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RESEARCH ARTICLE

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Do corporate sustainability initiatives improve corporate carbon performance? Evidence from European firms

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Abstract

We contribute to the business strategy and the environment literature by investigating the influence of corporate sustainability initiatives and corporate carbon performance of European listed firms. We use three-way fixed-effects model, and our sample comprises of 2444 firm-year observations from 12 European countries, covering a 16-year period (2004–2019). First, we find that corporate sustainability initiatives, a composite measure comprising of emission reduction initiatives, environmental innovations and efficient use of resources, has a positive relationship with corporate carbon performance, in terms of reduced greenhouse gas (GHG) emission intensity. Second, we find that the relationship between corporate sustainability initiatives and corporate carbon performance is stronger for firms in polluting industries. Overall, our evidence lends support for the efficiency-oriented arguments of the neo-institutional theory in that organisations respond to climate-related risks by making substantive engagements in corporate sustainability initiatives, such as emission reduction initiatives, environmental innovations and efficient use of resources, which in turn facilitates organisations' effort to reduce GHG emission and improve corporate carbon performance.

KEYWORDS

climate change, corporate environmental performance, corporate sustainability initiatives, efficient use of resources, environmental innovations, environmental policies, GHG emissions, neo-institutional theory

> … The European Green Deal is our growth strategy that is moving towards a decarbonised economy. Europe was the first continent to declare to be climate neutral in 2050, and now we are the very first ones to put a concrete roadmap on the table. Europe walks the talk on climate policies through innovation, investment and social compensation. European Commission President, Ursula von der Leyen (European Commission, 2021b; Press release IP/21/3541, Brussels 14 July 2021).

1 | INTRODUCTION

In this study, we seek to contribute to the extant business strategy and the environment literature by examining the influence of corporate sustainability initiatives on corporate carbon performance of

Abbreviations: CDP, carbon disclosure project; COP26, The 26th United Nations Climate Change Conference; CSR, corporate social responsibility; EC, European Commission; ESG, environmental, social and governance; ETS, emission trading scheme; EU, European Union; GHG, greenhouse gas; NFRD, non-financial reporting directive; NIT, neo-institutional theory; WINGS, weighted influence non-linear gauge system.

European firms. The 26th United Nations Climate Change Conference (COP26) has just reached the 2021 Glasgow Climate Pact—a global agreement on ambitious net-zero commitments covering around 90% of global emissions and 90% of global GDP, a nonbinding commitment from 153 countries covering four areas of priorities: (i) mitigation, (ii) adaptation, (iii) finance and (iv) collaboration (United Nations, 2021). While this is considered to be a significant progress towards meeting the emission reduction target to limit the rise in global temperature to 1.5°C, this is likely to be dependent on the degree of compliance with COP26 commitments by the signatories, especially by large businesses operating in developed and the largest polluting economies, together with close collaborations among the multilateral organisations, governments, market participants and civil societies.

European countries, being the forefront in driving the 2015 Paris Climate Agreement 2015, appear to be in a better position to meet their COP26 commitments and the 2050 Climate Neutrality target by undertaking several major policy initiatives, such as the 2019 European Green Deal 2019 and the 2021 European Climate Law. These initiatives were intended, among other things, to integrate corporate sustainability practices into the broad-based green transition agenda covering both market- and non-market-related mechanisms on climate, energy, land use, transport and taxation (European Commission [EC], 2021b). Against this backdrop, it would be interesting to understand whether and how corporate sustainability initiatives lead to a reduction of greenhouse gas (GHG) emissions and thus contribute to Europe's climate neutrality target.

Meanwhile, a growing body of available literature examines corporate sustainability disclosure and performance from a number of dimensions. Among others, Clarkson et al. (2008), Qian and Schaltegger (2017) and Giannarakis et al. (2017) investigate the relationship between environmental (carbon) disclosure and environmental (carbon) performance and find a positive association between these corporate sustainability indicators. This is contrary to the findings of related studies (Boiral & Hras-Saizarbitoria, 2017; Haque & Ntim, 2018) that support the legitimisation or greenwashing (or impression management) arguments in that organisations focus on environmental disclosures or symbolic environmental engagements, without demonstrating improved environmental performance. Another stream of literature (Baboukardos, 2018; Choi & Luo, 2021; Tuesta et al., 2021) addresses the value relevance of environmental performance and GHG emission and finds that investors reward firms with improved environmental performance and lower emissions with higher valuation.

Theoretically, neo-institutional theory (NIT) suggests that firms' responses to institutional pressures relating to climate-related risks are driven by legitimacy (symbolic)- and efficiency (economic)-oriented motives (DiMaggio & Powell, 1983, 1991; Scott, 2001). According to this theory, the interplay among the institutions, stakeholders and organisation's actors and groups can lead to the adoption of symbolic corporate sustainability practices to gain or enhance corporate legitimacy or a substantive engagement in climate mitigation projects to achieve efficient outcome in terms of reduced carbon missions (Haque & Ntim, 2018, 2020). In the context of our current study, the multidimensional constructs of NIT appear to be an appropriate framework to capture both the legitimisation aspect of an organisation's corporate sustainability initiatives and efficiency aspect of an organisation's substantive outcome, such as GHG emissions.

Interestingly, as mentioned above, available literature does not seem to have addressed the influence of firms' corporate sustainability initiatives on actual carbon performance or GHG emission. Although, as mentioned above, several studies examine corporate environmental (carbon) disclosure and corporate environmental (carbon) performance, the evidence tends to be largely inconclusive. Empirically, and from a policy perspective, it is imperative to understand this relationship. One the one hand, organisations' corporate sustainability practices might be focusing on legitimisation objective, rather than substantive environmental commitments, given that climate mitigation projects require significant long-term financial commitments. One the other hand, organisations might undertake substantive engagements in emission reduction initiatives, climate-related innovations and better use of scarce resources, so as to demonstrate efficient sustainability outcome in the form of improved carbon performance.

Therefore, we investigate whether and how corporate sustainability initiatives influence corporate carbon performance in terms of reduced GHG emissions of a firm. We carry out our analysis by using a sample of 2444 firm-year observations from 12 European Union (EU) countries by capturing data over a 16-year period from 2004 to 2019. Our analyses are based on both univariate (*t* tests and correlations) and multivariate (three-stage least square regressions) analyses.

Consequently, we intend to make the following notable new contributions to the existing body of business strategy and the environment literature: First, we contribute to a limited body of empirical literature on environmental (carbon) disclosure and environmental (carbon) performance by extending the investigation on whether and how corporate sustainability initiatives are associated with an improved corporate carbon performance. We do this by using a composite measure of corporate sustainability initiatives, as well as individual environmental indicators, such as emission reduction initiatives, environmental innovations and efficient use of resources to see if these initiatives are linked with a reduction in GHG emissions. Second, and contrary to the evidence of greenwashing or impression management or inconclusive findings of past studies (Boiral & Hras-Saizarbitoria, 2017; Haque & Ntim, 2018), our results suggest that European firms engage in substantive corporate sustainability initiatives through undertaking emission reduction initiatives, climate-related innovations and efficient use resources, which in turn reduce GHG emissions and improve corporate carbon performance. Third, we complement other contemporary studies on European firms (e.g., Number & Velte, 2021; Qureshi et al., 2020; Tuesta et al., 2021) that examine board characteristics; environmental, social and governance (ESG) disclosure; carbon performance and market value.

Fourth, we contribute to 'evidence-based research' that is likely to support policymakers to outline specific policies and action plans for the corporate sector to commit to, and engage in, meaningful sustainability initiatives in priority areas of climate, energy, land use and transportation, as set out in the European Green Deal 2019, as part of the EU's 2050 climate neutrality project. Finally, we use NIT—a multidimensional theoretical framework—to broaden our understanding of how organisations respond to unprecedented existential threat of climate change, while being driven either by the legitimisation motive of symbolic corporate sustainability initiatives or by the efficiency motive of substantive environmental outcome. Our evidence lends support for the efficiency-oriented view of NIT in that organisations tend to have substantive climate-related engagements, which in turn are linked with a reduction in actual GHG emissions.

