

The relationship between environmental performance and environmental disclosure

A meta-analysis

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Abstract

This research conceptually and empirically summarizes multiple aspects of the association between corporate environmental performance and corporate environmental reporting in previous literature, addressing the questions of (a) whether disclosure is a reliable indicator of performance and (b) whether variable measurement characteristics influence empirical outcomes. Systematic literature review and meta-analytic techniques are employed to generate objective and valid summarized effects. The research covers a total of 251 effect sizes within 62 primary studies, representing a total of 56,387 observations. This study discovers a weak and negative association between environmental performance and environmental reporting, supporting the sociopolitical perspective that poor environmental performers have higher motivations to increase their level of disclosure than strong performers. At the same time, this research confirms the heterogeneity of previous studies in the field and verifies the effects of measurement methods on empirical outcomes.

KEYWORDS

environmental disclosure, environmental performance, environmental reporting, industrial ecology, measurement characteristic, meta-analysis

1 | INTRODUCTION

Persistent pressures from corporate social responsibility (CSR) and corporate sustainable development practices have imposed considerable environmental obligations on businesses (Cooney, 2009). Therefore, firms are expected to improve their environmental impacts and demonstrate their commitments and achievements to stakeholders (O'Brien & Dhanarajan, 2016). Corporate environmental reporting (CER), as a result, has become essential to facilitating such communication (O'Donovan, 2002; Sumiani, Haslinda, & Lehman, 2007) and has gained immense popularity (Uwuijbe & Uadiale, 2011). However, glaring discrepancies in the level and nature of disclosure between companies can be observed (Hahn & Kühnen, 2013) due to issues such as greenwashing and non-standardization (Delmas & Burbano, 2011; He & Loftus, 2014; Sutantoputra, Lindorff, & Johnson, 2012). After several decades, scholars have pointed out the unpleasant truth that CER is indicative of reporting bias (Berthelot, Cormier, & Magnan, 2003; Romlah, 2005), often being used as a communication strategy and a manipulation of public perception rather than a fair reflection of corporate environmental performance (CEP; Cho, Guidry, Hageman, & Patten, 2012; Hummel & Schlick, 2016).

Until now, the controversial question of whether CER is a reliable indicator of CEP still remains unresolved (Aragón-Correa, Marcus, & Hurtado-Torres, 2016; Hummel & Schlick, 2016). Similar to the ongoing conceptual debate between two theoretical perspectives on disclosure, namely sociopolitical (stakeholder theory, legitimacy theory) and economics-based theories (voluntary disclosure theory, signaling theory), empirical work in the field constantly presents inconsistent results. While many studies verify that firms with better environmental records voluntarily report more information (e.g., Al-Tuwaijri, Christensen, & Hughes, 2004; Clarkson, Li, Richardson, & Vasvari, 2008; Iatridis, 2013), others prove that poorer

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performers have stronger motivations to enhance their reports (e.g., Braam, de Weerd, Hauck, & Huijbregts, 2016; Cho & Patten, 2007; Hughes, Anderson, & Golden, 2001). A few scholars show evidence that both good and bad environmental actors disclose more than the average actors (e.g., Dawkins & Fraas, 2011b; Hummel & Schlick, 2016), while others report weak or insignificant relationships (e.g., Fekrat, Inlan, & Petroni, 1996; Freedman & Wasley, 1990; Wiseman, 1982). The heterogeneous nature of empirical findings could be attributed to the divergence of research designs, for example, moderating factors, variable measurements, study locations, and sample characteristics.

Considering the importance of the association between CEP and CER, it is essential for reporters, report users, and other stakeholders to obtain a comprehensive overview of the situation. As of now, there has been just one systematic examination, from Cho, Maurice, Nègre, and Verdier (2016), consisting of 16 primary studies from 1970 to 2010, covering a total sample of 2,672 observations. This study found no association between environmental disclosure and performance. Given the large amount of literature in this area, it is likely that this study does not provide a completely comprehensive overview of previous empirical findings. Furthermore, recent developments of environmental disclosure in practice and research imply that such a summary effect may no longer hold true. The current study, in view of such context, intends to consolidate and summarize results from a broader range of empirical research in the field to provide a more general and valid summary effect. Furthermore, we address the influence of variable measurement characteristics which might carry practical implications to further the advancement in environmental reporting assessment, governance, and standardization.

The remainder of this paper is as follows. Section 2 documents the research lenses on the CEP-CER relationship and establishes a research framework, followed by Section 3, which introduces meta-analytic methodological approaches. Section 4 illustrates and discusses the results, while Section 5 provides a brief summary of the research, its contributions, limitations, and potential implications.

2 | RESEARCH FRAMEWORK

2.1 | Definitions and measurements of CEP

One inconsistency of previous studies is how they define and measure CEP and CER constructs. Since both variables are latent, abstract, and multidimensional, they cannot be directly observed and have to be measured by mid-level indicators (Borsboom, Mellenbergh, & van Heerden, 2003; Guenther & Hoppe, 2014). Standardization remains challenging because scholars often focus on devising extensive indicators instead of agreeing on a common foundation (Abba, Said, Abdullah, & Mahat, 2018).

The definitions of CEP vary significantly in literature. GRI (2013) defines CEP as “a measure of an organization’s impact on living and non-living natural systems, including land, air, water and ecosystems.” Walls, Phan, and Berrone (2011) also specify CEP based on its impacts, but note more explicitly that CEP is the outcome of environmental management strategies that aim to lessen the negative impacts of firms’ operations. Sutantoputra et al. (2012) refer to CEP in more detail, that is, a combination of environmental-related activities such as the management of waste, air, land, and water emissions or the existence of an environmental management system (EMS). Based on such divergence, we identify four characteristics of variable measurement as follows.

2.1.1 | Performance aspect

Delmas and Blass (2010) refer to three CEP proxies: environmental impact (e.g., amount of toxic emissions, the usage of energy), regulatory compliance (e.g., whether firms’ activities are in compliance with the International Organization for Standardization [ISO]), and organizational processes (e.g., the design of an EMS). Later research introduces more complex proxies that include all three categories, for example, dummy proxies for good and bad performers (e.g., Mahmood, Ahmad, Ali, & Ejaz, 2017; Meng, Zeng, Shi, Qi, & Zhang, 2014) or environmental strengths and concerns (e.g., Dawkins & Fraas, 2011a, 2011b; Tadros & Magnan, 2019).

2.1.2 | Measurement technique

Scholars usually rely on qualitative or quantitative techniques to measure CEP (Al-Tuwaijri et al., 2004). Qualitative methods involve categorical data (nominal and ordinal), for example, the adoption of environmental initiatives (e.g., Ahmadi & Bouri, 2017), while quantitative methods involve numerical data (interval and ratio), for example, the amount of toxic emissions (e.g., Clarkson et al., 2008; Connors & Gao, 2011; Patten, 2002).

