

# **The effects of national cultural dimensions on the association between environmental performance and environmental disclosure: a meta-review**

## **Abstract**

**Purpose:** This paper aims to investigate the moderating effect of study characteristics and cultural variables on the association between environmental performance and environmental disclosure.

**Design/Methodology/Approach:** We apply the meta-analysis technique developed by Lipsey and Wilson (2001) for a sample of 59 published studies during a period of 40 years. Moreover, we apply the meta-regression to study the impact of moderating variables on the association between environmental performance and environmental disclosure.

**Findings:** We find that the relationship between environmental performance and environmental disclosure is significantly negative. Qualitative environmental performance measuring technique, qualitative and mixed disclosure nature of environmental disclosure, content analysis and survey method to measure environmental disclosure significantly influence this relationship. Moreover, considering the cultural characteristics of countries, low power distance, high individualism, high masculinity culture significantly influence the association.

**Practical implications:** Our results suggest that regulators should develop sustainability reporting standards considering the cultural characteristics of countries to reduce probable opportunistic behavior by companies. Also, the manager should put more importance in qualitative part of disclosure as it significantly influences the association.

**Social implications:** This study argues that societies with low masculinity, low individualism and high-power distance need more awareness about the environmental disclosure and its importance while societies with high masculinity, high individualism and low power distance need more awareness about greenwashing.

**Originality/Value:** To the best of the authors' knowledge, this is the first meta-review study to explore both the study characteristics and the cultural factors of countries as moderating variables of the association between environmental performance and environmental disclosure.

**Paper type:** Research paper.

**Keywords:** environmental disclosure, environmental performance, meta-review, study characteristics, cultural factors.

# **The influence of cultural factors on the association between environmental performance and environmental disclosure: a meta-review**

## **1. Introduction**

In the last decade, the involvement of business in sustainability aspects has led companies to have good environmental performance and increased transparency on sustainability, which is becoming a central theme amongst academics, organizations and practitioners. Clarkson et al. (2008) classify the environmental accounting literature into three main fields: studies that analyze the impact of environmental disclosure on firm value, studies that examine decision process on disclosing potential environmental liabilities and studies that investigate the association between environmental performance and environmental disclosure. Focusing on this last field, several studies have investigated the association between environmental disclosure and environmental performance, but their results are mixed (i.e. Ingram and Frazier, 1980; Freedman and Jaggi, 1982; Wiseman, 1982; Belkaoui and Karpik, 1989; Freedman and Wasley, 1990; Patten, 1992, 2002b; Bewley and Li, 2000; Hughes et al., 2000, 2001; Al-Tuwaijri et al., 2004; Mitchell et al., 2006; Cho and Patten, 2007; Clarkson et al., 2008, 2011). These inconclusive results are due to the lack of standardization in defining and measuring the environmental performance disclosure as suggested by the meta-review of Doan and Sassen (2020). This study calls for more meta-review studies that explore different specific performance classification and the impact of categorization of study locations, suggesting that institutional characteristics such as the cultural value can influence the environmental disclosure. Recently, Lu and Wang (2021) find that companies have better environmental performance and disclose more CSR information when they operate in low power distance, feminine, high uncertainty avoidance and long-term oriented cultures; firm's better environmental performance is found in individualistic culture and better disclosure is found in collectivistic culture. However, no evidence is there regarding the effect of cultural value on the association between environmental performance and environmental disclosure.

Our study fills this gap and tests for the moderating effects of study characteristics and national culture on the association between environmental performance (EP) and environmental disclosure (ED). Accordingly, the aim of our paper is to summarize the results of these studies and to investigate the moderating variables influencing the heterogeneous nature of empirical findings, using a meta-analytical approach. Our sample consists of 59 empirical studies that have analyzed the association between environmental performance and

environmental disclosure, adopting the meta-review methodology. The main meta-analysis result provides a significant association between environmental performance and environmental disclosure. Furthermore, the meta-regression evidences that several environmental aspects, the qualitative techniques used to measure the environmental performance, the negative performance tone, the qualitative disclosure and the content analysis disclosure influence the above relationship analyzed. Our study shows that high individualism, high masculinity, low power distance and low long-term orientation affect this association.