This paper is structured as follows: Following this introduction, Section 2 presents a review of literature covering the context of the study, theoretical framework and hypotheses development. Section 3 specifies the methodological details, and Section 4 presents and discusses the findings of the study results. Finally, Section 5 provides conclusion of the study.

2 | LITERATURE REVIEW

2.1 | Context of the study

The EC is generally considered to be a pioneer in adopting a wide range of mandatory and voluntary regulatory initiatives with sector-wise targets and timetables for the European Union (EU) countries and firms to undertake climate adaptation and mitigation initiatives and action plans. For example, the European emission trading scheme (ETS), introduced in 2005 under the Kyoto protocol, is considered to be the largest government-mandated market-based mechanism to reduce GHG emissions. The ETS is considered to be a consolidated scheme to support organisations' climate change management through a collaborative relationship between the government and industry (Tuesta et al., 2021). The ETS (also known as 'cap-and-trade system') requires companies in polluting sectors to reduce the emission below the limits (caps) set by the regulators or pay the price of buying (trading) additional carbon credits from the carbon market to compensate for excessive carbon emission (Choi & Luo, 2021).

The EC issued the Non-Financial Reporting Directive (NFRD) (e.g., Directive 2014/95/EU) to promote corporate sustainability disclosure practices of large EU firms, with several subsequent amendments afterwards to include, among other things, climate-related disclosure requirements and the provision of assurance (audit) of the reported information (EC, 2021a). This included a recent issuance of a nonbinding guideline on climate-related corporate reporting in 2019 to improve the quality of corporate sustainability disclosures along the lines of the Task Force on Climate-Related Financial Disclosures (TCFD) recommendations (Number & Velte, 2021). As part of the 2050 climate neutrality target, the EC adopted the European Green Deal in 2019 consisting of a set policies and proposals relating to energy efficiency, climate change mitigation and adaption, taxation, transport and land use in order to reduce GHG emissions by at least 55% by 2030 from the benchmark emission level of 1990 (EC, 2021b). Part of these initiatives include the adoption of European Climate Law 2021 and the development of long-term budget of allocating €2 trillion to support the green transition over a 7-year period (2021–2027).

In addition to these market- and non-market-related policy initiatives, there have also been greater activisms of the institutional investors, market players and global media to promote ESG-related financial instruments and services, causing further pressure on companies to engage in corporate sustainability initiatives. For example, a recent Bloomberg study (Bloomberg, 2021) suggests a 10-fold increase in investments in sustainability-oriented funds and an eight-fold increase in ESG-related issuance of debt over a period of 5 years from 2015 to 2020. The report also highlights a significant increase in the size of the green economy that is estimated to be around 6% of global market capitalisation in 2020.

Many EU firms tend to demonstrate voluntary adoption of climate-related engagements, such as environmental management systems, compliance with the TCFD, partnership with the carbon disclosure project (CDP) and the provision of external assurance of carbon disclosure (Number & Velte, 2021). However, there is also evidence of a lack of substantive corporate commitments and initiatives by setting out both long- and short-term measurable targets and action plans towards net-zero emissions, with 53% of the largest emitters having no short-term targets in reducing carbon emission (Bloomberg, 2021).

2.2 | Theoretical framework

We use NIT to explain the influence of corporate sustainability initiatives and innovations on firms' GHG emissions. Unlike other theories, NIT is considered to be a multidimensional theory that has successfully captured the '(economic) efficiency or the value creation' arguments of the economic (agency and transection cost) theories and the 'moral, symbolic or legitimatisation' arguments of sociopolitical (stakeholder and legitimacy)[1] theories (Ashforth & Gibbs, 1990; DiMaggio & Powell, 1983). Consequently, a number of studies use NIT to explain the diffusion and/or imposition of corporate governance and accounting standards (Aguilera et al., 2007) and to explain the impact of the Climate Change Act (Haque & Ntim, 2018). As our empirical framework captures both process-oriented or symbolic aspects of corporate

[1]We note that the NIT version of institutional theory have both legitimation (symbolic) and efficiency (substantive) perspectives. We, however, note further that these two perspectives are not necessarily always dichotomous, but sometimes can be a continuum. For example, due to financial or time constraints, a firm may engage in symbolic sustainability initiatives (e.g., announcement of green policies, initiatives and plans) in order to gain or repair their legitimacy and continue to engage and expand their operations, but may not have a direct impact on the efficiency (e.g., reduction in energy expenses and reduction in carbon emissions/footprint) of their operations. This is because majority of sustainability initiatives tend to take time to have substantive impact. In this case, substantive initiative may have symbolic impact in the short term but substantive impact in the long term. In this case, the legitimation versus efficiency dichotomy will not exist but will be more of a continuum. Nonetheless, in practice, firms tend to pursue a mixture of symbolic (legitimation) and substantive (efficiency) motives with respect to sustainability initiatives.

sustainability initiatives and substantive outcome of actual GHG emissions, NIT appears to be more appropriate framework to capture our multidimensional constructs.

Scott (2001) builds on DiMaggio and Powell's (1983, 1991) arguments on institutional theory and advances the proposition of NIT. According to institutional theory, as proposed by DiMaggio and Powell (1983), organisations conform to three forms of institutional isomorphism to gain or enhance organisational legitimacy: First, organisations comply with laws, regulations and cultural expectations as part of *coercive/regulative isomorphism*. Second, organisations tend to emulate the best corporate practices of industry peers or other successful organisations, and thus conform to *cognitive/mimetic isomorphism*. Finally, organisations comply with *normative isomorphism* by adopting the policies, processes and practices that are followed or recommended by powerful professional bodies and networks. Subsequently, Scott (2001) broadens the scope of institutional theory by proposing NIT and argues that firms' responses to the three forms of institutional isomorphism are driven by both the legitimacy- and efficiency-oriented motives (Ntim & Soobaroyen, 2013).

On the one hand, the legitimisation or moral aspects of organisational motive tends to drive an organisations engagement in corporate sustainability policies and practices in order to respond to institutional pressures and to gain, maintain or enhance organisational legitimacy (e.g., Suchman, 1995). This can often be symbolic process-oriented environmental performance that might not result in an actual improvement in environmental outcome such as a decline in emission or environmental pollution (Delmas et al., 2013). In contrast, the instrumental or efficiency-oriented motive shapes organisations' engagement with substantive and economically efficient corporate sustainability projects (such as environmental innovations, energy-efficient solutions) that can lead to an improved environmental performance and shareholder value (Aguilera et al., 2007; North, 1991).

For Scott (2001), NIT focuses on analysing institutional norms and practices at three levels, such as societal or global institutions (such as COP26 or Paris Climate Agreement), organisation's structures and its industry practices (such as governance structure of firms and ETS) and individual actors and groups such as independent or gender-diverse board (Ntim & Soobaroyen, 2013). Ntim and Soobaroyen (2013) argue that these three levels of actors and forces tend interact with each other, and as a result, new forms of institutional norms and practices can be imposed, diffused or evolved through ongoing negotiations and/or innovations. This can eventually lead to either an adoption of symbolic corporate sustainability practices (such as regulatory compliance in the forms in policies, processes and disclosures) to gain/maintain/repair corporate legitimacy or a meaningful or substantive engagement in climate mitigation projects (such as target-oriented emission reductions initiatives, green products or energy-efficient solutions, efficient use of resources) with the objective of achieving 'efficient' outcome in terms of reduced pollutions or carbon emissions. This is largely dependent on the contextual setting, as well as stakeholder and institutional pressure, the power structure of an organisation and the degree of commitment of the actors and groups within an organisation.

In the context of the current study, NIT appears to be an appropriate framework to explain both the legitimisation aspect of an organisation's corporate sustainability initiatives and efficiency aspect of an organisation's actual sustainability performance, such as GHG emissions.

2.3 | Empirical literature and hypotheses development

We have discussed above the NIT that outlines two motives underlying an organisation's corporate sustainability initiatives and action plans: (i) legitimisation and (ii) efficiency motives. From the perspective of legitimisation aspect of NIT, organisations tend to be engaged in strategic aspect of corporate sustainability initiatives, such as environmental policies and processes, but these initiatives might not translate into substantive outcome such as reduced pollutions or carbon emissions. In this vein, Ntim and Soobaroyen (2013) and Berrone and Gomez-Mejia (2009), for example, contend that organisations might adapt to societal norms and expectations by engaging in corporate sustainability practices symbolically and thus extract the economic benefits of corporate legitimacy and good environmental performance. For Delmas et al. (2013), powerful executive management might pursue a compromise strategy to improve process-oriented environmental performance to influence shareholders and other market participants, without making substantial capital investments in carbon abatement projects that can reduce significant amount of actual GHG emissions.