2.1.3 | Impact direction

Researchers can direct their focus on the positive or negative edges of firms’ environmental actions. An action is positive if its intended impacts are beneficial to the environment, for example, establishment of an EMS (e.g., Deswanto & Siregar, 2018; Diantimala & Amril, 2018). A common negative-impact proxy is the level of greenhouse gases (GHGs) emitted (e.g., Braam et al., 2016; Fontana, D’Amico, Coluccia, & Solimene, 2015; Sutantoputra et al., 2012). A special case is that the amount of waste generated is a negative proxy, but the ratio of waste recycled to total waste generated (e.g., Al-Tuwaijri et al., 2004) is considered positive.

2.1.4 | Firm adjustment

A few scholars take firms' heterogeneity into consideration and normalize CEP by firms' individual features, for example, dividing total amount of emissions or waste by sales values (e.g., Clarkson et al., 2008; Connors & Gao, 2011; Dawkins & Fraas, 2011a).

2.2 | Definitions and measurements of CER

Similar to the case of CEP, interpretations and measurements for CER vary (Alrazi, de Villiers, & van Staden, 2015). Since environmental reports are often prepared for specific purposes of companies or target recipients (Cormier, Ledoux, & Magnan, 2011; da Silva Monteiro & Aibar-Guzmán, 2010; Dawkins & Fraas, 2011b) and their publication is mostly voluntary, firms can decide for themselves concerning the content and fashion of their disclosure (Abba et al., 2018; Meek, Roberts, & Gray, 1995).

GRI (2013) refers to CER as "the actions of measuring, disclosing and being accountable to stakeholders for a firm's environmental impacts." Campbell (2004) explains in more detail that CER presents a company's organizational and operational processes that influence the natural environment. Abba et al. (2018) describe CER as pertaining to aspects such as environmental policies, management schemes, environment-related investments, or pollution remediation. Researchers also characterize the attributes of high-quality disclosure. Cormier, Magnan, and van Velthoven (2005) set standards for the combination of precision, relevance, and usefulness for decision making. Hummel and Schlick (2016) highlight the presentation of relevant and transparent numerical data. In that sense, we sum up the CER measurement characteristics as follows.

2.2.1 | Reporting aspect

Some researchers take only the presence of CER into account, for example, whether firms participate in the GRI reporting scheme or respond to the Carbon Disclosure Project (CDP) (e.g., Dawkins & Fraas, 2011a, 2011b; Lu & Taylor, 2018). A few others consider the completeness of disclosure, for example, the proportion of reported items in a reporting standard (e.g., Deswanto & Siregar, 2018; Hassan & Romilly, 2018). The majority of studies look at the quality of information since it is necessary for value relevance (Abba et al., 2018).

2.2.2 | Measurement technique

Al-Tuwaijri et al. (2004) call into question the use of quantification (i.e., the amount of pages, sentences, lines, or words) as a common technique in early research, which is prone to bias since it is susceptible to manipulation by reporters. Later research introduces third-party indexes which offer higher reliability and comparability among industries or countries, for example, the Carbon Disclosure Leadership Index (CDLI) (e.g., Giannarakis, Konteos, Sariannidis, & Chaitidis, 2017a) or Bloomberg's Environmental, Social, and Governance (ESG) (e.g., Hassan & Romilly, 2018). Nevertheless, most scholars use scoring methods derived from content analysis (Meng et al., 2014), which allow for the transformation of texts into replicable numeric values (Krippendorff, 2012; Vourvachis & Woodward, 2015) and are considered more valid and meaningful. One of the most common methods is developed by Clarkson et al. (2008) and has been applied or modified by subsequent researchers often (e.g., Braam et al., 2016; Hassan & Guo, 2017; He & Loftus, 2014).

2.2.3 | Quality aspect

Studies usually address information quality through the level and nature of disclosure. The CER level includes three categories: total disclosures (all indicators), hard disclosures (objective and not easily mimicked indicators), and soft disclosures (general and less verifiable indicators) (Clarkson et al., 2008). The nature of disclosure refers to characteristics of the information reported, such as the proportion of hard to total disclosures (e.g., Clarkson, Overell, & Chapple, 2011; He & Loftus, 2014), or the specificity of information, such as quantitative versus qualitative (e.g., Ingram & Frazier, 1980; Tadros & Magnan, 2019). Ingram and Frazier (1980) also inspect the types and time of the evidence presented.

2.2.4 | Index adjustment

Several researchers share the view that adjusting CER scores brings objectiveness (Al-Tuwaijri et al., 2004; Bewley & Li, 2000; Cho & Patten, 2007). CER scores can be adjusted by assigning weights to specific indicators based on their perceived importance (e.g., He & Loftus, 2014; Hughes et al., 2001) or to the quality of the information reported, that is, specific, detailed, numeric, transparent, and verifiable data versus generic, irrelevant, or imprecise data (e.g., Al-Tuwaijri et al., 2004; Meng et al., 2014). Deswanto and Siregar (2018) and Hassan and Romilly (2018) also consider the industry average scores. However, certain researchers are against the practices of weighting, stating that it leads to similar results (Hodgdon, Tondkar, Harless, & Adhikari, 2008) and does not reflect reality (Wallace & Naser, 1995).

2.3 | Theoretical perspectives on the CEP-CER relationship

Common theories that explain the CEP-CER relationship are sociopolitical theories (stakeholder theory, legitimacy theory) and economics-based theories (voluntary disclosure theory, signaling theory). Sociopolitical theories assume that companies do not have licenses to operate in society

and participate in CER to ensure their survival (Bebbington, Larrinaga-González, & Moneva-Abadía, 2008; Deegan, 2002; Deegan & Blomquist, 2006; Magness, 2006; Spence, Husillos, & Correa-Ruiz, 2010). To do so, firms may exploit CER as a proactive public relations strategy (Cho, Patten, & Roberts, 2006) or a risk management plan (Cho & Patten, 2007; Cormier et al., 2005; Luo, Lan, & Tang, 2012), modifying information without altering performance, or directing attention toward good behavior (Gray, Kouhy, & Lavers, 1995; Hooghiemstra, 2000; Lindblom, 1994). Since CER can enhance firms' performance (Oliver, 1991), it is likely that poor performers are motivated to capitalize on such a benefit (Dawkins & Fraas, 2011b). Sociopolitical theories can thus demonstrate behaviors of companies with weak environmental records (Dawkins & Fraas, 2011b; Sutantoputra et al., 2012), those from environmentally sensitive industries (ESI), or large companies under high social pressure (Bewley & Li, 2000). These firms selectively disclose more to mitigate their negative impacts (Boiral, 2013; Brammer & Pavelin, 2006; Brown & Deegan, 1998; Freedman & Patten, 2004) or disclose more general, ambiguous, less verifiable (soft) information to appear as committed entities but do not truly reveal their performance (Clarkson et al., 2008; Clarkson et al., 2011). In short, sociopolitical theories imply a negative association between CEP and CER.

