294) | | (0.000291) |
| Lev | | − 0.118*** | | − 0.132*** | | − 0.115*** | | − 0.125*** |
| | | (0.0318) | | (0.0318) | | (0.0315) | | (0.0317) |
| Beta | | 0.0840 | | 0.192 | | 0.0865 | | 0.176 |
| | | (0.169) | | (0.168) | | (0.168) | | (0.167) |
| ROA | | − 0.0329 | | − 0.0313 | | − 0.0401 | | − 0.0353 |
| | | (0.0407) | | (0.0402) | | (0.0403) | | (0.0400) |
| 2019 | | | 0.00562 | 0.00560 | | | − 0.00637 | − 0.00145 |
| | | | (0.00904) | (0.00937) | | | (0.00920) | (0.00947) |
| 2020 | | | 0.0273*** | 0.0298*** | | | 0.0129 | 0.0217** |
| | | | (0.00918) | (0.00994) | | | (0.00945) | (0.0101) |
| 2021 | | | 0.0495*** | 0.0468*** | | | 0.0312*** | 0.0363*** |
| | | | (0.00935) | (0.0102) | | | (0.00981) | (0.0104) |
| 2022 | | | 0.0782*** | 0.0744*** | | | 0.0586*** | 0.0633*** |
| | | | (0.00971) | (0.0109) | | | (0.0102) | (0.0111) |
| Constant | 0.465*** | − 0.734*** | 0.501*** | − 0.203 | 0.362*** | − 0.354 | 0.414*** | − 0.0250 |
| | (0.0123) | (0.275) | (0.0128) | (0.283) | (0.0175) | (0.280) | (0.0199) | (0.285) |
| Observations | 1862 | 1786 | 1862 | 1786 | 1862 | 1786 | 1862 | 1786 |
| *R*-squared | 0.038 | 0.059 | 0.081 | 0.091 | 0.076 | 0.078 | 0.099 | 0.101 |
| Number of id | 214 | 212 | 214 | 212 | 214 | 212 | 214 | 212 |
| Panel-effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

This table reports panel regression results examining the impact of corporate governance (CGI) and social performance (SOCI) on circular economy initiatives. All models include panel effects. Standard errors are in parentheses. The variables are defined in Table 1; ***, **, and * are significant at 1%, 5%, and 10% level, respectively

efforts—again reflecting stakeholder pressures for sustainable and resilient practices.

To mitigate potential endogeneity, we employ a 2SLS panel analysis (Table 4). The results reinforce our primary inferences: CGI remains positively associated with CE initiatives (Models 1, 3, 4), and SOCI also has a positive, significant effect (Models 1, 3, 4, 5), supporting **H1** and **H2**. Consistent with the baseline results, firms with higher debt ratios appear less inclined to invest in CE activities, and the 2020–2022 period shows a favourable influence on CE initiatives. The Sargan test is insignificant across all reported models, affirming the appropriateness of the chosen instruments.

Overall, these results align well with stakeholder-agency theory, suggesting that both robust governance structures and heightened social performance effectively align managerial decision-making with the interests of multiple stakeholders, thereby strengthening corporate engagement in circular economy practices.

In our third set of models, we extend the analysis by examining whether the relationships between CE initiatives, corporate governance (CGI), and social responsibility (SOCI) vary across different quantiles (20%, 50%, 75%, and 95%). Table 5 presents the results: the first four models exclude COVID and post-COVID dummies, while the last four include them. CGI remains significant across quantiles (except at the 95% level in Models 4 and 8), and SOCI is significant in all models.

These findings strongly support our main hypotheses (**H1** and **H2**) and align with the results in Tables 3 and 4, emphasising the importance of good governance and social responsibility in driving CE initiatives. From the viewpoint of stakeholder-agency theory, these quantile results suggest that robust governance mechanisms and

**Table 4** Two-stage least squares (2SLS) panel regression results

| Variables | (1) M1 | (2) M2 | (3) M3 | (4) M4 | (5) M5 |
|---|---|---|---|---|---|
| CGI | 0.00235*** | | 0.00156*** | 0.00152*** | 0.000655 |
| | (0.000426) | | (0.000471) | (0.000510) | (0.000624) |
| SOCI | | 0.00322*** | 0.00251*** | 0.00246*** | 0.00167*** |
| | | (0.000423) | (0.000487) | (0.000543) | (0.000591) |
| Size | | | | 0.0100 | − 0.00107 |
| | | | | (0.0125) | (0.0119) |
| Liq | | | | 0.000202 | 0.000251 |
| | | | | (0.000285) | (0.000280) |
| Lev | | | | − 0.0939*** | − 0.0989*** |
| | | | | (0.0330) | (0.0327) |
| Beta | | | | 0.235 | 0.345 |
| | | | | (0.211) | (0.210) |
| ROA | | | | − 0.0398 | − 0.0274 |
| | | | | (0.0413) | (0.0406) |
| 2019 | | | | | − 0.00124 |
| | | | | | (0.00960) |
| 2020 | | | | | 0.0198* |
| | | | | | (0.0112) |
| 2021 | | | | | 0.0348*** |
| | | | | | (0.0129) |
| 2022 | | | | | 0.0618*** |
| | | | | | (0.0148) |
| Constant | 0.420*** | 0.376*** | 0.319*** | − 0.181 | 0.00794 |
| | (0.0273) | (0.0256) | (0.0296) | (0.360) | (0.348) |
| Sargan test | 0.852 | 1.760 | 1.548 | 0. 0119 | 0.0001 |
| Observations | 1596 | 1596 | 1596 | 1574 | 1574 |
| Number of id | 208 | 208 | 208 | 207 | 207 |
| Panel-effects | Yes | Yes | Yes | Yes | Yes |