From the perspective of efficient aspect of NIT, firms can take advantage of technological advancement to adopt low carbon business models by developing green products and energy-efficient solutions, using renewable energy, improving operational efficiency in using materials and energy in industrial activities, which in turn can reduce actual GHG emissions and improve financial performance (Berrone & Gomez-Mejia, 2009; Busch & Hoffmann, 2011). Qian and Schaltegger (2017) also make similar arguments in that organisations act proactively to face environmental challenges and that the disclosure of carbon initiatives can act as catalyst to drive organisational climate-related commitments to improve actual carbon performance. For them, corporate sustainability is getting integrated into an organisation's strategic priority and core business, and hence, organisations are increasingly moving ahead from seeking legitimacy to an actual reduction in carbon emission, so as to make a real contribution to societies and ecosystem.

Empirically, very few studies seem to have addressed the linkage between corporate sustainability initiatives and corporate sustainability performance. Among others, Clarkson et al. (2008) support the signalling or economic efficiency hypothesis in that firms with superior environmental performance tend to have greater environmental disclosure in US firms and. Giannarakis et al. (2017) also find similar evidence. Moussa et al. (2020) find that firms with a carbon strategy tend to demonstrate lower GHG emission in US firms. Qian and Schaltegger (2017) find a positive association between the disclosure of carbon initiatives and carbon performance in global 500 firms and suggest that improved carbon disclosure motivates companies and creates an outside-in opportunity for organisations to make subsequent improvement in carbon performance. Bai et al. (2020) find that environmental management performance, rather than environmental operational performance, is inversely related to risk-taking of UK firms. Mishra (2017) finds that more innovative US firms exhibit improved corporate social responsibility (CSR) performance and that higher CSR innovative firms enjoy higher valuation. This evidence is broadly consistent with efficiency aspect of the NIT.

However, Haque and Ntim (2020) use a different dataset and measurement and find a statistically insignificant relationship between process-oriented carbon performance and GHG emissions in the UK and EU firms. Berrone and Gomez-Mejia (2009) find that pollution prevention strategies (or process-oriented performance) are likely to bring greater legitimacy and economic benefits US firms. Lokuwaduge and Heenetigala (2017) observe that the extension of ESG disclosure in Australia is largely driven by an organisation's perceived legitimacy gains from that disclosure. Sullivan and Gouldson (2017) observe that corporate actions on climate change appear to be constrained by a firm's preference towards a 'business case' of investing in capital projects. This evidence is broadly consistent with the findings of many related studies (Boiral & Hras-Saizarbitoria, 2017; Haque & Jones, 2020) that support greenwashing or impression management hypothesis in that organisations tend to enhance environmental disclosure without demonstrating improved environmental performance.

We argue that organisations might focus on symbolic engagement in corporate sustainability practices to achieve legitimisation objective, without committing to substantive environmental commitments or efficient outcomes, especially in areas of climate adaptation and mitigation projects, given that such commitments likely require significant financial commitments over a long period of time without an immediate gain in economic efficiency. We also contend that organisations might undertake emission reduction initiatives, environmental innovations and better use of resources as part of its core business strategy and make substantive engagements in those corporate sustainability initiatives, so as to make a meaningful impact on climate mitigation effort by reducing actual GHG emissions. Moreover, given the scarcity of societal resources, organisations will strive to find an optimal and efficient use of resources through longer term commitments and technology-oriented solutions in order to ensure economic efficiency such as shareholder value creation or substantive outcome such as energy-efficient solutions. We, therefore, draw on both legitimisation- and efficiency-based arguments of the NIT and develop the following two related hypotheses:

Hypothesis 1. Ceteris paribus, corporate sustainability initiatives are not related to corporate carbon performance.

Hypothesis 2. Ceteris paribus, corporate sustainability initiatives are positively associated with corporate carbon performance.

3 | METHODOLOGY

3.1 | Sample

Our analysis is based on European nonfinancial listed firms, and we use Refinitiv's Eikon database to collect data on ESG and financial characteristics. Refinitiv ESG scores are based on a comprehensive assessment of corporate sustainability initiatives, capacity and performance, covering publicly reported information on 186 ESG indicators (e.g., 68 environmental, 62 social and 56 governance) that are grouped into 10 categories, before being reformulated to generate company-level scores on three main pillars of E, S and G, as well as overall ESG score (Refinitiv, 2021). Among others, Tuesta et al. (2021), and Filippou and Taylor (2021) use Refinitiv ESG rating data for European firms. Our initial sample comprises 3501 observations from the listed companies in 12 EU countries such as Austria, Belgium, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Spain, Sweden and Switzerland. We dropped 1057 observations because of missing company-specific data on corporate sustainability initiatives and carbon performance. Our final sample comprises of 2444 firm-year observations, ranging data for a 16-year period from 2004 to 2019.

3.2 | Empirical model and measurement

We estimation is based on three-way fixed-effects regressors with industry, year and country dummy variables to investigate the influence of corporate sustainability initiatives on carbon performance. Among others, Berrone and Gomez-Mejia (2009) use two-way fixed-effects regressions with industry and time dummies to study environmental disclosure and/or environmental performance. Gallego-Alvarez et al. (2015) observe that fixed-effects model is considered to be a better estimator in terms of consistency and efficiency in measurement by addressing omitted variable problems, as well as unobserved heterogeneity.

We develop and estimate the following empirical model to test Hypotheses 1 and 2:

$$\begin{aligned}\text{GHG (or DEI)}_{it} = {} & \beta_0 + \beta_1 \text{CSI}_{it} + \beta_2 \text{BS}_{it} + \beta_3 \text{Ind}_{it} + \beta_4 \text{Sep}_{it} \\ & + \beta_5 \text{CSR}_{it+} \beta_6 \text{Size}_{it} + \beta_7 \text{ROA}_{it} + \beta_8 \text{Lev}_{it} + \beta_9 \text{Q}_{it} \\ & + \beta_{10} \text{MTB}_{it} + \beta_{11} \text{Growth}_{it} + \beta_{12} \text{PPE}_{it} + \beta_{13} \text{Cash}_{it} \\ & + \beta_{14} \text{Employee}_{it} + \beta_{15} \text{Country}_i + \beta_{16} \text{Industry}_i \\ & + \beta_{17} \text{Year} + u_{it}.\end{aligned} \tag{1}$$

3.2.1 | Dependent variable

We use two alternative measures of actual carbon performance: total GHG emission intensity (GHG) and direct emission intensity (DEI), with a higher value of emission intensity indicating inferior carbon performance of a firm. Total GHG emission intensity is the ratio of a firm's total of Scope 1 (direct) and Scope 2 (indirect) GHG emissions to the net sales revenue. DEI is the ratio of the firm's Scope 1 emission to the net sales revenue. Among others, Lewandowski (2017), and Number and Velte (2021) use total and DEI measures carbon performance. Table 1 presents a list and the descriptions of the dependent, independent and control variables used in the empirical models.