Conversely, economics-based theories presume that the voluntary nature of CER imposes no requirement for complete disclosure (Mitchell, Percy, & McKinlay, 2006). In case of asymmetric information, that is, when stakeholders are not fully aware of a firm's environmental performance, the firm only engages in CER if the perceived benefits exceed the reporting costs (Clarkson, Dontoh, Richardson, & Sefcik, 1992; Healy & Palepu, 2001; Verrecchia, 1983). Since CER can signal information to stakeholders and attract investments (Verrecchia, 1983), improve corporate brands and reputation (Fombrun, 1996; Guthrie & Parker, 1990; McWilliams & Siegel, 2001), enhance competitiveness (Mackey, Mackey, & Barney, 2007; Waddock & Graves, 1997), and realize higher profits (Russo & Fouts, 1997), firms with better environmental records have more incentives to capitalize on these assets (Luo & Tang, 2014; Lys, Naughton, & Wang, 2015; Mahoney, Thorne, Cecil, & LaGore, 2013). Economics-based theories thus can explain the behaviors of good environmental actors (Dawkins & Fraas, 2011b), suggesting that they report more accurate, detailed, verifiable, and difficult to imitate (hard) information, and often benchmark themselves to industry averages to present their achievements and distinguish themselves from poorer performers (Al-Tuwaijri et al., 2004; Clarkson et al., 2008; Connelly, Certo, Ireland, & Reutzel, 2011; Hughes et al., 2001; Li, Richardson, & Thornton, 1997; Meng et al., 2014; Moseñe, Burrett, Sanagustín, Moneva, & Tingey-Holyoak, 2013). In summary, economics-based theories propose a positive association between CEP and CER.

2.4 | Empirical findings on the CEP-CER relationship

Early research in the field does not find a strong or significant association between CEP and CER, which is partly attributed to the lack of consideration for industry- and firm-specific characteristics (e.g., Fekrat et al., 1996; Li et al., 1997; Rockness, 1985; Rockness, Schlachter, & Rockness, 1986). Later studies demonstrate highly inconsistent and contradictory results.

There is various empirical evidence supporting sociopolitical theories. Ingram and Frazier (1980) suggest that poorer environmental actors disclose more. Hughes et al. (2001) demonstrate that bad companies report more positive data to offset their impacts. Patten (2002) also discovers that low performance levels are associated with high levels of reporting. Cho and Patten (2007) take the stand that low-performing companies report more proprietary information. Delmas and Montes-Sancho (2010) contribute to the discussion by showing that firms who comply with environmental laws the least disclose more than average. Excessive disclosure is also observed by Villiers and van Staden (2011), where underperforming companies voluntarily publish information to lessen negative impacts. Clarkson et al. (2011) provide evidence showing that high emission firms provide more information. Cho et al. (2012) conclude that poorer performers report more extensively. Recently, Aragón-Correa et al. (2016) and Braam et al. (2016) find out that poor environmental actors report more as they face greater threats and pressures. Hassan and Romilly (2018) also signal that low performance levels are related to high reporting levels.

There are also numerous findings supporting economics-based theories. Deegan and Gordon (1996) and Deegan and Rankin (1996) reveal that firms' disclosures are biased toward positive information. Al-Tuwaijri et al. (2004) revealed that better performers, aiming for a candid public image, disclose more pollution-related information. In the same manner, Clarkson et al. (2008) show that over performing companies are more active in disclosing discretionary and verifiable data. Boiral (2013) reports that many firms do not disclose a large proportion of their negative actions. Likewise, good environmental actors from the study of Iatridis (2013) exhibit better disclosure scores. More recently, He and Loftus (2014) provide evidence that better environmental performers have higher levels of disclosure. Qiu, Shaikat, and Tharyan (2014) state that firms with excellent performance have more incentives to increase disclosure quality.

Against this background, many scholars emphasize that disclosure is neither useful nor reliable enough to be an indicator of firms' environmental practices (Braam et al., 2016; Clarkson et al., 2011; Hughes et al., 2001). This study therefore focuses on the statistical relationship between CEP and CER and the effects of different measurement characteristics on empirical outcomes. Figure 1 presents the research framework.

3 | METHODS

Meta-analysis methods are selected because they can accumulate statistical results from multiple studies with different original characteristics (Schmidt & Hunter,) and estimate an overall effect with greater generality and validity (Borenstein, Hedges, Higgins, & Rothstein, 2009). This

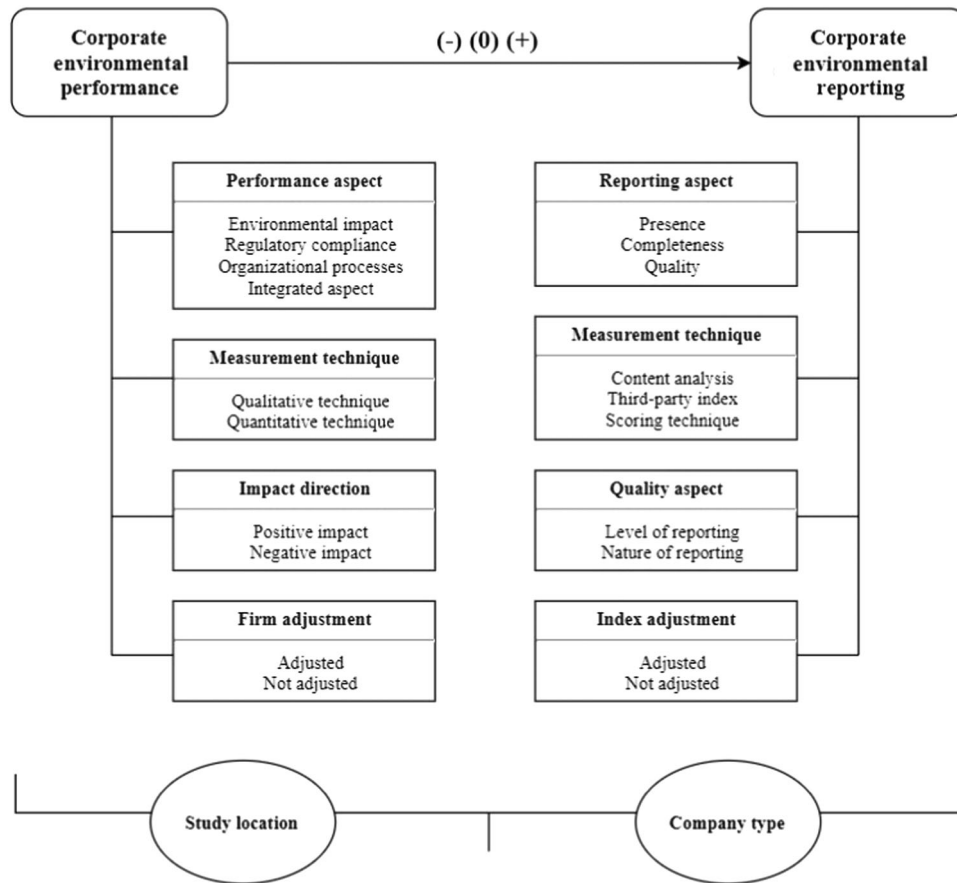


FIGURE 1 Research framework

research is carried out in three steps: sampling by structured literature review, coding relevant statistics, and calculating the summarized effects (Borenstein et al., 2009).