This table presents 2SLS panel regression results to address potential endogeneity concerns. Lagged values of corporate governance, social performance, and financial performance serve as instruments. The Sargan test of overidentifying restrictions confirms instrument validity. Standard errors are in parentheses. All models include panel effects. The variables are defined in Table 1; ***, **, * are significant at 1%, 5%, and 10% level, respectively

strong social engagement encourage CE activities not just for the "average" firm but also across a wide range of CE engagement levels. Even as firm circumstances vary—whether at lower or higher quantiles—the accountability to multiple stakeholders, advocated by stakeholder-agency theory, appears to consistently drive managers towards more sustainable and community-oriented outcomes.

Moreover, larger firms, those with lower debt ratios, and those with lower systematic risk, exhibit greater CE adoption across quantiles. There is a modest negative impact in 2019 for firms at the low (20%) quantile and a limited positive effect in 2022 for those at the high (95%) quantile. While this indicates that pandemic-related factors may have slightly influenced CE at the extremes of the distribution, the overall effect of the COVID/post-COVID period is relatively muted.

Table 6 shifts focus to whether different board structure attributes and social performance (SOCI) influence CE initiatives. The table includes eight models: Models 1–4 are panel analyses, and Models 5–8 are 2SLS panel analyses.

Results suggest that board size shows some evidence of a positive association with CE initiatives (Model 3), implying that larger boards might provide more diverse expertise or monitoring capacity. This finding aligns with De Villiers et al. (2011), Haque and Ntim (2018), and Orazalin and Mahmood (2021). Similarly, board independence exerts a positive impact on CE initiatives in Models 3 and 4, reinforcing the idea that independent directors can channel stakeholder demands—environmental and otherwise—more effectively (De Villiers et al., 2011; Orazalin & Mahmood, 2021; Post et al., 2015). In the language of

**Table 5** Quantile regression analysis across different levels of CE engagement

| Variables | (20) M1 | (50) M2 | (75) M3 | (95) M4 | (20) M5 | (50) M6 | (75) M7 | (95) M8 |
|---|---|---|---|---|---|---|---|---|
| CGI | 0.00120*** | 0.00146*** | 0.00162*** | 0.000118 | 0.00144*** | 0.00139*** | 0.00197*** | − 0.000297 |
| | (0.000422) | (0.000453) | (0.000443) | (0.000572) | (0.000468) | (0.000486) | (0.000467) | (0.000584) |
| SOCI | 0.00467*** | 0.00370*** | 0.00518*** | 0.00401*** | 0.00457*** | 0.00353*** | 0.00502*** | 0.00363*** |
| | (0.000461) | (0.000494) | (0.000483) | (0.000624) | (0.000495) | (0.000514) | (0.000493) | (0.000617) |
| Size | 0.0275*** | 0.0202*** | 0.0123* | 0.0164* | 0.0241*** | 0.0237*** | 0.0129* | 0.0243*** |
| | (0.00641) | (0.00688) | (0.00672) | (0.00868) | (0.00692) | (0.00718) | (0.00690) | (0.00863) |
| Liq | 9.01e − 05 | − 0.000448 | − 0.00102 | − 0.00157 | − 0.000795 | − 0.000359 | − 0.000945 | − 0.00156 |
| | (0.000726) | (0.000779) | (0.000761) | (0.000983) | (0.000779) | (0.000807) | (0.000776) | (0.000970) |
| Lev | − 0.0713 | − 0.110** | − 0.217*** | − 0.221*** | − 0.0590 | − 0.108* | − 0.216*** | − 0.263*** |
| | (0.0490) | (0.0526) | (0.0514) | (0.0664) | (0.0532) | (0.0552) | (0.0530) | (0.0663) |
| Beta | 0.00999 | − 0.00653 | − 0.00125 | − 0.0474*** | 0.0106 | − 0.00157 | 0.00223 | − 0.0584*** |
| | (0.0110) | (0.0118) | (0.0115) | (0.0149) | (0.0117) | (0.0122) | (0.0117) | (0.0146) |
| ROA | − 0.0542 | − 0.0629 | − 0.0939 | − 0.0260 | 0.0262 | − 0.0585 | − 0.0741 | 0.00262 |
| | (0.0680) | (0.0730) | (0.0713) | (0.0921) | (0.0729) | (0.0756) | (0.0726) | (0.0908) |
| 2019 | | | | | − 0.0587** | − 0.0263 | − 0.0401 | 0.00838 |
| | | | | | (0.0279) | (0.0290) | (0.0278) | (0.0348) |
| 2020 | | | | | − 0.0233 | − 0.0213 | − 0.0113 | 0.0211 |
| | | | | | (0.0281) | (0.0291) | (0.0280) | (0.0350) |
| 2021 | | | | | − 0.0220 | − 0.00479 | − 0.0331 | 0.0148 |
| | | | | | (0.0280) | (0.0290) | (0.0279) | (0.0349) |
| 2022 | | | | | − 0.0286 | 0.00373 | − 0.0266 | 0.0628* |
| | | | | | (0.0283) | (0.0294) | (0.0282) | (0.0353) |
| Constant | − 0.596*** | − 0.156 | 0.122 | 0.481*** | − 0.522*** | − 0.224 | 0.0997 | 0.365** |
| | (0.123) | (0.132) | (0.129) | (0.167) | (0.133) | (0.138) | (0.132) | (0.165) |
| Observations | 1786 | 1786 | 1786 | 1786 | 1786 | 1786 | 1786 | 1786 |
| Panel-effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

stakeholder-agency theory, independent directors serve as potent agents of accountability, ensuring that multiple stakeholder concerns, including sustainability, are integrated into strategic decision-making.