The study contributes to the extant literature in three main ways. First, our research is the first meta-review that have examined the moderating effects of study characteristics and national cultural dimensions on the association between environmental performance and environmental disclosure extending of the work of Doan and Sassen (2020). Investors, managers, researchers should be aware that the qualitative nature of disclosure influences this association. Second, it informs standard setters of sustainability reporting since measurement characteristics of environmental disclosure and culture characteristics of countries could influence how the environmental performance impact on environmental disclosure. Third, our study gives vital cautionary that different national cultural dimensions influence the association between environmental performance and environmental disclosure. Section 2 and Section 3 provide the theoretical framework, literature review and hypothesis development. Section 4 presents the sample and the meta-review methodological aspects. Section 5 provides the empirical results, and finally, Section 6 concludes.

## **2. Theoretical Framework**

Academics theorize the association between environmental performance and environmental disclosure on the basis of the following competing theories: socio-political theories and economic-based theories.

Socio-political theories, including legitimacy theory and stakeholder theory, suggest that the corporate disclosure cannot be investigated without considering the pressures of economic, social and political forces. According to the legitimacy theory, companies must legitimize their economic activity to survive. A company will achieve legitimacy when it complies with the socially constructed system of norms, values, and bounds of the society in which it operates and when it satisfies the expectations of the community. Lindblom (1994) suggests that a company may use disclosure as a legitimizing device to “(1) educate and inform relevant publics about (actual) changes in its performance, (2) change perceptions about the performance of the organization, (3) deflect attention from the issue of concern by highlighting

other accomplishments related to the social issue, or (4) seek to change public expectations of its performance” (see also, Gray et al., 1995, Patten, 2002). In the environmental disclosure literature, stakeholder theory is also used as socio-political theory (Clarkson, 1995; Roberts, 1992; Ullmann, 1985). It suggests that companies must satisfy the stakeholder’s information needs because they can affect the corporate reputation that “is a valuable asset which needs to be protected and developed” (Unerman, 2008). In this context, the managers meet the stakeholders demands, increasing performance and environmental disclosure.

Under the above theories, it is expected that there is negative association between the level of environmental disclosure and environmental performance as suggested by several empirical studies (i.e. Bewley and Li, 2000; Braam et al, 2016; Clarkson et al. 2011; Wiseman, 1982).

Alternative theories relating to the relationship between disclosure and performance are the economic-based theories, i.e. voluntary disclosure theory and signaling theory.

The voluntary disclosure theory is based on the disclosure equilibrium due to the benefits associated with disclosure and the proprietary costs, suggesting that managers have incentives to disclose voluntarily information “good news” and withhold “bad news”. Investors reduce firm value until managers are not bound to disclose information, to separate it from hidden information (when nature of the information are unknown to the investors) (Dye, 1985). The signalling theory (Spence, 1978) is based on the existence of an information asymmetry between companies and shareholders. The theory suggests that managers provide additional information to communicate firm quality or value, reducing this information asymmetry and helping investors in making investment decisions.

Under the above theories, in the environmental disclosure context, inferior environmental performers tend to reduce the provided information or to be silent, while superior environmental performers disclose more information, suggesting no association or positive association between environmental performance and environmental disclosure.