3.2.2 | Independent variables

We use corporate sustainability initiatives (CSI) to measure a firm's environmental commitment, capacity, effectiveness and performance in responding to corporate climate-related risks and contributing to global climate adaptation and mitigation efforts. We use Refinitiv's environmental score as a proxy for corporate climate engagements that can be symbolic or substantive depending on their impact on actual carbon performance. CSI score, as constructed by the Refinitiv, is based on the weighted average scores of reported environmental commitments of a firm in three subcategories such as emission reduction initiatives (ERI), environmental innovations (INOV) and efficient use of resources (EFF). First, as explained in Refinitiv (2021), the ERI score captures 28 firm-level commitments and initiatives to reduce GHG emission in the firm's manufacturing and operational processes. Second, INOV score covers 20 elements of capacity building through environmental innovations, technology-oriented adaptations, eco-designed product and processes

TABLE 1 Variable definitions

Variables	Name	Descriptions
Dependent variable		
GHG emission intensity	GHG	GHG emission intensity is the ratio of the Scope 1(direct) and Scope 2 (indirect) emission to net sales. This is used as a measure of firm's actual carbon performance, with lower intensity score indicating superior carbon performance of a firm.
Direct emission intensity	DEI	Direct emission intensity (DEI) is the ratio of the Scope 1 CO_2 emission to net sales. This is used as a measure of firms' alternative carbon performance, with lower intensity score indicating superior carbon performance of a firm.
Independent variables		
Corporate sustainability initiatives	CSI	CSI is an overall corporate sustainability score of a firm, as constructed by the Refinitiv, based on the weighted average scores of reported environmental commitments of a firm in three subcategories such as emission reduction initiatives, environmental innovations and efficient use of resources (Refinitiv, 2021).
Emission reduction initiatives	ERI	ERI score captures 28 firm-level commitments and initiatives to reduce GHG emission in the firms manufacturing and operational processes (Refinitiv, 2021).
Environmental innovations	INOV	INOV score captures 20 elements of capacity building through environmental innovations, technology-oriented adaptations, eco-designed product and processes in order to mitigate environmental risks and to create business opportunities (Refinitiv, 2021).
Efficient use resources	EFF	EFF score is based on 20 firms' initiatives on capacity building and eco-efficient solutions in order to ensure better and efficient use of energy, water and materials and to develop sustainable supply chain (Refinitiv, 2021).
Control variables		
Board size	BS	Ln. of the total numbers of the board.
Board independence	Ind	Percentage of independent members of the board.
CEO–chair separation	Sep	A dummy variable indicating a separation of roles of the CEO and board chairperson.
CSR committee	CSR	A dummy variable that indicates if the firm has a board committee on CSR or sustainability.
Firm size	Size	Ln. Of the value of a firms total assets.
Profitability	ROA	Return on assets.
Leverage	Lev	(Long-term debt + Short-term debt + Current portion of long-term debt)/Total assets * 100
Firm value	Q	(Total assets − Book value of equity + Market value of equity)/Total assets.
Market to book value	MTB	The ratio of market to book value of equity.
Sales growth	Growth	5-year average of growth of net sales.
Tangible assets	PPE	Property, plant and equipment/total assets.
Liquidity	Cash	The ratio of cash and equivalents to total current liabilities.
Employees	Employee	Ln. of the total number of employees.

in order to mitigate environmental risks and to explore new business opportunities. Third, EFF score is based on 20 aspects of capacity building and eco-efficient solutions of a firm in order to ensure better and efficient use of energy, water and materials and to develop sustainable supply chain management. In order to test the validity and internal consistency of CSI score, we estimate Cronbach's alpha of the individual components of CSI (e.g., ERI, INOV and EFF). We find that the alpha value is .8849, indicating that the CSI score is internally consistent and valid as a construct.

Baboukardos (2018) uses a slightly different version of Thomson Reuters' environmental performance score to examine the value relevance of environmental performance of French firms. Busch and Hoffmann (2011) also use similar carbon performance measures and observe that the process-oriented carbon performance measures represent a firm's internal efforts, management strategies and actions (such as environmental management system and managerial commitment to environmental causes) to deal with the challenges of climate change and to mitigate a firm's environmental impacts. Bhattacharyya and Cummings (2015) also use a similar measure of environmental management performance that includes an organisation's sustainability policies, disclosure and stakeholder relations as well as product and process innovations.

3.2.3 | Control variables

We follow related studies (e.g., Choi & Luo, 2021; Qian & Schaltegger, 2017) in using two categories of control variables. First, we use several governance-related control variables that are widely used as important determinants of corporate sustainability performance. These include, board size (BS), board independence (Ind), separation of the roles of the CEO and board chairperson (Sep) and the presence of the CSR or sustainability committee of the board (CSR). Second, we use several company-specific financial indicators as control variables such as firm size (Size), firm profitability (ROA), financial leverage (Lev), firm value (Q), market-to-book ratio (MTB), sales growth (Growth), tangible assets (PPE), liquidity (Cash) and employees. Table 1 provides a description of the variables. Our fixed-effects regression models also incorporate time (year), industry and country dummies to control for variations among the sampled firms across the time, industries and countries.

While our main specification (Equation 1) incorporates overall CSI score as the main independent variable, we also estimate Equation 1 by replacing CSI with the individual scores of each of three subcategories of ERI, INOV and EFF that constitute CSI score. If the estimation results suggest a statistically insignificant regression coefficient of CSI (and individual scores of ERI, INOV and EFF), our evidence would support Hypothesis 1, which is based on the symbolic aspect of NIT. Conversely, if CSI score and its three components show statistically significant inverse association with carbon performance indicators, our findings would support Hypothesis 2, which is based on the substantive aspect of NIT.

We also split the sample into firms in polluting and non-polluting industries and estimate Equation 1 with two alternative carbon performance indicators. This is because related studies (e.g., Choi & Luo, 2021) observe that firms in polluting industries are more likely to face additional regulatory stringency such as ETS, direct tax or strict pollution laws, and hence, these firms tend to demonstrate

TABLE 2 Descriptive statistics

Variables	Obs	Mean	SD	Min	Max
GHG	2444	0.46	1.56	0.00	51.91
DEI	2153	0.41	1.35	0.00	32.69
CSI	3171	56.36	27.37	0	98.46
ERI	3171	62.36	31.38	0	99.83
INOV	3060	40.99	33.83	0	99.69
EFF	3171	61.68	31.72	0	99.84
BS	3164	2.20	0.86	0.69	3.26
Ind	2906	81.26	55.17	1	100
Sep	3171	0.27	0.45	0	1
CSR	3171	0.62	0.49	0	1
Size	3501	15.86	1.65	6.63	20.09
ROA	3314	7.06	86.35	−107.68	4926.05
Lev	3500	31.50	223.62	0	11,367.68
Q	3425	1.75	1.72	0.42	71.45
MTB	3419	1479.29	557.00	7	2958.00
Growth	3318	5.68	18.16	−100	462.91
PPE	3442	0.64	0.44	0	8.46
Cash	3477	27.84	18.23	0.07	99.94
Employee	3499	8.28	0.96	1.39	9.26

Note: Table 1 provides definitions of the variable.

TABLE 3 Correlation matrix

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
(1) GHG	1																		
(2) DEI	.98	1																	
(3) CSI	−.03	−.03	1																
(4) ERI	−.01	.02	.74	1															
(5) INOV	−.02	−.02	.64	.17	1														
(6) EFF	−.01	−.01	.75	.58	.24	1													
(7) BS	.00	.01	−.07	−.07	.03	−.12	1												
(8) Ind	−.03	−.03	.17	.14	.06	.16	−.13	1											
(9) Sep	−.01	−.01	.10	.18	.01	.10	−.08	.04	1										
(10) CSR	.03	.05	.36	.33	.17	.39	−.06	.17	.02	1									
(11) Size	.02	.03	.45	.43	.23	.36	−.12	.14	.16	.26	1								
(12) ROA	.07	.11	.04	.06	−.07	.10	−.12	.04	.03	.00	−.14	1							
(13) Lev	−.03	−.04	.04	.03	−.04	.00	.07	.02	.03	.10	.14	−.28	1						
(14) Q	.12	.15	.00	−.02	−.03	.06	−.07	−.01	.06	−.04	−.33	.73	−.23	1					
(15) MTB	−.11	−.11	−.05	−.08	−.02	.02	−.07	.00	.05	−.14	−.21	.44	−.27	.55	1				
(16) Growth	−.17	−.15	−.06	.01	−.08	−.07	−.08	.01	.07	−.02	.05	.23	−.04	.12	.16	1			
(17) PPE	.10	.09	−.04	−.03	−.01	−.12	.06	−.01	−.12	.02	−.10	−.24	.15	−.15	−.18	−.16	1		
(18) Cash	.01	.02	.09	.11	.03	.03	.04	−.02	.11	.04	.07	.09	.08	.14	.04	−.02	−.01	1	
(19) Employee	.03	.04	−.09	−.05	−.06	−.07	−.03	.00	−.09	−.04	−.12	.03	.00	.08	.05	−.02	.03	−.01	1

Note: Table 1 provides definitions of the variable.