We also find that board gender diversity consistently relates positively with CE initiatives, suggesting that female directors may be especially attuned to stakeholder concerns related to social and environmental responsibility (Orazalin & Mahmood, 2021). Meanwhile, board busyness is negatively associated with CE initiatives, implying that overstretched directors might have less capacity to guide or monitor sustainability practices. This finding resonates with Al-Najjar and Salama (2022), who highlight the pitfalls of overcommitted board members.

Interestingly, ex-CEOs serving as board chairs positively influence CE initiatives, as they likely possess the leadership insights and operational familiarity to guide strategic sustainability investments (Al-Najjar & Salama, 2022). By contrast, board skills do not significantly affect CE initiatives, although this may reflect measurement challenges, or the context-specific nature of "skills" needed to advance CE strategies.

Regarding social performance (SOCI), our findings affirm its positive association with CE initiatives, reinforcing that firms committed to social responsibility also tend to emphasise environmental sustainability. Consistent with earlier results, larger firms, lower leverage, and lower risk correlate with stronger engagement in CE. Lastly, 2021–2022 again show a positive effect on CE initiatives, hinting at continued stakeholder pressures or emerging regulatory frameworks favouring circular practices in the post-pandemic setting.

These findings emphasise the critical interplay between corporate governance, social performance, and board structure in cultivating CE initiatives. In alignment with stakeholder-agency theory, robust governance practices, socially focused strategies, and well-configured boards collectively facilitate alignment between managers and a broad array of stakeholders, thereby motivating deeper engagement with sustainable and circular economic models.

**Table 6** Impact of board structure characteristics on board characteristics

| | | REG | | | | IVREG | | |
|---|---|---|---|---|---|---|---|---|
| VARIABLES | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 |
| B.size | 0.00287 | 0.00294 | 0.00433* | 0.00384 | 0.000350 | 0.000674 | 0.000747 | 0.000783 |
| | (0.00254) | (0.00252) | (0.00250) | (0.00248) | (0.00285) | (0.00283) | (0.00281) | (0.00278) |
| B.indep | 0.000393 | 0.000285 | 0.000780** | 0.000627* | − 0.000682 | − 0.000448 | − 0.000523 | − 0.000297 |
| | (0.000354) | (0.000351) | (0.000342) | (0.000340) | (0.000482) | (0.000491) | (0.000471) | (0.000483) |
| B.diversity | 0.00158*** | 0.000659* | 0.00148*** | 0.000573 | 0.00342*** | 0.00185* | 0.00326*** | 0.00199* |
| | (0.000355) | (0.000397) | (0.000337) | (0.000390) | (0.000795) | (0.00112) | (0.000769) | (0.00111) |
| B.buzy | − 0.0323*** | − 0.0311*** | − 0.0313*** | − 0.0297*** | − 0.0315*** | − 0.030*** | − 0.0300*** | − 0.028*** |
| | (0.00858) | (0.00854) | (0.00855) | (0.00851) | (0.00918) | (0.00910) | (0.00928) | (0.00919) |
| Ex-CEO-chair | 0.0423** | 0.0470** | 0.0471** | 0.0520*** | 0.0354 | 0.0389* | 0.0392* | 0.0427** |
| | (0.0190) | (0.0188) | (0.0190) | (0.0189) | (0.0218) | (0.0214) | (0.0219) | (0.0216) |
| B.skills | 7.00e − 05 | 0.000177 | 2.74e − 05 | 0.000139 | − 0.000331 | 3.52e − 05 | − 0.000863 | − 0.000417 |
| | (0.000240) | (0.000239) | (0.000239) | (0.000238) | (0.000700) | (0.000702) | (0.000707) | (0.000723) |
| SOCI | 0.00149*** | 0.00127*** | 0.00198*** | 0.00168*** | 0.00127* | 0.00125* | 0.00138** | 0.00144** |
| | (0.000321) | (0.000324) | (0.000302) | (0.000311) | (0.000693) | (0.000670) | (0.000641) | (0.000620) |
| Size | 0.0269*** | 0.0124 | | | 0.00798 | 0.000266 | | |
| | (0.0102) | (0.0106) | | | (0.0120) | (0.0118) | | |
| Liq | 0.000198 | 0.000236 | | | 0.000210 | 0.000244 | | |
| | (0.000293) | (0.000290) | | | (0.000285) | (0.000280) | | |
| Lev | − 0.111*** | − 0.123*** | | | − 0.0906*** | − 0.093*** | | |
| | (0.0315) | (0.0318) | | | (0.0331) | (0.0331) | | |
| Beta | 0.188 | 0.257 | | | 0.374* | 0.415** | | |
| | (0.169) | (0.168) | | | (0.213) | (0.209) | | |
| ROA | − 0.0301 | − 0.0264 | | | − 0.0288 | − 0.0188 | | |
| | (0.0403) | (0.0400) | | | (0.0412) | (0.0406) | | |
| 2019 | | − 0.000571 | | − 0.00551 | | − 0.00273 | | − 0.0104 |
| | | (0.00973) | | (0.00947) | | (0.0105) | | (0.0104) |
| 2020 | | 0.0225** | | 0.0135 | | 0.0143 | | 0.00211 |
| | | (0.0106) | | (0.0100) | | (0.0135) | | (0.0132) |
| 2021 | | 0.0379*** | | 0.0323*** | | 0.0285* | | 0.0172 |
| | | (0.0111) | | (0.0106) | | (0.0154) | | (0.0153) |
| 2022 | | 0.0634*** | | 0.0576*** | | 0.0536*** | | 0.0414** |
| | | (0.0120) | | (0.0112) | | (0.0172) | | (0.0167) |
| Constant | − 0.395 | − 0.143 | 0.350*** | 0.386*** | − 0.153 | − 0.0445 | 0.502*** | 0.485*** |
| | (0.285) | (0.288) | (0.0380) | (0.0384) | (0.357) | (0.347) | (0.0765) | (0.0735) |
| Sargan test | | | | | 0.2161 | 0.1095 | 0.4242 | 0.1505 |
| Observations | 1781 | 1781 | 1857 | 1857 | 1569 | 1569 | 1643 | 1643 |
| R-squared | 0.092 | 0.112 | 0.091 | 0.110 | | | | |
| Number of id | 212 | 212 | 214 | 214 | 207 | 207 | 210 | 210 |
| Panel-effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