### **3. Literature Review and Hypotheses Development**

Many empirical studies have investigated the association between environmental performance and environmental disclosure with contradictory results. The first pioneering study is the research by Ingram and Frazier (1980), that analyses the association between the discretionary nature of CSR reports and an environmental index formed by “Council on Economic Priorities” (CEP). They find no significant association between these two. However, only important association identified is that the poor performers disclose more environmental topics than the better performers. Similarly, Wiseman (1982), using a new disclosure index

based on 18 factors (economic factors, environmental litigation, pollution abatement, other) find no significant relationship between corporate environmental performance rankings and environmental disclosure. Many environmental disclosure studies have adopted the Wiseman disclosure index. Freedman and Wasley (1990) analyze the relationship between corporate pollution performance and pollution disclosures made in annual reports and 10 K reports filed with the SEC. Spearman rank and order correlation tests show that neither annual report environmental disclosures nor the 10 K environmental disclosures are indicative of firms' actual environmental performance. In contrast with the previous findings, Bewley and Li (2000), examining the factors associated with the environmental disclosures, find that companies with higher pollution propensity disclose more general environmental disclosure, providing a negative association between environmental performance and environmental disclosure. Hughes et al. (2001) modify the Wiseman index to examine if environmental disclosures are consistent with environmental performance ratings (good, mixed, and poor). They don't find any significant difference in the disclosure of good and mixed performers. However, their findings demonstrate that poor environmental performers by the CEP tend to make substantially more environmental disclosures than the good performers. To overcome the methodological problems of previous studies, Patten (2002) uses toxics release inventory (TRI) data deflated by sales as a proxy for environmental performance, finding negative association between environmental performance and environmental disclosure level. Analyzing non-discretionary disclosure, Al-Tuwaijri et al. (2004) also use as environmental performance the ratio of recycled toxic waste to the total toxic waste volume, while environmental reporting is determined by a weighted content index. The study shows positive association between voluntary disclosure and environmental reporting. Also, Cho and Patten (2007) create an environmental reporting index and examine the link between environmental disclosure extent and the KLD environmental score, providing a negative relationship. Clarkson et al. (2008) examine the extent of disclosure through a content analysis based on GRI indicators and measure the environmental performance on the basis of corporate emissions of toxic chemicals relative to sales. The authors show a positive relationship between environmental performance and voluntary environmental disclosure, confirming the results of Al Tuwaiiri et al. (2004) and in line with the voluntary disclosure theory and signaling theory. De Villiers and van Staden (2011), distinguishing between annual report disclosure and website disclosure, provide a negative association between long-term environmental performance and the level of environmental disclosure, supporting the socio-political theories. Also, the meta-review studies report mixed results. Doan and Sassen (2020), suggest that environmental performance is

negatively associated with environmental disclosure, while Cho et al. (2016) reveals no association between these variables. On the basis of these mixed and inconclusive results, the following hypothesis is formulated:

H<sub>1</sub>: The environmental performance is associated to environmental disclosure.

### 3.1 The influence of study characteristics

The inconclusive results of the empirical literature review above analyzed are due to the different definition and measurement of environmental performance and environmental disclosure. Following the previous meta-review (Doan and Sassen, 2002), we identify five study characteristics used by the studies: performance aspect, performance measurement techniques, performance tone, disclosure nature and disclosure measurement techniques.

Regarding the environmental performance aspect, Delmas and Blass (2010) identify three main categories of environmental performance indicators: environmental impact (e.g., amount of toxic emissions, usage of energy, pollution performance index), regulatory compliance (e.g., whether firms' activities are in compliance with sustainability regulation), and organizational processes (environmental accounting, audits, reporting). Ingram and Frasier (1980) measure environmental performance as a performance index by the Council on Economic Priorities (CEP), but focusing on the air and water performance, while Wiseman (1980) uses the overall CEP index. However, the findings of these papers are the same. On the contrary, Brown & Deegan (1997) adopt the print media coverage given to various industries' environmental effects as environmental aspect, finding that the high level of environmental attention in the newspaper and journal is associated to high level of environmental disclosure in annual report. Also, Li et al. (1997) confirm these findings using an electronic database of spills that occurred in the jurisdiction of Ontario from 1988 onward, where the firms are ranked on the basis of (1) quantity of materials spilled, (2) the nature of the spill in terms of cleanup difficulty and environmental impact, and (3) relative size of the company. Furthermore, Mitchel et al. (2004) define the poor performing companies as companies subject to the Environmental Protection Agency (EPA) prosecutions, providing no association between EP and ED, while Brammer and Pavelin (2006), using published Environment Agency data, find a negative association between EP and ED. Van Staden and Hooks (2007) use an organization process measuring the company's environmental responsiveness through a survey based on corporate environmental policy, environmental objectives, environmental management systems etc. Their results confirm the negative association between EP and ED. Finally, Cho et al. (2010) employ the KLD concern rating considering the following items: (1) hazardous waste, (2) regulatory