3.1 | Sampling procedures

For the sampling procedures, three steps are developed to bring transparency and reproducibility: establishing search scope, database, and criteria, developing search strategies, and screening for suitable results (Tranfield, Denyer, & Smart, 2003).

Empirical studies with statistical findings on the association between CEP and CER are included in this review. To achieve comprehensive results, not only are academic articles in high-impact, peer-reviewed journals included, but also conference papers, dissertations, and working papers. First, database searching by keywords is applied for the sake of extensive coverage (Crossan & Apaydin, 2010; Hahn & Kühnen, 2013). Subsequently, as suggested by Hunter and Schmidt (2004) and in line with recent meta-analyses (e.g., Busch & Lewandowski, 2018), the reference lists of relevant articles and recommendations from colleagues, reviewers, and the meta-analysis of Cho et al. (2016) are taken into account to extend the primary sample.

The following databases are chosen: Social Science Citation Index (Web of Science) with 17,000 journals in various fields, EBSCO Business Source Complete with 2,000 journals in business, management, and accounting, Emerald Insight with 300 management journals, and ECONIS with 1,700 economics-related journals. Such a combination of extensive and discipline-specific databases ensures the breadth and depth of the review (Podsakoff, Mackenzie, Bachrach, & Podsakoff, 2005). A trial phase is conducted to test keyword combinations and avoid missing relevant articles (Fink, 2014). Four terms are chosen as anchors: “environment*” (environment, environmental), “performance,” “disclos*” (disclose, disclosure, disclosed, disclosing), and “report*” (report, reports, reported, reporting). The terms “disclos*” and “report*” are used alternately to ensure the reliability and scope of the search. The inclusion of “relationship” or “association” neglects important studies and is dismissed. The extension of umbrella terms “environment* performance” to specific categories (carbon, climate change, emission*, pollution, waste, toxic, resource*) leads to further relevant studies and is applied.

Following the search, results that are not scientific articles, for example, book reviews, editorial notes, news, comments, lectures, presentations, and identical articles from different databases are screened out. Next, studies that are not particularly relevant to CEP and CER, for example, those

which focus more broadly on environmental and social reporting, sustainability reporting, or CSR reporting, are excluded. Subsequently, articles that apply methods other than quantitative, for example, conceptual or theoretical reasoning, qualitative interviews, case studies, experiments, models, or surveys, are removed from the sample since meta-analyses require empirical estimates such as correlations or regression coefficients. Accordingly, quantitative studies that do not provide these statistics are also not qualified. The study from Freedman and Wasley (1990) is not accessible because of its publisher and is not included in the sample.

The search period ends in October 2019, resulting in 62 studies from 1980 to September 2019, covering a sampling period from 1970 to 2017 and a total of 56,387 observations. Table 1 presents the primary studies and their research settings.

3.2 | Coding procedures

In addition to the CEP and CER variables, also their respective measurement characteristics, study locations, company types, effect size sources (presented in Section 3.3), and the reliability of publication (e.g., rankings of journals) are categorized and coded (see Appendix S1 in Supporting Information S1 for the list of codes).

Within each primary study, the number of effect sizes, that is, the quantitative measures of the CEP-CER relationship, is identified. Some studies apply one measure for CEP, one measure for CER, and study one sample, resulting in one effect size. Many others use either multiple measures for CEP and/or CER (e.g., the amount of emissions and the amount of waste), and examine multiple samples or one sample in multiple time periods, resulting in multiple effect sizes. In these situations, different effect sizes are extracted separately to maintain their statistical dependence (Schmidt & Hunter,). In total, there are 251 effect sizes coded from 62 studies (see Appendix S2 in Supporting Information S1 for the summary of effect sizes).

The metric to be analyzed is the Pearson product-moment correlation coefficient between CEP and CER variables, as it is a standardized metric that takes into account the differences between primary studies (Borenstein et al., 2009). When both Pearson and Spearman correlations are provided, the Pearson values are prioritized. If only Spearman correlations are reported, they are transformed to Fisher's z values (Myers & Sirois, 2004). If studies do not indicate calculation methods, their statistics are kept unaffected. In case of no available correlations, statistical indicators from multivariate regression analyses (t -statistics, p -values, or standard errors of the regression slopes) are employed to calculate partial correlations, that is, correlations controlled by moderating variables (see Appendix S3 in Supporting Information S1 for the calculation procedures).

3.3 | Analysis procedures

Prior to meta-analysis procedures, the signs of the correlations of positive impact CEP variables are reversed. This practice transforms all CEP variables into negative impact variables (a high CEP score indicates a poor performance level), establishing a consistent direction of interpretation. Subsequently, all correlations are converted to Fisher's z indexes to normalize the sampling distribution of Pearson correlations and mitigate the bias from distribution skew (Corey, Dunlap, & Burke, 1998; Fisher, 1958) (see Appendix S3 in Supporting Information S1 for the calculation procedures).

With regards to meta-analysis models, because of the discrepancies in study settings of the primary studies, the random-effects model introduced by DerSimonian and Laird (1986) is applied to estimate mean correlations. The confidence intervals are set at 95%. A general model including 251 effect sizes is constructed for the overall effect. Subsequently, eight models are run for eight CEP and CER measurement characteristics. As a robustness check, two models are made for the sources of effect sizes (i.e., correlations or partial correlations) and the reliability of publication. Further models are built for study locations and company types. After each model, the discrepancy in the true effect sizes, which implies the presence of a heterogeneity issue, is analyzed through Q -statistics and I^2 index. To test for publication bias, that is, bias when studies with more significant or stronger effect sizes have higher publication opportunities, a funnel plot is used to investigate asymmetrical distribution of standard errors, and the Rosenthal (1979) Fail-safe N is performed to see whether the summarized effect sizes are artifacts of bias. In case of publication bias, the Duval and Tweedie's trim and fill method is applied to discover the hypothetical effect sizes that could be achieved if there is no information asymmetry. Extra sensitivity analyses are carried out in case some primary studies have significantly high proportions of effect sizes in the combined sample.