TABLE 4 Three-way fixed-effects regression of greenhouse gas emission intensity (GHG) against the scores of corporate sustainability initiatives

Variables	(1) All	(2) All	(3) All	(4) All	(5) Polluting	(6) Non-polluting
CSI	−0.0116***				−0.0142***	−0.00107***
	(0.00212)				(0.00252)	(0.000221)
ERI		−0.00861***				
		(0.00186)				
INOV			−0.00289***			
			(0.00111)			
EFF				−0.00751***		
				(0.00170)		
BS	−0.0252	−0.0282	−0.0194	−0.0302	−0.136***	−0.00374
	(0.0428)	(0.0429)	(0.0435)	(0.0430)	(0.0523)	(0.00390)
Ind	−0.000820	−0.000982	−0.000918	−0.000976	−0.000954	9.80e-05
	(0.000638)	(0.000638)	(0.000648)	(0.000638)	(0.000741)	(7.22e-05)
Sep	−0.148*	−0.135	−0.147*	−0.147*	−0.308***	0.00319
	(0.0867)	(0.0869)	(0.0880)	(0.0869)	(0.105)	(0.00825)
CSR	0.153*	0.147	0.0818	0.173*	0.0149	0.0289***
	(0.0911)	(0.0915)	(0.0912)	(0.0929)	(0.109)	(0.00882)
Size	0.135***	0.113***	0.0796***	0.104***	0.244***	0.00526
	(0.0327)	(0.0319)	(0.0308)	(0.0314)	(0.0400)	(0.00344)
ROA	0.00971	0.0119	0.00683	0.0107	0.0247**	−0.000308
	(0.00915)	(0.00918)	(0.00930)	(0.00917)	(0.0118)	(0.000768)
Lev	−0.00702***	−0.00757***	−0.00764***	−0.00741***	−0.00448	2.86e-05
	(0.00238)	(0.00238)	(0.00240)	(0.00238)	(0.00293)	(0.000214)
Q	0.500***	0.487***	0.491***	0.489***	1.121***	−0.00598
	(0.0523)	(0.0522)	(0.0531)	(0.0523)	(0.0787)	(0.00368)
MTB	−0.000620***	−0.000632***	−0.000622***	−0.000614***	−0.00115***	5.34e-06
	(7.22e-05)	(7.24e-05)	(7.31e-05)	(7.24e-05)	(9.76e-05)	(5.58e-06)
Growth	−0.0233***	−0.0219***	−0.0223***	−0.0233***	−0.0405***	−0.000144
	(0.00326)	(0.00326)	(0.00329)	(0.00328)	(0.00447)	(0.000238)
PPE	0.178**	0.183**	0.168**	0.149*	0.281***	0.181***
	(0.0775)	(0.0777)	(0.0785)	(0.0779)	(0.0880)	(0.0155)
Cash	−0.00534**	−0.00523**	−0.00506**	−0.00558**	−0.00309	−0.000947***
	(0.00233)	(0.00234)	(0.00237)	(0.00234)	(0.00285)	(0.000231)
Employee	0.0310	0.0407	0.0348	0.0325	0.0400	0.000384
	(0.0327)	(0.0327)	(0.0333)	(0.0328)	(0.0407)	(0.00275)
Constant	−1.727**	−1.394**	−1.185*	−1.344*	−3.699***	0.0282
	(0.716)	(0.709)	(0.715)	(0.708)	(0.863)	(0.0683)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2215	2215	2198	2215	1735	480
R^2	.176	.173	.168	.172	.267	.496

Note: These results are based on three-way fixed-effects regression with year, industry and country dummy variables. Figures in the bracket are the heteroskedasticity-adjusted robust standard errors. Please see Table 1 for variable definitions. Please see Table 1 for variable definitions.

*The estimation results are significant at 10% level.

**The estimation results are significant at 5% level.

***The estimation results are significant at 1% level.

substantive environmental engagements, leading to a decline in GHG emissions. This is consistent with the findings of Chang et al. (2015) that corporate sustainability policy shows stronger positive influence on environmental investment in polluting firms in China. Qureshi et al. (2020) also observe that organisations in sensitive industry exhibit superior social and governance performance and that the relationship between ESG disclosure and firm valuation is more significant in environmentally sensitive industries.

4 | RESULTS AND DISCUSSION

4.1 | Descriptive statistics and univariate analysis

Table 2 presents descriptive statistics of the main variables that are used in the regression model. It shows that the mean value and standard deviation of carbon emission intensity (GHG) is 0.46 and 1.56, respectively, implying that that the total emission intensity appears to be less clustered from the mean. Moreover, the mean value and standard deviation of DEI are 0.41 and 1.35, respectively, indicating a roughly similar (greater) spread of the direct emission data as evident for total GHG emission. Table 2 also shows that the average score of CSI is 56.36 on scale of zero to 100, with the standard deviation of 27.37, indicating a less spread of CSI data among the sampled firms. Moreover, the average scores of the three individual components of environmental initiatives such as ERI, INOV and EFF are 62.36, 40.99 and 61.68, respectively. This suggests that individual scores for ERI and EFF are relatively higher and INOV score is relatively lower than the mean value of overall CSI score. Table 2 further shows an average of 81% independent board members in the sampled firms, and this percentage is relatively higher than those reported in related studies such as Liao et al. (2015) for the UK listed firms. In addition, roughly a quarter of the sampled firms tend to have separation in between the roles of the CEO and chairperson. Moreover, around 62% of the sampled firms have the CSR committee of the board.

Table 3 presents the correlation matrix. It is shown that CSI and its individual components ERI, INOV and EFF are negatively correlated with total (GHG), as well as DEI measures, although the magnitude of the relationship is weak. Overall, correlation coefficients tend to suggest inconclusive findings about the relationship between corporate sustainability initiatives and corporate carbon performance, and hence, it is imperative to rely on multivariate regression analysis to draw an inference about this relationship. Table 3 also shows that the bivariate relationships among the independent and control variables are relatively small, suggesting that our empirical estimation is less likely to be influenced by the concerns of multicollinearity problems.

4.2 | Multivariate results and discussion

Table 4 shows estimation results of the regression of GHG emission intensity against the overall measure of CSI and three individual components of CSI score and control variables, as specified in Equation 1. Column 1 presents regression results with CSI as the main explanatory variable alongside all control variables. It is evident that CSI has a statistically significant negative association with GHG, indicating that an increase in corporate sustainability initiatives causes a reduction in firms' carbon emission intensity. Columns 2–4 show estimation results of the same specification by replacing CSI with each of the three components of CSI such as ERI, INOV and EFF as the main explanatory variables, respectively. As expected, all of the three components of CSI show statistically significant negative association with the measure of total carbon intensity. We also estimate Equation 1 for the subsamples of polluting and non-polluting industries in order to test if industry sensitivity moderates the relationship between CSI and emission intensity. The results shown in Columns 5 and 6 shows that our main explanatory variable CSI has a statistically significant negative association with GHG for both subsamples, but the magnitude of the relationship between CSI and GHG is greater for firms in polluting industry.

Table 5 presents specification results of the regression of DEI against CSI and three individual components of CSI and all control variables, as specified in Equation 1. As predicted, Column 1 shows that the main test variable CSI is negatively associated with DEI and this relationship is significant at 1% level. Columns 2–4 show that the three individual components of CSI (e.g., ERI, INOV and EFF) also maintain negative relationship with DEI. Finally, Columns 5 and 6 show estimation results for the subsamples of polluting and non-polluting industries, respectively. It is evident that CSI maintains statistically significant and negative relationship with DEI for both subsamples, and but the magnitude of the relationship is greater for the polluting firms. Among the control variables, the estimation results of the governance-oriented variables are either statistically insignificant or inconsistent. Among the financial control variables, firm size, Tobin's *Q* and tangible assets are positively related to carbon intensity, whereas financial leverage, market-to-book ratio, sales growth and liquidity have an inverse relationship with the emission measures.