This table examines how specific board characteristics influence CE adoption. Board variables include size (total directors), independence (% independent directors), gender diversity (% female directors), busyness (average directorships per member), ex-CEO chair (dummy), and skills (% with relevant expertise). All models include panel effects. Standard errors are in parentheses. The variables are defined in Table 1; ***, **, and * are significant at 1%, 5%, and 10% level, respectively

## Further Analyses

We re-estimate our models using the ratio of recycled waste to total waste as the dependent variable, with the results reported in Table 7. We present eight models: Models 1–4 rely on panel regression, while Models 5–8 employ 2SLS panel estimation. Models 3, 4, 7, and 8 further incorporate board structure factors.

Table 7, Panel A examines how corporate governance (CGI) and social performance (SOCI) relate to firms'

**Table 7** Robustness tests using alternative dependent variables and industry controls

| (Panel A): Waste recycle ratio | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | REG | | | | | IV | |
| Variables | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 |
| CGI | 0.000802** | 0.000493 | | | 0.00199** | 0.00125 | | |
| | (0.000347) | (0.000362) | | | (0.000896) | (0.00113) | | |
| SOCI | 0.000156 | − 0.000173 | − 0.000368 | − 0.000404 | − 0.000265 | − 0.00084 | 0.00127* | 0.00125* |
| | (0.000499) | (0.000514) | (0.000519) | (0.000522) | (0.000933) | (0.00104) | (0.000693) | (0.000670) |
| B.size | | | 0.00282 | 0.00273 | | | 0.000350 | 0.000674 |
| | | | (0.00418) | (0.00419) | | | (0.00285) | (0.00283) |
| B.indep | | | 0.000537 | 0.000450 | | | − 0.000682 | − 0.000448 |
| | | | (0.000593) | (0.000596) | | | (0.000482) | (0.000491) |
| b.diversity | | | 0.00218*** | 0.00174*** | | | 0.00342*** | 0.00185* |
| | | | (0.000553) | (0.000650) | | | (0.000795) | (0.00112) |
| B.busy | | | − 0.0273* | − 0.0272* | | | − 0.0315*** | − 0.0309*** |
| | | | (0.0147) | (0.0148) | | | (0.00918) | (0.00910) |
| Ex-CEO-chair | | | − 0.0225 | − 0.0180 | | | 0.0354 | 0.0389* |
| | | | (0.0284) | (0.0286) | | | (0.0218) | (0.0214) |
| B.skills | | | 0.000418 | 0.000462 | | | − 0.000331 | 0.003 |
| | | | (0.000409) | (0.000410) | | | (0.000700) | (0.000702) |
| Control variables | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 0.544 | 0.936* | 0.622 | 0.796 | 0.805 | 0.971 | − 0.153 | − 0.0445 |
| | (0.549) | (0.562) | (0.556) | (0.566) | (0.703) | (0.689) | (0.357) | (0.347) |
| Sargan test | | | | | 0.0189 | 0. 0323 | 0.2161 | 0.1095 |
| Observations | 820 | 820 | 820 | 820 | 747 | 747 | 1569 | 1569 |
| R-squared | 0.017 | 0.034 | 0.044 | 0.050 | | | | |
| Number of id | 127 | 127 | 127 | 127 | 126 | 126 | 207 | 207 |
| Panel-effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