4 | RESULTS AND DISCUSSION

4.1 | Descriptive results

Figure 2 illustrates the numbers of effect sizes of individual proxies. In terms of the CEP aspect, the most popular of the four indicators (i.e., environmental impact, regulatory compliance, organizational processes, and integrated proxy) is environmental impact (71%). The use of regulatory compliance and organizational processes as single indicators is not widespread; nonetheless, they are still indispensable parts of the integrated

TABLE 1 Details of primary studies

No.	Author(s) (Year)	Publication journal	Study location	Time period	Sample characteristic	Sample size
1	Abba et al. (2018)	<i>Journal of Environmental Accounting and Management</i>	Nigeria	2015	Manufacturing companies	53
2	Adinehzadeh, Jaffar, Abdul Shukor, and Che Abdul Rahman (2018)	<i>Asian Academy of Management Journal of Accounting and Finance</i>	Malaysia	2013	Non-compliant companies	344
3	Ahmadi and Bouri (2017)	<i>Management of Environmental Quality: An International Journal</i>	France	2011–2013	Large companies	108
4	Al-Tuwaijri et al. (2004)	<i>Accounting, Organizations and Society</i>	U.S.	1994	Large companies generating toxic wastes	198
5	Arena, Bozzolan, and Michelon (2015)	<i>Corporate Social Responsibility and Environmental Management</i>	U.S.	2008–2010	Listed companies	288
6	Bednárová, Klimko, and Rievajová (2019)	<i>Sustainability</i>	Worldwide	2017	Large companies	60
7	Bewley and Li (2000)	<i>Advances in Environmental Accounting & Management</i>	Canada	1993	Manufacturing companies	188
8	Braam et al. (2016)	<i>Journal of Cleaner Production</i>	Netherlands	2009–2011	Voluntarily reported companies	160
9	Brammer and Pavelin (2008)	<i>Business Strategy and the Environment</i>	U.K.	2000	Large companies	447
10	Cho and Patten (2007)	<i>Accounting, Organizations and Society</i>	U.S.	2001–2002	Listed companies	100
11	Cho, Roberts, and Patten (2010)	<i>Accounting, Organizations and Society</i>	U.S.	2002	Listed companies	190
12	Cho et al. (2012)	<i>Accounting, Organizations and Society</i>	U.S.	2009	Companies in environmentally sensitive industries	92
13	Clarkson et al. (2008)	<i>Accounting, Organizations and Society</i>	U.S.	2003	Public companies in polluting industries	191
14	Clarkson et al. (2011)	<i>A Journal of Accounting, Finance and Business Studies</i>	Australia	2002 and 2006	Mining or manufacturing companies	51
15	Connors and Gao (2011)	<i>International Review of Accounting, Banking and Finance</i>	U.S.	2001–2007	Electric utility companies	324
16	Cormier and Magnan (2015)	<i>Business Strategy and the Environment</i>	U.S. and Canada	2009	Non-financial companies	550
17	Cormier et al. (2011)	<i>Management Decision</i>	Canada	2005	Listed companies	137
18	Datt, Luo, and Tang (2019)	<i>Accounting Research Journal</i>	U.S.	2011–2012	Companies participated in CDP	487
19	Dawkins and Fraas (2011a)	<i>Journal of Business Ethics</i>	U.S.	2008	Large companies	344
20	Dawkins and Fraas (2011b)	<i>Journal of Business Ethics</i>	U.S.	2005 and 2006	Large companies	363
21	de Villiers and van Standen (2011)	<i>Journal of Accounting and Public Policy</i>	U.S.	2004	Large listed companies	120
22	Delmas and Blass (2010)	<i>Business Strategy and the Environment</i>	Worldwide	2000–2005	Listed chemical companies	15
23	Deswanto and Siregar (2018)	<i>Social Responsibility Journal</i>	Indonesia	2012–2014	Companies related to natural resources	211

(Continues)

TABLE 1 (Continued)

No.	Author(s) (Year)	Publication journal	Study location	Time period	Sample characteristic	Sample size
24	Diantimala and Amril (2018)	<i>Accounting Analysis Journal</i>	Indonesia	2010–2014	Companies sensitive to environmental damages	150
25	Fekrat et al. (1996)	<i>The International Journal of Accounting</i>	Worldwide	1991	Large companies in ESI	26
26	Fontana et al. (2015)	<i>Measuring Business Excellence</i>	Italy	2006 and 2009	Listed companies	44
27	Freedman and Jaggi (1982)	<i>Omega</i>	U.S.	1972–1973	Companies in environmentally sensitive industries	37
28	Freedman and Jaggi (2004)	<i>Re-Inventing Realities</i>	U.S.	1990	Coal-fired plants	66
29	Freedman and Jaggi (2009)	<i>Sustainability, environmental performance and disclosures</i>	EU, Japan and Canada	2004–2007	Large companies	128
30	Freedman and Stagliano (2008)	<i>Accounting and the Public Interest</i>	U.S.	2002	Industrial companies	124–145
31	Giannarakis et al. (2017a)	<i>International Journal of Law and Management</i>	U.S.	2009–2013	Large companies	102
32	Giannarakis, Zafeiriou, and Sariannidis (2017b)	<i>Business Strategy and the Environment</i>	U.K.	2014	Large companies	119
33	Hassan and Guo (2017)	<i>Journal of Applied Accounting Research</i>	Europe	2011	Large multi-national companies	100
34	Hassan and Kouhy (2014)	<i>International Journal of Accounting and Economics Studies</i>	Nigeria	1997–2009	Oil and gas industry	11
35	Hassan and Romilly (2018)	<i>Business Strategy and the Environment</i>	Worldwide	2006–2014	Companies having climate change information	9,120
36	He and Loftus (2014)	<i>Pacific Accounting Review</i>	China	2010	Listed companies in ESI	100
37	Heflin and Wallace (2017)	<i>Journal of Business Finance & Accounting</i>	Worldwide	2009	Listed companies in oil and gas industry	123
38	Hora and Subramanian (2019)	<i>Journal of Industrial Ecology</i>	U.S.	2004–2006	Listed companies	316
39	Hughes et al. (2001)	<i>Journal of Accounting and Public Policy</i>	U.S.	1992	Manufacturing companies	51
40	Iatridis (2013)	<i>Emerging Markets Review</i>	Malaysia	2005–2011	Listed companies in ESI	3,703
41	Ingram and Frazier (1980)	<i>Journal of Accounting Research</i>	U.S.	1970–1974	Widely traded companies	40
42	Iqbal, Sutrisno, Assih, and Rosidi (2013)	<i>International Journal of Business and Management Invention</i>	Indonesia	2010	Listed companies	59
43	Lai, Wong, and Lam (2015)	<i>International Journal of Production Economics</i>	Hong Kong	N/A	Textile and apparel trading companies	210
44	Li et al. (1997)	<i>Contemporary Accounting Research</i>	Canada	1882–1992	Listed companies	106
45	Li et al. (2017)	<i>Human and Ecological Risk Assessment: An International Journal</i>	China	2013–2014	Listed companies	950
46	Ling (2007)	<i>Doctor dissertation</i>	U.S.	2004	Chemical companies	74
47	Liu, Zhou, Yang, and Hoepner (2016)	<i>Discussion paper</i>	U.K.	2010–2012	Listed companies	113
48	Lu and Talylor (2018)	<i>Asian Review of Accounting</i>	U.S.	2011–2012	Large companies	450
49	Luo (2019)	<i>Accounting and Finance</i>	Worldwide	2008–2015	Listed companies	1,956

(Continues)

TABLE 1 (Continued)