Overall, our empirical estimation results are consistent with Hypothesis 2 in that corporate environmental initiatives are inversely associated with GHG emission intensity, indicating a positive association between corporate sustainability initiatives and corporate carbon performance. This relationship holds for an overall measure of CSI and for each of the three individual components CSI such as ERI, INOV and EFF. This relationship also holds for alternative measures of total and DEI. This evidence implies that companies respond to climate-related risk by making substantive engagements corporate sustainability initiatives such as emission reduction initiatives, environmental innovations and efficient use of scarce, which in turn reduce GHG emission intensity and improves actual carbon performance. Our results support the findings of related studies (Clarkson et al., 2008; Giannarakis et al., 2017; Qian & Schaltegger, 2017) that suggest a positive association between corporate environmental (carbon) disclosure and corporate environmental (carbon) performance. Moussa et al. (2020) also find an inverse association between carbon strategy GHG emission. This evidence also corroborates the findings of

TABLE 5 Three-way fixed-effects regression of direct emission intensity (DMI) against the scores of corporate sustainability initiatives

Variables	(1) All	(2) All	(3) All	(4) All	(5) Polluting	(6) Non-polluting
CSI	−0.0113***				−0.0130***	−0.00125***
	(0.00190)				(0.00225)	(0.000177)
ERI		−0.00668***				
		(0.00166)				
INOV			−0.00303***			
			(0.000977)			
EFF				−0.00812***		
				(0.00155)		
BS	−0.00277	−0.00560	0.00315	−0.0114	−0.0968**	−0.00456
	(0.0381)	(0.0383)	(0.0388)	(0.0382)	(0.0458)	(0.00306)
Ind	−0.00135**	−0.00149***	−0.00140**	−0.00146***	−0.00132**	5.90e-05
	(0.000555)	(0.000558)	(0.000564)	(0.000556)	(0.000636)	(5.52e-05)
Sep	−0.151**	−0.136*	−0.150*	−0.147*	−0.316***	0.00361
	(0.0766)	(0.0770)	(0.0778)	(0.0768)	(0.0909)	(0.00635)
CSR	0.118	0.113	0.0427	0.150*	0.0130	0.0268***
	(0.0835)	(0.0848)	(0.0837)	(0.0852)	(0.0991)	(0.00697)
Size	0.143***	0.111***	0.0938***	0.119***	0.209***	0.00343
	(0.0287)	(0.0279)	(0.0270)	(0.0275)	(0.0343)	(0.00268)
ROA	0.0189**	0.0211**	0.0156*	0.0200**	0.0257**	0.000871
	(0.00827)	(0.00833)	(0.00842)	(0.00829)	(0.0101)	(0.000705)
Lev	−0.00684***	−0.00710***	−0.00728***	−0.00697***	−0.00515**	−0.000126
	(0.00208)	(0.00209)	(0.00211)	(0.00208)	(0.00255)	(0.000163)
Q	0.535***	0.516***	0.531***	0.528***	1.036***	−0.00673**
	(0.0475)	(0.0475)	(0.0483)	(0.0475)	(0.0660)	(0.00321)
MTB	−0.000659***	−0.000668***	−0.000658***	−0.000649***	−0.00106***	−1.66e-06
	(6.33e-05)	(6.37e-05)	(6.41e-05)	(6.35e-05)	(8.27e-05)	(4.30e-06)
Growth	−0.0186***	−0.0172***	−0.0180***	−0.0190***	−0.0357***	−0.000196
	(0.00293)	(0.00293)	(0.00296)	(0.00295)	(0.00410)	(0.000176)
PPE	0.173***	0.175***	0.163**	0.141**	0.248***	0.0935***
	(0.0663)	(0.0666)	(0.0671)	(0.0666)	(0.0740)	(0.0119)
Cash	−0.00435**	−0.00440**	−0.00430**	−0.00483**	−0.000514	−0.000584***
	(0.00208)	(0.00209)	(0.00212)	(0.00208)	(0.00250)	(0.000181)
Employee	0.0174	0.0249	0.0216	0.0184	0.0188	0.00224
	(0.0286)	(0.0288)	(0.0292)	(0.0287)	(0.0358)	(0.00200)
Constant	−1.984***	−1.522**	−1.481**	−1.688***	−3.033***	0.0270
	(0.637)	(0.631)	(0.637)	(0.631)	(0.758)	(0.0522)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1972	1972	1957	1972	1553	419
R^2	.235	.227	.226	.232	.330	.501

Note: These results are based on three-way fixed-effects regression with year, industry and country dummy variables. Figures in the bracket are the heteroskedasticity-adjusted robust standard errors. Please see Table 1 for variable definitions. Please see Table 1 for variable definitions.
*The estimation results are significant at 10% level.
**The estimation results are significant at 5% level.
***The estimation results are significant at 1% level.

TABLE 6 Robustness test—three-way fixed-effects regression of greenhouse gas emission intensity (GHG) against the lagged values of scores of corporate sustainability initiatives

Variables	(1) All	(2) All	(3) All	(4) All	(5) Polluting	(6) Non-polluting
L.CSI	−0.00768***				−0.00995***	−0.000843***
	(0.00208)				(0.00246)	(0.000213)
L.ERI		−0.00484***				
		(0.00175)				
L.INOV			−0.00181			
			(0.00114)			
L.EFF				−0.00568***		
				(0.00167)		
BS	−0.0185	−0.0198	−0.0148	−0.0208	−0.126**	−0.00583
	(0.0445)	(0.0445)	(0.0451)	(0.0445)	(0.0542)	(0.00402)
Ind	−0.00108	−0.00120*	−0.00113*	−0.00119*	−0.00110	6.47e-05
	(0.000661)	(0.000661)	(0.000670)	(0.000660)	(0.000766)	(7.49e-05)
Sep	−0.142	−0.143	−0.148	−0.145	−0.287***	0.000586
	(0.0898)	(0.0899)	(0.0909)	(0.0898)	(0.108)	(0.00851)
CSR	0.147	0.138	0.0959	0.166*	0.00257	0.0264***
	(0.0945)	(0.0949)	(0.0942)	(0.0959)	(0.113)	(0.00891)
Size	0.113***	0.0928***	0.0730**	0.0972***	0.219***	0.00478
	(0.0338)	(0.0329)	(0.0316)	(0.0324)	(0.0413)	(0.00351)
ROA	0.0104	0.0118	0.00898	0.0114	0.0246**	−0.000321
	(0.00947)	(0.00949)	(0.00960)	(0.00948)	(0.0122)	(0.000795)
Lev	−0.00769***	−0.00804***	−0.00807***	−0.00802***	−0.00541*	2.45e-05
	(0.00244)	(0.00245)	(0.00246)	(0.00244)	(0.00301)	(0.000219)
Q	0.497***	0.486***	0.489***	0.488***	1.122***	−0.00725*
	(0.0538)	(0.0537)	(0.0544)	(0.0536)	(0.0810)	(0.00374)
MTB	−0.000625***	−0.000635***	−0.000627***	−0.000618***	−0.00117***	5.53e-06
	(7.43e-05)	(7.45e-05)	(7.50e-05)	(7.44e-05)	(0.000100)	(5.71e-06)
Growth	−0.0263***	−0.0254***	−0.0254***	−0.0264***	−0.0429***	−0.000171
	(0.00355)	(0.00354)	(0.00356)	(0.00356)	(0.00473)	(0.000267)
PPE	0.172**	0.171**	0.161**	0.150*	0.284***	0.178***
	(0.0793)	(0.0795)	(0.0801)	(0.0794)	(0.0900)	(0.0159)
Cash	−0.00577**	−0.00578**	−0.00547**	−0.00585**	−0.00349	−0.000946***
	(0.00241)	(0.00242)	(0.00245)	(0.00241)	(0.00295)	(0.000238)
Employee	0.0367	0.0405	0.0389	0.0378	0.0451	0.000415
	(0.0335)	(0.0336)	(0.0340)	(0.0336)	(0.0418)	(0.00279)
Constant	−1.602**	−1.293*	−1.133	−1.383*	−3.458***	0.0226
	(0.737)	(0.727)	(0.729)	(0.727)	(0.891)	(0.0690)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2136	2136	2120	2136	1676	460
R^2	.174	.172	.170	.173	.264	.487

Note: These results are based on three-way fixed-effects regression with year, industry and country dummy variables. Figures in the bracket are the heteroskedasticity-adjusted robust standard errors. Please see Table 1 for variable definitions. Please see Table 1 for variable definitions.
*The estimation results are significant at 10% level.
**The estimation results are significant at 5% level.
***The estimation results are significant at 1% level.