| (Panel B): Pollution-dummy | | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| Variables | M1 | M2 | M3 | M4 | M5 | M6 |
| CGI | 0.00109*** | 0.000971*** | 0.000537** | 0.000822** | 0.000804** | 0.000496 |
| | (0.000199) | (0.000208) | (0.000219) | (0.000325) | (0.000347) | (0.000362) |
| SOCI | 0.00228*** | 0.00178*** | 0.00136*** | 0.000150 | 0.000163 | − 0.000165 |
| | (0.000278) | (0.000307) | (0.000318) | (0.000446) | (0.000500) | (0.000515) |
| Pollution-dummy | 0.0127 | 0.0245 | 0.0237 | 0.00545 | 0.0147 | 0.0151 |
| | (0.0166) | (0.0185) | (0.0183) | (0.0270) | (0.0294) | (0.0293) |
| Control variables | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 0.354*** | − 0.373 | − 0.0439 | 0.616*** | 0.525 | 0.915 |
| | (0.0196) | (0.280) | (0.285) | (0.0362) | (0.551) | (0.564) |
| Observations | 1861 | 1786 | 1786 | 849 | 820 | 820 |
| R-squared | 0.077 | 0.080 | 0.102 | 0.010 | 0.018 | 0.034 |
| Number of id | 214 | 212 | 212 | 130 | 127 | 127 |
| Panel-effects | Yes | Yes | Yes | Yes | Yes | Yes |

Panel A: Waste Recycling Ratio as Dependent Variable, this panel uses the ratio of recycled waste to total waste as an alternative measure of CE engagement. Panel B: Including Industry Pollution Intensity Controls, this panel adds a dummy variable for potentially high-polluting sectors (Energy, Materials, Industrials, High Technology, Utilities). All models include panel effects. Standard errors are in parentheses. The variables are defined in Table 1; ***, **, and * are significant at 1%, 5%, and 10% level, respectively; for parsimony, we reported only our main variable

recycling efforts—an essential dimension of CE initiatives. The results indicate a positive association between CGI and the ratio of recycled waste in Models 1 and 5 and a positive effect of SOCI on the recycling ratio in Models 7 and 8. These findings echo our earlier conclusions that robust governance and strong social engagement underpin effective recycling programmes. We also observe that board gender diversity and having an ex-CEO as board chair each have a positive impact on the recycling ratio in Model 8, whereas board busyness exerts a negative influence. This pattern suggests that directors with multiple affiliations may lack the bandwidth to effectively oversee sustainability-oriented initiatives. In addition, firm leverage, systematic risk, and the years 2021–2022 emerge as important determinants of recycling efforts.

In Table 7, Panel B, we include an industry dummy to account for potential differences in highly polluting sectors. The first four models use CE as the dependent variable, and the subsequent four use the recycling ratio. The results show no significant effect of belonging to a highly polluting industry. Moreover, the positive relationships between CGI, SOCI, and CE activities remain robust, reinforcing the importance of sound governance practices and social responsibility for promoting both circular economy engagement and effective recycling efforts.

## Robust Analysis-Additional Models to Address Endogeneity

We employ multiple approaches to mitigate potential endogeneity concerns in line with our methodology. First, we use a dynamic GMM framework, with results reported in Table 8. Our key variables of interest—corporate governance (CGI) and social performance (SOCI)—both show a positive association with CE initiatives (Models 1, 2, 7,

**Table 8** Dynamic GMM models addressing endogeneity

| Variables | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 |
|---|---|---|---|---|---|---|---|---|
| L.ceratio | 0.649*** | 0.620*** | 0.615*** | 0.603*** | | | 0.646*** | 0.623*** |
| | (0.103) | (0.104) | (0.103) | (0.104) | | | (0.103) | (0.104) |
| l.waste | | | | | 0.475** | 0.436** | | |
| | | | | | (0.187) | (0.189) | | |
| CGI | 0.00049** | 0.00032 | | | 0.000286 | 0.000338 | 0.00051** | 0.000326 |
| | (0.000246) | (0.0002) | | | (0.00040) | (0.00041) | (0.000246) | (0.000257) |
| SOCI | 0.0022*** | 0.002*** | 0.002*** | 0.0017*** | 0.000752 | 0.00103 | 0.0022*** | 0.0018*** |
| | (0.000389) | (0.0004) | (0.0004) | (0.0004) | (0.00062) | (0.00071) | (0.000389) | (0.000439) |
| B.size | | | 0.00481 | 0.00407 | | | | |
| | | | (0.00319) | (0.00317) | | | | |
| B.indep | | | 0.000670 | 0.000130 | | | | |
| | | | (0.000450) | (0.000460) | | | | |
| B.diversity | | | 0.000484 | 0.00105** | | | | |
| | | | (0.000406) | (0.000446) | | | | |
| b.buzy | | | − 0.0275** | − 0.0264** | | | | |
| | | | (0.0128) | (0.0126) | | | | (0.0128) |
| Ex-CEO-chair | | | 0.0190 | 0.0215 | | | | |
| | | | (0.0276) | (0.0266) | | | | |
| B.skills | | | 0.000219 | 0.000216 | | | | |
| | | | (0.000295) | (0.000291) | | | | |
| Pollution-dummy | | | | | | | 0.00894 | 0.0176 |
| Control variables | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 0.0379 | − 0.379 | 0.00301 | − 0.273 | 0.299** | 0.780 | 0.0344 | − 0.405 |
| | (0.0667) | (0.418) | (0.0812) | (0.432) | (0.133) | (0.750) | (0.0672) | (0.420) |
| Observations | 1435 | 1363 | 1431 | 1359 | 571 | 549 | 1434 | 1363 |
| Number of id | 204 | 200 | 204 | 200 | 108 | 105 | 204 | 200 |
| Panel-effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

This table presents Generalized Method of Moments (GMM) results to address potential endogeneity and dynamic effects. Models include lagged dependent variables (L.ceratio for CE-ratio, L.waste for waste ratio). All models include panel effects. Standard errors are in parentheses. The variables are defined in Table 1; ***, **, and * are significant at 1%, 5%, and 10% level, respectively; for parsimony, we reported only our main variable

and 8 for CGI; Models 1, 2, 3, 4, 7, and 8 for SOCI), corroborating our earlier findings and supporting H1 and H2. Additionally, board independence and board gender diversity positively affect CE initiatives, whereas board busyness has a negative effect, mirroring previous results.