problems, (3) ozone depleting chemicals, (4) substantial emissions, (5) agricultural chemicals, (6) climate change and (7) other concern (KLD Research and Analytics, Inc., 2003). Also, they find a negative association between KLD concern rating and environmental disclosure. Based on these results, the following hypothesis is formulated:

H<sub>2</sub>: The association between EP and ED depends on the environmental performance aspects

Academics measure the environmental performance in different ways, classifying it in qualitative and quantitative methods (Al-Tuwaijri et al., 2004). As qualitative methodologies, many studies use ordinal data such as the Council on Economic Priorities' (CEP) company rating charts (e.g. Ingram and Fraser, 1980), while other authors employ nominal data such as the adoption of environmental initiatives (e.g., Ahmadi & Bouri, 2017). On the contrary, some studies adopt quantitative data using, for example, the amount of toxic emissions (e.g., Clarkson et al., 2008) or the carbon intensity (e.g. Datt et al, 2019). Combining these two methodologies, Delmas and Blass (2010) employ the toxic release inventory, the health risks associated with toxic releases and the compliance with US environmental regulations. Therefore, it is expected that the association between EP and ED can be influenced by the different performance measurement techniques. Consequently, the following hypothesis is formulated:

H<sub>3</sub>: The association between EP and ED depends on the environmental measurement techniques

The variety of quantitative measures of environmental performance evidence that the environment performance data can have positive and negative tone (Dixon-Fowler et al., 2017; Hughes et al., 2001; Klassen & McLaughlin, 1996). The environmental performance has a positive tone when the environmental impact has a positive effect on the society or when the studies use a ratio such as the ratio of toxic waste recycled to total toxic waste generated (Al Al-Tuwaijri et al. (2004). On the contrary, negative environmental proxies are ratio such as the ratios of GHG emissions, waste production, and water consumption to total revenue (e.g., Braam et al., 2016; Fontana, D'Amico, Coluccia, & Solimene, 2015; Sutantoputra et al., 2012 or TRI emission scaled by total sales revenue (Al-Tuwaijari et al., 2004; Cho and Patten, 2007; Clarkson et al., 2008). Therefore, we expect that the tone used to measure the environmental

performance could influence the relationship between EP and ED. Thus, the following hypothesis is:

H<sub>4</sub>: The association between environmental performance and environmental disclosure depends on the performance tone.

Similar to the definition and measurement of environmental performance, the studies analyzed vary also in the nature of disclosure tested and the techniques used to measure the disclosure. Regarding the nature of the disclosure, it can be classified as qualitative if the information is expressed in narrative form, and as quantitative if it is expressed in numerical form. Deswanto and Siregar (2018) measure the disclosure using a scoring technique based on GRI, G3.1 or G4 index which quantifies the percentage of the item disclosed over the maximum numbers of item disclosed, whereas Brammer and Pavelin (2006) employ the PIRC Environmental Reporting 2000 survey data to describe the quality of the ranked on the following aspects: policy, initiative, improve, auditing, target. Thus, the following hypothesis is:

H<sub>5</sub>: The association between environmental performance and environmental disclosure depends on the disclosure nature