TABLE 7 Robustness test—three-way fixed-effects regression of an alternative measure of carbon intensity (total of Scope 1 and Scope 2 emission/total assets) against the scores of corporate sustainability initiatives

Variables	(1) All	(2) All	(3) All	(4) All	(5) Polluting	(6) Non-polluting
CSI	−0.00481***				−0.00494***	−0.000926***
	(0.00149)				(0.00153)	(0.000165)
ERI		−0.00142				
		(0.00131)				
INOV			−0.00144*			
			(0.000773)			
EFF				−0.00353***		
				(0.00119)		
BS	0.0747**	0.0751**	0.0772**	0.0722**	−0.0160	−0.00131
	(0.0301)	(0.0302)	(0.0304)	(0.0301)	(0.0319)	(0.00291)
Ind	−0.000709	−0.000791*	−0.000692	−0.000769*	−0.000701	0.000264***
	(0.000448)	(0.000448)	(0.000453)	(0.000448)	(0.000451)	(5.39e-05)
Sep	−0.0659	−0.0631	−0.0665	−0.0654	−0.216***	−0.000323
	(0.0609)	(0.0610)	(0.0615)	(0.0609)	(0.0637)	(0.00615)
CSR	0.257***	0.237***	0.229***	0.271***	0.119*	0.0204***
	(0.0640)	(0.0643)	(0.0638)	(0.0651)	(0.0663)	(0.00658)
Size	0.0202	−0.00284	0.000743	0.0102	0.105***	−0.00315
	(0.0230)	(0.0224)	(0.0216)	(0.0220)	(0.0243)	(0.00257)
ROA	0.0184***	0.0187***	0.0169***	0.0189***	0.0197***	0.000415
	(0.00643)	(0.00645)	(0.00650)	(0.00643)	(0.00719)	(0.000573)
Lev	−0.00621***	−0.00637***	−0.00666***	−0.00638***	−0.00391**	−0.000158
	(0.00167)	(0.00167)	(0.00168)	(0.00167)	(0.00178)	(0.000160)
Q	0.562***	0.552***	0.565***	0.558***	1.405***	−0.00548**
	(0.0367)	(0.0367)	(0.0371)	(0.0366)	(0.0479)	(0.00275)
MTB	−0.000507***	−0.000510***	−0.000511***	−0.000504***	−0.00113***	1.61e-06
	(5.08e-05)	(5.09e-05)	(5.11e-05)	(5.08e-05)	(5.94e-05)	(4.17e-06)
Growth	−0.00495**	−0.00431*	−0.00473**	−0.00510**	−0.0102***	−0.000215
	(0.00229)	(0.00229)	(0.00230)	(0.00230)	(0.00272)	(0.000177)
PPE	0.198***	0.197***	0.190***	0.185***	0.378***	0.163***
	(0.0545)	(0.0546)	(0.0549)	(0.0546)	(0.0536)	(0.0115)
Cash	−0.00785***	−0.00779***	−0.00766***	−0.00798***	−0.00356**	−0.000506***
	(0.00164)	(0.00164)	(0.00166)	(0.00164)	(0.00173)	(0.000172)
Employee	0.0346	0.0378	0.0364	0.0349	0.0480*	−0.00185
	(0.0230)	(0.0230)	(0.0233)	(0.0230)	(0.0248)	(0.00205)
Constant	−0.536	−0.272	−0.366	−0.403	−2.529***	0.126**
	(0.503)	(0.498)	(0.500)	(0.497)	(0.526)	(0.0509)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2215	2215	2198	2215	1735	480
R^2	.293	.290	.293	.292	.530	.578

Note: These results are based on three-way fixed-effects regression with year, industry and country dummy variables. Figures in the bracket are the heteroskedasticity-adjusted robust standard errors. Please see Table 1 for variable definitions.
*The estimation results are significant at 10% level.
**The estimation results are significant at 5% level.
***The estimation results are significant at 1% level.

TABLE 8 Robustness test—three-way fixed-effects regression of greenhouse gas emission intensity (GHG) against individual scores of corporate sustainability initiatives

Variables	(1) Polluting	(2) Non-polluting	(3) Polluting	(4) Non-polluting	(5) Polluting	(6) Non-polluting
ERI	−0.0115***	−0.00070***				
	(0.00220)	(0.000190)				
INOV			−0.00406***	3.97e-05		
			(0.00134)	(0.000112)		
EFF					−0.00945***	−0.00084***
					(0.00203)	(0.000180)
BS	−0.134**	−0.00509	−0.128**	−0.00412	−0.141***	−0.00429
	(0.0524)	(0.00393)	(0.0526)	(0.00420)	(0.0526)	(0.00390)
Ind	−0.00105	5.54e-05	−0.000970	9.54e-05	−0.00108	9.38e-05
	(0.000742)	(7.17e-05)	(0.000746)	(7.82e-05)	(0.000743)	(7.22e-05)
Sep	−0.282***	0.000660	−0.292***	−0.00204	−0.298***	0.000324
	(0.105)	(0.00830)	(0.105)	(0.00893)	(0.105)	(0.00821)
CSR	0.0464	0.0189**	−0.0948	0.0212**	0.0410	0.0327***
	(0.110)	(0.00872)	(0.108)	(0.00938)	(0.111)	(0.00905)
Size	0.221***	0.00488	0.182***	0.000354	0.208***	0.00341
	(0.0388)	(0.00354)	(0.0381)	(0.00341)	(0.0385)	(0.00336)
ROA	0.0274**	−0.000210	0.0197*	6.83e-05	0.0248**	−0.000216
	(0.0119)	(0.000776)	(0.0119)	(0.000800)	(0.0119)	(0.000769)
Lev	−0.00480	−7.22e-05	−0.00521*	−0.000119	−0.00518*	2.21e-06
	(0.00293)	(0.000218)	(0.00295)	(0.000225)	(0.00293)	(0.000214)
Q	1.118***	−0.00771**	1.120***	−0.00965**	1.119***	−0.00645*
	(0.0788)	(0.00368)	(0.0795)	(0.00374)	(0.0790)	(0.00367)
MTB	−0.00117***	2.43e-06	−0.00115***	2.88e-06	−0.00114***	4.11e-06
	(9.78e-05)	(5.61e-06)	(9.82e-05)	(5.87e-06)	(9.79e-05)	(5.57e-06)
Growth	−0.0391***	−1.91e-05	−0.0392***	−5.77e-05	−0.0402***	−0.000192
	(0.00446)	(0.000239)	(0.00449)	(0.000247)	(0.00448)	(0.000240)
PPE	0.300***	0.176***	0.273***	0.164***	0.249***	0.178***
	(0.0882)	(0.0157)	(0.0886)	(0.0173)	(0.0885)	(0.0155)
Cash	−0.00313	−0.000976***	−0.00259	−0.00110***	−0.00311	−0.001000***
	(0.00285)	(0.000233)	(0.00286)	(0.000247)	(0.00285)	(0.000231)
Employee	0.0579	0.000286	0.0452	0.000941	0.0431	−0.000204
	(0.0407)	(0.00278)	(0.0409)	(0.00293)	(0.0408)	(0.00276)
Constant	−3.378***	0.0472	−3.108***	0.0908	−3.279***	0.0715
	(0.856)	(0.0688)	(0.861)	(0.0711)	(0.857)	(0.0672)
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1735	480	1735	463	1735	480
R^2	.265	.485	.257	.450	.262	.495

Note: These results are based on three-way fixed-effects regression with year, industry and country dummy variables. Figures in the bracket are the heteroskedasticity-adjusted robust standard errors. Please see Table 1 for variable definitions. Please see Table 1 for variable definitions.
*The estimation results are significant at 10% level.
**The estimation results are significant at 5% level.
***The estimation results are significant at 1% level.

Mishra (2017), who shows firms with greater innovations demonstrating improved CSR performance.