No.	Author(s) (Year)	Publication journal	Study location	Time period	Sample characteristic	Sample size
50	Luo and Tang (2014)	<i>Journal of Contemporary Accounting & Economics</i>	U.S., U.K., Australia	2010	Listed companies	474
51	Mahmood et al. (2017)	<i>Pakistan Journal of Commerce and Social Sciences</i>	Pakistan	2014 and 2015	Listed companies	78
52	Meng et al. (2014)	<i>Journal of Environmental Management</i>	China	2010	Listed companies	533
53	Mitchell et al. (2006)	<i>Australian Journal of Corporate Law</i>	Australia	1994–1998	Listed companies	29
54	Patten (2002)	<i>Accounting, Organizations and Society</i>	U.S.	1988	Top companies in terms of emissions	131
55	Prado-Lorenzo and Garcia-Sanchez (2010)	<i>Journal of Business Ethics</i>	Worldwide	2007	Listed companies	283
56	Qian and Schaltegger (2017)	<i>The British Accounting Review</i>	Worldwide	2008–2012	Large companies	766
57	Shima and Fung (2019)	<i>Meditari Accountancy Research</i>	U.S.	2003–2011	Utility industries	578
58	Sutantoputra et al. (2012)	<i>Australasian Journal of Environmental Management</i>	Australia	2006	Listed companies	53
59	Tadros and Magnan (2019)	<i>Sustainability Accounting, Management and Policy Journal</i>	U.S.	1997–2010	Companies in ESI	1,092
60	van Staden and Hooks (2007)	<i>The British Accounting Review</i>	New Zealand	2002–2003	Large companies	32
61	Wiseman (1982)	<i>Accounting, Organizations and Society</i>	U.S.	1972	Companies in ESI (Steel)	7
62	Wu and Shen (2010)	<i>Conference paper</i>	China	2005–2007	Listed chemical companies	145

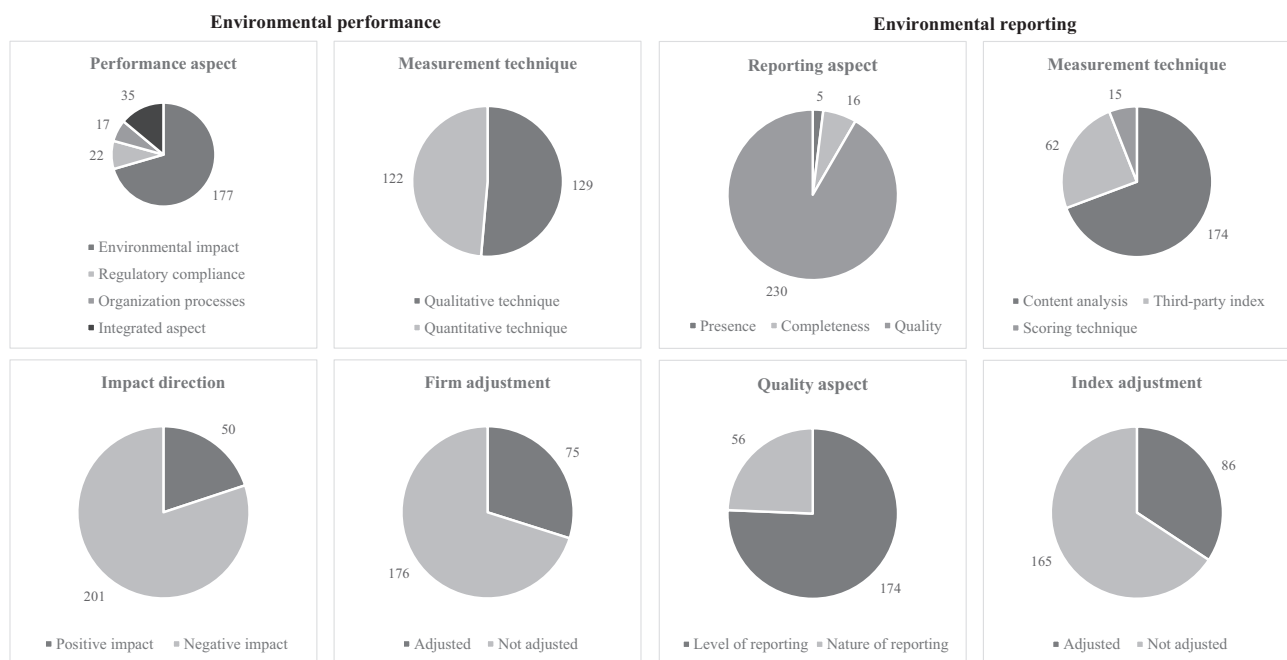


FIGURE 2 Descriptive results

Note. Underlying data used to create this figure can be found in Supporting Information S2

proxy. Regarding measurements, qualitative techniques are used slightly more frequently than quantitative (129 vs. 122 effect sizes). A notable feature of CEP measurement is that significantly more studies employ negative rather than positive impacts to evaluate CEP (201 vs. 50). On another note, adjusting CEP scores to the firms' specific features is fairly common (30%).

Concerning the characteristics of CER, the vast majority of scholars select disclosure quality as the principal assessment aspect (92%), while presence and the completeness of environmental reports are less popular. The most commonly applied technique to evaluate quality is content analysis (69%), while the use of third-party indexes and self-developed scoring techniques is less prevalent. Referencing only the quality aspect, a large proportion of effect sizes focus on the level of reporting (total, hard, and soft disclosures) (76%), while the rest direct their attention to the nature of the information. The adjustment of disclosure scores is slightly less common than the case of CEP, with only 25% considering the perceived importance of individual indicators.

In the absence of a standard classification scheme for study locations, we group them into the United States, other single countries, and multiple countries. Most of the primary research originates from the United States (41%), while the proportion of single countries outside the United States and mixed countries are fairly similar (30%). Such statistics call for more transnational and non U.S.-based research. Companies are also classified based on three features: listing, operating in ESI, and size. 41% cases are listed companies, 55% are ESI, while large companies make up only 16%.

Regarding the sources of effect sizes, 73% are correlations and 27% are partial correlations. In terms of publication reliability, the journal rankings from the German Academic Association for Business Research, VHB-Jourqual3 (VHB, 2019) are applied since their association includes a large number of internationally oriented researchers in business and management. Journals are ranked A+, A, B, C, or D based on their quality and importance. Among the sample, the majority (40%) are B-ranked, while there was none ranked D. 17% are not included in the rankings, and only a few (2%) are unpublished.

4.2 | Meta-analysis results and discussion

Table 2 presents the summarized correlations and other statistics of the meta-analyses. The overall CEP-CER relationship has a weak but statistically significant mean correlation ($r = 0.147$, $p = 0.000$). This result indicates that, although the association of CEP and CER is tangible, it is not substantial. The positive sign of the correlation suggests that CEP is negatively associated with CER. The Q-statistic is significant ($p_Q = 0.000$), implying a critical extent of disparity between primary studies. The high I^2 index (95.2%) suggests that the majority of such variance comes from the true differences of the original effect sizes instead of random errors. These findings reveal a heterogeneous nature of previous empirical research, supporting the sociopolitical theories which suggest that poor environmental performers and those who are under greater societal pressures have higher motivations to increase their disclosure (Lindblom, 1994, Grey et al., 1995), and concluding that disclosure is not indicative of performance.