Next, to further address possible reverse causality, we lag the independent variables and re-estimate the models, as reported in Table 9. The results again confirm the positive link between corporate governance, social performance, and CE initiatives, while the effects of board gender diversity and board busyness remain consistent. These outcomes highlight the robustness of our findings under lagged specifications.

We also adopt a Propensity Score Matching (PSM) methodology (Table 10, Panels A and B) to control for any endogeneity issues without relying on instrumental variables. Following prior governance and policy studies (e.g. Casu et al., 2013), we classify firms with CGI (Panel A) or SOCI (Panel B) above the mean as the treatment group and those below the mean as the control group, performing 1:1 nearest-neighbour matching. Across both panels, we again observe a positive effect of CGI and SOCI on CE initiatives and consistent relationships for board gender diversity (positive) and board busyness (negative).

Finally, we use a neural network model to estimate the relative importance of our independent variables. In repeated estimations, the Corporate Governance Index generally emerges as the most influential predictor (importance ~ 0.275, normalised at 100%), closely followed by Social Performance (importance ~ 0.263, normalised at ~ 95%). In some iterations, SOCI attains the highest importance. Given the consistency of these results, we omit detailed tables for parsimony.

Overall, these additional robustness checks—dynamic GMM, lagged variable models, PSM, and neural network analyses—reinforce the positive and significant effects of corporate governance and social performance on CE initiatives while highlighting the importance of board composition in driving environmentally sustainable practices.

**Table 9** Robustness tests using lagged independent variables

| Variables | M1 | M2 | M3 | M4 | M5 | M6 | M7 | M8 |
|---|---|---|---|---|---|---|---|---|
| CGI | 0.000779*** | 0.000685*** | | | 0.000853** | 0.000748** | 0.000779*** | 0.000685*** |
| | (0.000207) | (0.000211) | | | (0.000340) | (0.000358) | (0.000207) | (0.000211) |
| SOC | 0.00191*** | 0.00151*** | 0.00130*** | 0.00113*** | 7.29e − 05 | − 0.000162 | 0.00191*** | 0.00151*** |
| | (0.000287) | (0.000314) | (0.000310) | (0.000327) | (0.000467) | (0.000522) | (0.000287) | (0.000314) |
| B.size | | | 0.00371 | 0.00289 | | | | |
| | | | (0.00257) | (0.00258) | | | | |
| B.indep | | | 0.000406 | 0.000394 | | | | |
| | | | (0.000357) | (0.000359) | | | | |
| B.diversity | | | 0.00197*** | 0.00159*** | | | | |
| | | | (0.000360) | (0.000370) | | | | |
| b.buzy | | | − 0.0157* | − 0.0216** | | | | |
| | | | (0.00894) | (0.00890) | | | | |
| Ex-CEO-Chair | | | 0.0183 | 0.0231 | | | | |
| | | | (0.0193) | (0.0191) | | | | |
| B.skills | | | − 0.000211 | − 0.000161 | | | | |
| | | | (0.000240) | (0.000239) | | | | |
| Control Variables | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |
| Constant | 0.411*** | − 0.815*** | 0.414*** | -0.769*** | 0.623*** | 0.144 | 0.411*** | − 0.815*** |
| | (0.0183) | (0.276) | (0.0392) | (0.282) | (0.0349) | (0.562) | (0.0183) | (0.276) |
| Observations | 1649 | 1595 | 1644 | 1590 | 776 | 755 | 1649 | 1595 |
| *R*-squared | 0.050 | 0.075 | 0.073 | 0.091 | 0.010 | 0.016 | 0.050 | 0.075 |
| Number of id | 210 | 208 | 210 | 208 | 129 | 126 | 210 | 208 |
| Panel-effects | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes |

This table reports results using one-period lagged values of all independent variables to address potential reverse causality. All models include panel effect. Standard errors are in parentheses. The variables are defined in Table 1; ***, **, and * are significant at 1%, 5%, and 10% level, respectively; for parsimony, we reported only our main variable