Nonetheless, this evidence is contrary to several recent studies (e.g., Delmas et al., 2013; Haque & Ntim, 2018) that observe a symbolic environmental engagement of firms such as corporate sustainability policies, planning and disclosure, without reducing actual GHG emissions. Our findings are also against the evidence of other related studies (e.g., Boiral & Hras-Saizarbitoria, 2017; Cong & Freedman, 2011) that support the arguments of impression management or greenwashing in corporate sustainability disclosures or initiatives.

Theoretically, our evidence lends support for the efficiency-oriented arguments (or instrumental view) of NIT (Aguilera et al., 2007; North, 1991) that organisations recognise the disastrous consequence of climate change risks and enormous economic potential for keeping corporate sustainability initiatives at the core of long-term organisational strategies and action plans (Qian & Schaltegger, 2017). Accordingly, on the one hand, organisations try to engage in meaningful emission reduction initiatives to minimise the negative impact of organisational practices on environment and society, and on the other hand, adopt substantive longer term commitments towards environmental innovations and technology-oriented solutions for green products and services, efficient use of scarce resources and energy-efficient solutions. This eventually leads to a substantive outcome both for the society in the form on reduced GHG emission and for the organisation in terms of economic efficiency and shareholder value creation (Busch & Hoffmann, 2011; Clarkson et al., 2008).

Our estimation results also suggest that the magnitude of the negative relationship between CSI and both (total and direct) indicators of emission intensity are stronger for firms in polluting industry. This relationship also holds for each of the three individual components CSI (e.g., ERI, INOV and EFF) its relationship with GHG emission intensity. This evidence is consistent with the observation of related studies (e.g., Choi & Luo, 2021) firms in polluting industry are under greater scrutiny from the shareholders, regulators (such as ETS, carbon tax or strict pollution laws), environmental groups and media, and therefore, these firms are inclined to engage in substantive environmental engagements, leading to a decline in GHG emissions. Accordingly, related studies (e.g., Chang et al., 2015; Choi & Luo, 2021; Qureshi et al., 2020) find that the relationship between GHG emission (and ESG disclosure) and firm valuation is stronger for firms in environmentally sensitive industries. Moussa et al. (2020) observe that companies operating in carbon-intensive industries are more likely to engage in corporate sustainability initiatives to legitimise their operations.

While the bivariate correlations coefficients suggest a weak negative relationship between our corporate sustainability initiatives indicators and emission intensity measures, our multivariate regression framework suggests a highly significant estimation results for all four sustainability indicators in a number of alternative estimations and robustness tests (as reported in Tables 4–8). We argue that the complexity of the multidimensional relationship between corporate sustainability indicators and GHG emission intensity is unlikely to be captured by bivariate correlations, as corporate carbon performance is likely to be determined not just by the sustainability initiatives but also corporate governance mechanisms and financial characteristics of an organisation. Therefore, it is imperative to develop a multivariate regression model by incorporating all of these factors and to estimate this model by using advanced estimation techniques, such as three-way fixed effects to control for variations across countries, industries and time (years).

4.3 | Robustness tests

We undertake a number of robustness tests to verify our reported findings: First, we estimate the regression of GHG by taking the first lags of the main explanatory variables (e.g., CSI and its components). Our results, as shown in Table 6, are broadly similar to the reported evidence. Second, we re-estimate our regression model with an alternative measure of carbon emission intensity, which is the ratio of total GHG emission to total assets. Table 7 shows the estimation results that suggest a roughly similar explanatory power of our test variables, as reported earlier. Third, we estimate Equation 1 for the subsamples of polluting and non-polluting firms by replacing CSI with each of the three individual components of CSI (e.g., ERI, INOV and EFF) as the main explanatory variables. The results presented in Table 8 shows no noticeable difference from our reported findings for firms in the polluting industries. Fourth, as our bivariate correlation coefficients suggest a weak negative relationship between corporate sustainability initiatives indicators and carbon performance, we carry out three-way fixed-effects regressions of GHG (and DEI) against CSI and each of the three individual components of CSI (e.g., ERI, INOV and EFF) as the only explanatory variables (without control variables). This is to test the robustness of the explanatory power of our standalone explanatory variables using the regression framework, while controlling for variations across countries, industries and time (years). Our results (not shown to conserve space) suggest that all four indicators of corporate sustainability initiatives show a statistically significant negative association with carbon performance indicators.

5 | CONCLUSIONS

In this empirical investigation, we examined how corporate sustainability initiatives influence corporate carbon performance. Our analysis is based on three-way fixed-effects model to analyse data on 2444 observations from European listed firms, covering a period from 2004 to 2019. Our findings suggest that corporate sustainability initiatives are positively associated with corporate carbon performance, in terms of lower GHG emission intensity. We also find that the relationship between corporate sustainability initiatives and corporate carbon performance is stronger for firms in polluting industries. Overall, our estimations results suggest that organisations tend to respond to climate change risks by making substantive corporate sustainability engagements such as emission reduction initiatives, environmental innovations and efficient use of resources, which in turn facilitate organisations' effort to reduce GHG emission intensity and improve corporate carbon performance. Our evidence broadly supports the instrumental view or efficiency-oriented arguments of the NIT in that organisations make substantive commitment and engagement in climate mitigation and adaption projects that can lead an efficient outcome both for the society in terms of reduced carbon emission and for the organisation in terms of greater economic efficiency and shareholder value.

Our evidence has important implications for corporate sustainability policies, practices and business strategy. First and from the perspective of corporate sustainable strategy, corporate boards and executive management teams ought to recognise both the disastrous consequence of climate change risks and enormous economic potential for keeping corporate sustainability agenda at the core of long-term organisational strategies and action plans. Consequently, as our evidence suggests, they need to make meaningful engagement in climate mitigation initiatives and to undertake substantive longer term commitments towards technology-oriented environmental innovations, green products and services and energy-efficient solutions. This will eventually serve the dual purpose of minimising the negative impact of organisational practices on environment and society and maximising economic value of corporate sustainability projects for the shareholders and other stakeholders.

Second and from the perspective of investors, institutional investors have the incentives and capacity to identify and rank companies that adopt meaningful engagements in corporate sustainability initiatives and use measurable targets and action plans to reduce GHG emission, before making investment decisions based on that ranking. They can also exert direct and indirect pressure on the board and management through private negotiations, shareholder proposals, proxy contests and public criticisms, so that companies undertake substantive climate-related initiatives and projects to ensure gradual and sustained improvement in actual carbon performance.

Third and from the perspective of corporate sustainability policies and regulations, regulators should move beyond disclosure-oriented regulations such as NFRD and TCFD and outline a more comprehensive policy framework for organisations and industries capturing both climate mitigation such as emission reduction initiatives and climate adaptation such as capacity building, environmental innovations, technology-oriented and energy-efficient solutions. The policymakers should also lay out more explicit, verifiable, legally binding targets for corporate climate mitigation and adaptation programmes and develop appropriate monitoring and enforcement mechanisms with relevant expertise, power and accountability.

Although our evidence is robust with alternative measures and estimations, it has some limitations that have implications for future research. First, as we use publicly available (archival) data to measure our proxies for CSI, ERI, INOV, EFF, GHG and other variables, these indicators might not reflect actual corporate sustainability practices and outcome. Therefore, further research can adopt case study analysis or interviews with various economic agents and stakeholders in order to provide more in-depth analysis and greater insight on these critical issues of corporate sustainability initiatives and actual outcome of these initiatives. Second, our empirical framework could be further improved by incorporating country-specific indicators and institutional characteristics; hence, further studies can include country-specific governance quality, quality of sustainability-oriented institutions and macroeconomic variables to broaden the scope of this study. Third, our evidence of a negative influence of CSI on carbon emission intensity (GHG) might be driven, among other things, by the motives of powerful economic agents such as shareholders and executives. Therefore, future researchers can include the likely moderating or mediating effect of ownership structure and executive compensation on CSI–GHG nexus.

Fourth, as our correlation coefficients suggest inconclusive findings about the relationship between corporate sustainability initiatives and corporate carbon performance, future researchers can use alternative measures of corporate sustainability initiatives and carbon performance and re-examine this relationship in the context of EU or other regions or countries. Finally, while our findings are robust and seem to be appropriate in the context of European countries with developed climate-related policies and institutions, future researchers can extend this study to undertake a comparative analysis between North America and Europe or cross-country analysis of countries from different regions with different institutional settings.

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