Regarding the CEP definitions, all the mean correlations except organization processes are significant, which validates the Delmas and Blass (2010) classification of CEP aspects (environmental impact, regulatory compliance, organizational processes). However, the overwhelming proportion of environmental impact suggests that it should be further classified into specific sub-categories (e.g., performance-based: carbon, waste, toxic). The insignificance of organization processes could partly be attributed to the small amount of effect sizes. This research also contributes to literature and practice by adding the integrated proxy to the definition of Delmas and Blass (2010), and advises contemporary researchers and practitioners to investigate companies' environmental performance in an in-depth and comprehensive manner rather than a fragmented approach. A new question, however, is raised about the formation of such a complex proxy, that is, the proportion and weighted importance of each aspect.

In terms of CEP measurement techniques, the results show a positive relationship between CEP measured by quantitative techniques and CER ($r = 0.269$), while such association in the case of qualitative techniques is statistically insignificant. We therefore support the opinion of Al-Tuwaijri et al. (2004) stating that quantitative measurement is more objective and informative, and recommend future researchers and relevant parties involved in reporting assessment, assurance, governance, and standardization to apply categorical data.

With regards to the directions of environmental impacts, negative impact CEP proxies show a stronger correlation with CER ($r = 0.221$) in comparison to positive impact proxies ($r = -0.092$). This finding sheds light on the directions of impacts that the majority of researchers in this field employ, confirming that the use of negative impact proxies is not only more popular but also slightly better at demonstrating the CEP-CER relationship. This result does not underestimate the role of positive-impact proxies; instead, it calls for a more balanced use of positive and negative indicators in future research. In other words, there should be more indicators that attend to the good conducts of corporations, for example, reducing resources or emissions, and pioneering initiatives.

Concerning the adjustment of performance scores in accordance with specific features of firms such as environmental efficiency, the normalization of firms' performance data has been proven to have certain validity, since adjusted CEP measures have a stronger relationship with CER ($r = 0.231$) compared to non-adjusted measures ($r = 0.106$). This study therefore upholds the popularity of data adjustment and suggest that this practice would mitigate firms' heterogeneity for better comparison or benchmarking in both academia and practice.

Among the three aspects used to define CER, presence and the completeness of reports are found to have insignificant relationships with CEP, implying that the availability or the quantity of reporting has little validity in assessing the relationship between CEP and CER. Although one possible explanation could be the small number of effect sizes in both cases, it is still recommended that CER be evaluated based on the quality of

TABLE 2 Results of meta-analyses

Variable	Characteristic	Proxy	No. of effect sizes	No. of observations	Mean correlation	95% confidence interval	Q-statistic	I ² index (%)
Overall			251	56,387	0.147	0.106–0.188	5,248.93	95.2
Corporate environmental performance	Performance aspect	Environmental impact	177	36,177	0.173	0.122–0.225	3,498.58	95.0
		Regulatory compliance	22	2,282	0.208	0.011–0.405	439.22	95.2
	Measurement technique	Organization processes	17	5,180	−0.085	−0.204–0.033	136.08	88.2
		Integrated aspect	35	12,748	0.129	0.056–0.201	537.71	93.7
		Qualitative technique	129	26,736	0.033	−0.018–0.085	1,943.24	93.4
		Quantitative technique	122	29,651	0.269	0.204–0.335	3,215.17	96.2
		Positive impact (reversed)	50	34,706	−0.092	−0.170–0.114	1,625.19	97.0
		Negative impact	201	21,681	0.221	0.172–0.270	3,424.30	94.2
		Adjusted	75	14,912	0.231	0.169–0.292	788.21	90.6
		Not adjusted	176	41,475	0.106	0.054–0.158	4,236.80	96.0
Corporate environmental reporting	Reporting aspect	Presence	5	1,322	−0.120	−0.276–0.037	30.32	86.8
		Completeness	16	10,158	−0.062	−0.243–0.120	232.69	93.6
	Measurement technique	Quality	230	44,907	0.169	0.124–0.214	4,780.88	95.2
		Content analysis	174	35,890	0.100	0.052–0.148	3,217.16	94.6
		Third-party index	62	19,459	0.347	0.253–0.441	1,851.47	96.7
		Scoring technique	15	1,038	−0.091	−0.296–0.114	136.13	89.7
		Level of reporting	174	35,629	0.088	0.040–0.136	3,141.66	94.5
		Nature of reporting	56	9,278	0.423	0.322–0.524	1,214.67	95.5
		Adjusted	86	29,508	−0.030	−0.084–0.024	1,229.10	93.1
		Not adjusted	165	26,879	0.236	0.178–0.294	3,619.68	95.5
Study location	U.S.	103	19,184	0.126	0.058–0.194	2,008.44	94.9	
	Other countries	76	17,538	−0.006	−0.065–0.054	1,029.18	92.7	
	Mixed countries	72	19,665	0.375	0.289–0.461	1,749.76	95.9	

(Continues)

TABLE 2 (Continued)

Variable	Characteristic	Proxy	No. of effect sizes	No. of observations	Mean correlation	95% confidence interval	Q-statistic	I ² index (%)
Company type	Listing	Listed companies	102	21,190	0.244	0.178	1,955.11	94.8
		Other companies	149	35,197	0.084	0.034	2,732.54	94.6
	Industry	Sensitive industries	137	23,876	0.250	0.177	3,827.34	96.4
		Other industries	114	32,511	0.048	0.007	1,329.94	91.5
	Size	Large companies	39	7,184	0.007	-0.067	344.84	89.0
		Other companies	212	49,203	0.178	0.131	4,885.12	95.7
Effect size source	Correlation		184	40,731	0.151	0.104	3,425.92	94.7
	Partial correlation		67	15,656	0.135	0.050	1,764.55	96.3
Publication reliability	Rank A+		20	800	0.157	0.087	5.91	0.0
	Rank A		43	3,815	0.025	-0.052	154.71	72.9
	Rank B		101	18,715	0.353	0.288	1,400.40	92.9
	Rank B/C		2	128	-0.141	-0.903	996.40	95.0
	Rank C		39	18,541	0.020	-0.057	20.03	96.2
	Other sources		42	13,982	-0.035	-0.159	1,999.02	97.9
	Unpublished work		4	406	-0.096	-0.582	81.62	96.3

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

environmental reports. The positive association between the quality of reporting and performance ($r = 0.169$) indicates that poor performers tend to possess higher quality reports.