**Table 10** Propensity score matching (PSM) analysis

| PSM-Panel A | | | | |
|---|---|---|---|---|
| Variables | M1 | M2 | M3 | M4 |
| CGI | 0.00107*** | 0.00100*** | | |
| | (0.000204) | (0.000211) | | |
| SOC | 0.00213*** | 0.00185*** | 0.00174*** | 0.00156*** |
| | (0.000286) | (0.000310) | (0.000313) | (0.000324) |
| B.size | | | 0.00396 | 0.00309 |
| | | | (0.00255) | (0.00257) |
| B.indep | | | 0.000428 | 0.000409 |
| | | | (0.000361) | (0.000359) |
| B.diversity | | | 0.00176*** | 0.00159*** |
| | | | (0.000345) | (0.000359) |
| b.buzy | | | − 0.0303*** | − 0.0328*** |
| | | | (0.00862) | (0.00863) |
| Ex-CEO-Chair | | | 0.0454** | 0.0440** |
| | | | (0.0193) | (0.0193) |
| B.skills | | | 0.000158 | 9.60e − 05 |
| | | | (0.000245) | (0.000245) |
| Control Variables | Yes | Yes | Yes | Yes |
| Constant | 0.372*** | − 0.373 | 0.375*** | − 0.432 |
| | (0.0184) | (0.283) | (0.0398) | (0.289) |
| Observations | 1772 | 1772 | 1767 | 1767 |
| R-squared | 0.067 | 0.081 | 0.082 | 0.094 |
| Number of id | 212 | 212 | 212 | 212 |
| Panel-effects | Yes | Yes | Yes | Yes |
| PSM Panel B | | | | |
| Variables | M5 | M6 | M7 | M8 |
| CGI | 0.00108*** | 0.000982*** | | |
| | (0.000202) | (0.000209) | | |
| SOC | 0.00209*** | 0.00180*** | 0.00170*** | 0.00150*** |
| | (0.000286) | (0.000310) | (0.000313) | (0.000325) |
| B.size | | | 0.00393 | 0.00300 |
| | | | (0.00254) | (0.00256) |
| B.indep | | | 0.000415 | 0.000392 |
| | | | (0.000358) | (0.000356) |
| B.diversity | | | 0.00178*** | 0.00158*** |
| | | | (0.000343) | (0.000356) |
| b.buzy | | | − 0.0298*** | − 0.0322*** |
| | | | (0.00859) | (0.00860) |
| Ex-CEO-Chair | | | 0.0456** | 0.0444** |
| | | | (0.0193) | (0.0193) |
| B.skills | | | 0.000154 | 7.63e − 05 |
| | | | (0.000241) | (0.000241) |
| Control Variables | Yes | Yes | Yes | Yes |
| Constant | 0.375*** | − 0.358 | 0.379*** | − 0.415 |
| | (0.0184) | (0.283) | (0.0394) | (0.288) |
| Observations | 1778 | 1778 | 1773 | 1773 |
| *R*-squared | 0.066 | 0.078 | 0.081 | 0.092 |
| Number of id | 211 | 211 | 211 | 211 |
| Panel-effects | Yes | Yes | Yes | Yes |

Panel A: PSM Results for Corporate Governance Treatment. Panel B: PSM Results for Social Performance Treatment. All models include panel effects. Standard errors are in parentheses. The variables are defined in Table 1; ***, **, and * are significant at 1%, 5%, and 10% level, respectively; for parsimony, we reported only our main variable

## Discussion and Conclusion

This study makes a distinctive contribution to the literature on corporate governance, social performance, and the circular economy (CE) by analysing a newly constructed CE index for non-financial FTSE 350 firms. Comprising eight key policies including recycling, eco-product design, and resource and energy efficiency, this index provides a comprehensive lens for gauging firms' CE commitments. The main independent variables, the Corporate Governance Index (CGI) and Social Performance Index (SOCI), obtained from Refinitiv Eikon/LSEG, offer granular insights into firms' governance structures and social engagement.

Grounded in stakeholder-agency theory, our findings reveal that strong governance practices significantly enhance firms' engagement in CE initiatives, emphasising the role of effective board oversight and accountability in promoting sustainable resource use. Likewise, commendable social performance positively influences CE adoption, suggesting that social responsibility catalyses the embedding of sustainability practices, with CE activities acting as a tangible reflection of these values. Together, these insights extend environmental research and situate the CE firmly within the governance–social responsibility nexus—an area that has remained relatively unexplored. Moreover, the results are robust to extensive endogeneity checks and across diverse quantiles in both the COVID-19 and post-COVID periods, indicating that the pandemic context did not substantially impede firms' progress towards CE. At the board level, board size, independence, gender diversity, the presence of former-CEO chairs, and members' busyness, each shape CE outcomes; notably, board busyness is negatively linked to CE, implying that overstretched directors may hinder attention to environmental concerns. These conclusions hold when the CE index is replaced with the recycling ratio and remain unaffected by controlling for highly polluting industries, underscoring the generalisability of our findings.

The ethical dimensions of these results extend beyond the statistical relationships observed. Following Greenwood and Freeman (2017, 2018), we recognise that circular economy initiatives are not inherently ethical without critical scrutiny. Our findings reveal that the ethical implications of CE practices are deeply intertwined with corporate governance structures, challenging the notion that such practices can be "*ethically neutral*" (Greenwood & Freeman, 2017; p. 1). The association between high-quality governance and CE engagement points to the importance of ethical accountability mechanisms in promoting responsible resource stewardship. However, as Islam and Greenwood (2021) contend, business ethics must move beyond prescribing corporate actions to questioning the kind of economic world they create. Our evidence suggests that CE initiatives, when supported by strong governance and social performance, represent not merely operational adjustments but potential transformations in how businesses conceptualise their relationship with natural resources and society. This aligns with Hockerts and Searcy's (2023) call to shift the focus from eco-efficiency—optimising resource use while keeping profit primary—to eco-effectiveness, where sustainable resource use becomes the prime objective and profit is secondary.

Tensions between competing objectives in CE implementation reveal further ethical considerations. Our findings on board characteristics suggest that governance structures influence how firms navigate what Hockerts and Searcy (2023) describe as "paradoxical frames" (p. 228)—scenarios in which multiple desirable objectives are in conflict. For instance, the positive effect of board gender diversity on CE initiatives suggests that diverse perspectives may help boards better balance competing stakeholder interests in sustainability decisions. Conversely, the adverse impact of board busyness highlights the ethical concern that divided attention may compromise directors' stewardship obligations. From a society-centric perspective (Du et al., 2023), our results raise questions about the distribution of benefits from CE initiatives. While we demonstrate that governance quality enhances CE adoption, it remains necessary to assess whether these initiatives benefit all stakeholders equally or impose unintended burdens on vulnerable groups—particularly salient given the continuation of CE programmes during the pandemic, a period of heightened social vulnerability.

The study yields several policy implications. Evidence on board composition strongly supports regulations that promote gender diversity as a deliberate environmental-governance instrument; diversity requirements therefore should be strengthened and accompanied by measures that reinforce board independence. Because we find that overextended directors impede CE engagement, policymakers should impose tighter limits on the number of concurrent directorships, particularly in environmentally sensitive industries, to ensure directors have the capacity to address complex sustainability challenges. Retaining organisational knowledge also matters: the positive association between former-CEO chairs and CE initiatives suggests that carefully structured succession or hybrid leadership arrangements can balance continuity with the need for independent oversight. The persistence of CE programmes during COVID-19 demonstrates that emergency economic measures need not undercut environmental objectives, implying that post-crisis recovery packages can—and should—explicitly target governance improvements as a mechanism for "building back circular". Finally, heterogeneous effects across the CE distribution argue for tiered regulatory frameworks that recognise firms' different starting points rather than one-size-fits-all rules.

Translating these insights into actionable strategies, governments could combine diversity targets or disclosure mandates with fiscal incentives that reward firms for demonstrable improvements in governance quality linked to CE performance. Limits on multiple directorships should be codified, and industry-specific CE benchmarks—built on the study's eight-dimension index—should become standard reporting metrics. Within firms, boards can institute CE-specific governance training, embed CE indicators in executive remuneration, create dedicated sustainability committees to counteract director busyness, and use the expertise of independent directors and seasoned former CEOs to steer circular initiatives. Public–private partnerships, knowledge-sharing platforms, and investor-oriented education campaigns can further diffuse best practices that connect effective governance to CE progress.

In positioning the research within the existing literature, the results corroborate earlier evidence that board size and independence promote environmental initiatives (De Villiers et al., 2011; Orazalin & Mahmood, 2021), yet they extend these insights to the more demanding domain of circularity. Gender-diverse boards again prove advantageous, while the negative impact of board busyness nuances claims that multiple directorships enhance board capital. The results regarding gender diversity align with those of Bear et al. (2010) and Al-Najjar and Salama (2022), who also found positive relationships between female directors and CSR performance. By spanning the COVID-19 period, the study shows that the governance–sustainability relationship endures even amid systemic shocks, suggesting deeper institutionalisation of CE principles than previously assumed. Methodological contributions include a purpose-built CE index and the triangulation of panel regression, 2SLS, GMM, and PSM, which collectively provide stronger causal inference than single-method designs.

Our study also differs from previous research (e.g. Esposito et al., 2023) in its temporal context. Unlike studies conducted before the COVID-19 pandemic, our analysis spans this critical period, revealing that the governance–sustainability relationship remained robust even during unprecedented disruption. This finding reinforces that sustainability initiatives might not be sacrificed during crises (Rahman et al., 2024; Antonia et al., 2013) and suggests greater institutional embedding of sustainability than previously recognised. Methodologically, our study advances beyond previous work by employing multiple analytical approaches (panel regression, 2SLS, GMM, PSM) to address endogeneity concerns. This comprehensive approach provides stronger causal evidence than many previous studies that relied on single methodologies. Additionally, our development of a specific CE index represents a methodological innovation compared to studies using generic ESG ratings or environmental performance metrics.

Future research could enrich understanding by comparing governance–CE dynamics across countries, probing how specific governance attributes influence distinct circular practices such as recycling versus eco-design, and clarifying the mediating role of regulatory frameworks. Additional work should also investigate how social performance metrics interact with governance structures to spur circular innovation and how stakeholder benefits are distributed across socioeconomic groups.

For managers, the practical message is clear: robust governance mechanisms, independent directors, gender diversity, carefully selected former-CEO chairs, and limits on external board mandates are critical enablers of CE initiatives. Social performance should be integrated with, not isolated from, CE strategy, and stakeholder engagement must inform the design of circular business models. Because the pandemic demonstrated the resilience of well-designed sustainability programmes, CE should be treated as a strategic imperative rather than a discretionary add-on, with governance approaches tailored to a firm's stage of circular maturity. Managers must also recognise the inherent trade-offs among economic, environmental, and social objectives and deploy governance mechanisms capable of navigating, rather than denying, these tensions.

The positive relationship between governance quality and CE adoption suggests that well-governed firms are more likely to align their operations with broader societal values regarding resource stewardship and environmental protection. However, following Islam and Greenwood's (2021) call for "reconnecting to the social in business ethics", we recognise that the ethical implications of CE extend beyond corporate boundaries to encompass impacts on communities, workers, and future generations. The circular economy represents not merely an operational shift but a potential reimagining of business–society relationships. Our findings suggest that governance structures play a crucial role in enabling or constraining this reimagining. By integrating these insights, this research strengthens our understanding of how firms can better align managerial decision-making with the diverse interests of stakeholders—ultimately advancing the long-term sustainability and competitive advantage of organisations committed to circular economy principles.

**Data availability** The data of this study are available from the corresponding author upon reasonable request.

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