Concerning the measurement techniques of CER, there are significant CEP-CER relationships in the cases of content analysis and third-party index ($r = 0.100$ and 0.347 , respectively), while the use of scoring techniques has little relevance. The strongest association, between third-party CER scores and CEP, confirms the validity and reliability of such indexes compared to methods developed by individual researchers. We also support the opinion of Al-Tuwaijri et al. (2004) which states that, even though self-developed scoring techniques are quite popular in early research, they are more prone to subjectivity and biases. With that in mind, we recommend future researchers to apply validated indexes or well-developed content analysis frameworks to assess environmental reports. The comparison of different measurement scales is also worthy of investigation, since it brings further insight into the accuracy and effectiveness of each individual scale (see, e.g., the study of Delmas and Blass (2010)).

Among the studies that evaluate the quality of reports, the CEP-CER relationship is significant in both the cases of measuring CER by the level and the nature ($r = 0.088$ and 0.423 , respectively), confirming the validity of such categorization. Given the large number of indicators and small number of effect sizes to demonstrate the nature of CER in primary studies, it is not possible to provide concrete insights on the effects of each feature of the nature of CER. Future research should thus focus more on the specificity of information reported, which could reflect the behaviors of different performers (Clarkson et al., 2011).

Concerning the weighting of disclosure scores, the results cast doubt on its effectiveness, since the CEP-CER relationship is only significant in the case of non-adjusted measures ($r = 0.236$). We therefore support the opinion of Wallace and Naser (1995) and Hodgdon et al. (2008) that adjusting CER scores based on the importance of indicators or the quality of information does not influence empirical outcomes. However, since the use of such an adjustment inserts more emphasis on the quality of information reported, we do not advise researchers or practitioners against this practice; instead, further research on appropriate adjustment methods should be carried out.

One notable finding from the country perspectives is that the results are meaningful in the cases of the United States and multiple countries ($r = 0.126$ and 0.375 , respectively), but not in the case of other countries outside the United States. The higher correlation in the case of multiple countries is a positive sign that there are certain similarities in their background and driving factors of the CEP-CER relationship. These results prove that the choice of study location influences empirical results, and raises the need for more theoretical framework and transnational comparison studies, especially those with similar contextual characteristics.

On another note, with regards to company classification, listed companies and companies from ESI show significant and high CEP-CER correlations ($r = 0.244$ and 0.250 , respectively), supporting the sociopolitical perspective that companies who are under higher societal pressure disclose more (Bewley & Li, 2000). The size of companies shows no relevance to the CEP-CER relationship in this combined sample, though that could be attributed to the mixed samples of primary studies. Thus, we recommend forthcoming research to specifically define specific company size criteria for better comparison and summarization.

As a robustness check, the sources of effect sizes show fairly equal relevance to and influence on empirical outcomes ($r = 0.151$ and 0.135 for correlations and partial correlations, respectively), signifying that the CEP-CER relationship holds true when considering moderating factors or not. Publication reliability does not provide much insight since the results are only significant in one ranking (B), implying that the quality and importance of publication are not relevant to research in this area.

Across all variables, the presence of heterogeneity is quite apparent, proving that previous research provides inconsistent results. The Rosenthal's Fail-safe N test results in $N = 22,150$ ($p_N < 0.0001$), indicating that 22,150 non-significant effect sizes have to be included to make the summarized effects insignificant. Therefore, the summarized effects achieved are not artifacts of publication bias. A sensitivity analysis that excludes the study of Delmas and Blass (2010), which accounts for 19% of the sample, also results in a significant, positive, and weak CEP-CER relationship ($r = 0.051$, $p = 0.013$), indicating that the results are not skewed by this study.

5 | CONCLUSION

This research finds a weak and negative association between CEP and CER and concludes that disclosure is not indicative of performance. Compared to previous research, this study presents more comprehensive and up-to-date results, involving an extensive number of primary studies and providing summarized effects with greater generality and validity. For these reasons, the research provides future scholars a concrete starting point to investigate further into this field and other related fields.

5.1 | Shortcomings of previous research

With regards to theoretical assumptions, most of the previous studies assume that the relationship between CEP and CER is linear. However, there has been increasing evidence implying a more complicated association, for example, a U-shaped relationship (Dawkins & Frass, 2011b; Meng et al., 2014; Hummel & Schlick, 2016; Li, Zhao, Sun, & Yin, 2017). Furthermore, Patten (2002) suggests that the simple correlation between CEP and CER without controlling for other factors leads to weak or insignificant results. Later studies in the field, while attempting to overcome this

issue by including more variables and conducting multiple regressions, have not yet accounted for variable endogeneity (Clarkson et al., 2008; Luo & Tang, 2014). Some studies employ structural equation models instead of regressions but rely only on cross-sectional data and lack a temporal dimension (Hassan & Romilly, 2018). The choices of moderating variables also account for the emergence of disparity between studies and limit the opportunities for generalization.

In terms of definitions and measurements of variables, this research suggests that not all the techniques being used have similar levels of relevance or effectiveness. The subjectivity in current self-developed methodologies also has certain influences on the accuracy and comparability of empirical findings (Patten, 2002). It thus raises the need for a comprehensive, uniform, and comparable method to define and characterize the aspects of performance and disclosure across different research contexts.

Considering sample characteristics, current studies have either samples which are relatively small or lack sufficient diversity to provide meaningful insights (Patten, 2002). For instance, findings from studies that observe only firms listed in the Standard and Poor's (S&P) 500 Index is not a fair representation of smaller firms or those from other countries with different political, economic, social, and technological settings. It is therefore necessary to deploy more substantial, broad, holistic, cross-sectional, and cross-national studies in the field. Timing also plays a role in determining empirical outcomes. Taking into account the possibility that the relationship between CEP and CER changes over time, short-term studies are not the best option for capturing and explaining this phenomenon. In this sense, Hassan and Romilly (2018) point out that if poor performers currently disclose more information that then results in better performance in the future, current study designs might miss out on such a temporal dimension. Against this background, longitudinal studies are a promising option to invest in.

5.2 | Limitations and implications

For research that follows our topic, the theoretical framework and application of a more specific performance categorization (e.g., carbon-, greenhouse gases-, or toxics-related proxies) could be explored. Different content analysis methods, third-party indexes, as well as their derivatives could also be compared to efficiently assess environmental reports. The categorization of study locations and company types could also benefit from the development and validation of appropriate frameworks to generate more meaningful insights.

Studies that target broader or more specific topics could investigate other characteristics of the CEP-CER association rather than its correlation. The inclusion of moderating factors should also be highlighted as it promises stronger and more meaningful findings. The influence of disclosure on future performance should also be considered a potential topic for research and discussions. Furthermore, since this study has not extensively addressed the case of a non-linear CEP-CER relationship, we recommend forthcoming research to further investigate the possibility that sociopolitical theories and economics-based theories are not mutually exclusive.

For studies that stand on broader fields, there are numerous topics to follow, for example, the relationship of performance and reporting with regards to the economic, social, and governance dimensions. To reach beyond the scope of the corporate sector, there are also research opportunities in the social and public area, for example, the environmental and sustainability reporting practices of higher education institutions or government bodies.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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