The qualitative and quantitative disclosure can be measured using several techniques, which can be classified into five groups: content analysis, index, scoring, survey and index. Al-Tuwajri et al. (2004) identify the first and the second groups. The first group quantifies the level of environmental disclosure in the annual report using the number of pages (Gray, Kouhy, & Lavers, 1995; Guthrie & Parker, 1989; Patten, 1992, 1995), sentences (Frazier, 1982; Ingram & Wiseman, 1980), and words (Deegan & Gordon, 1996; Zeghal & Ahmed, 1990). However, these measures have limitations because the pages include the pictures that are not about environmental and social topics, while the sentences and words don't contain graphs and tables. Therefore, the authors could use these techniques to manipulate the environmental information in impression management perspective. The second group of measures is based on the disclosure scoring derived from content analysis, identifying several environmental items that authors code with a score of 1 if the item is present and 0 if the item is not present. Many studies employ a variation of this score such as Fontana et al. (2015), that assign a different in relation to the completeness of information. The third group of measure is an index created by



third-party for example, the Carbon Disclosure Leadership Index (CDLI) (e.g., Giannarakis, et al, 2017a) or Bloomberg's Environmental, Social, and Governance (ESG) (e.g., Wang et al., 2017, 2018). The fourth group of the measures is the survey, for instance, Lai et al. (2015) utilize survey responses collected from 210 trading firms in Hong Kong to measure the environmental disclosure. Since the studies analyzed in our paper use several disclosure measurement techniques, we expect that one technique can influence more than the other techniques on the association between EP and ED. Therefore, the following hypothesis is formulated:

H<sub>6</sub>: The association between EP and ED depends on the disclosure measurement techniques

### 3.2 The influence of cultural factors

Hofstede defines culture as “the collective programming of the mind which distinguishes the members of one human group from another” (Khlif et al., 2015). Hofstede identifies 6 cultural dimensions which are power distance, individualism vs collectivism, masculinity vs femininity, uncertainty avoidance, long term orientation vs short term orientation and indulgent vs restraint.

Power distance is the extent to which the less powerful members of an organization within a country expect and accept that the power is distributed unequally (Gallén & Peraita, 2018; Insights, 2022). People from high or low power distance culture may have different orientation toward sustainability action in their society. People from low power distance culture seek more equal and democratic relation with other people, hence they are more sustainable toward society and environment. Various studies have been conducted to test the relation between power distance and CSR practice and disclosure. Literature provides mostly negative relation among these variables. Halkos and Skouloudis (2017), Ringov and Zollo (2007); Thanetsunthorn (2015), Yu-Shu et al. (2014) find negative relation between power distance and CSR performance in line with other researches (Gallego-Álvarez & Ortas, 2017; Garcia-Sanchez et al., 2016). On the contrary, Ho et al. (2012) show positive relation between power distance and CSR performance. Other studies demonstrate that lower power distance has positive relation with CSR disclosure. Based on these empirical evidences, we can assume that power distance moderates the association between environmental performance and environmental disclosure. For this reason, our next hypothesis is:

H<sub>7</sub>: The association between EP and ED depends on the high/low power distance.

Individualism is the degree to which people in a society are integrated in a group. People from the individualistic society are expected to take care of themselves and their immediate family members and are less interested about the collective interest of the society. So, less individualistic society people are expected to be more sustainable toward society and environment (Gallén & Peraita, 2018; Insights, 2022). Existing literature generally shows a mixed relation between individualism and environmental disclosure. Halkos and Skouloudis (2017), Ho et al. (2012), Thanetsunthorn (2015) find that there is a negative relation between individualism and CSR disclosure. However, other studies provide evidence that there is a positive relation between individualism and CSR or environmental disclosure because collectivist culture support and provide favor to some groups which ultimately bring corruption and unethical actions (Disli et al., 2016; Vachon, 2010). These different directional relation between individualism and environmental or CSR disclosure inspire us to assume that individualism may significantly moderate the relation between environmental performance and environmental disclosure. Consequently, our next hypothesis is:

H<sub>8</sub>: The association between EP and ED depends on the high/low individualism.

Masculinity is the degree to which a society differentiates and emphasizes traditional role between genders. A high masculine society values more masculine characteristics such as assertiveness, competitiveness, success and status. On the other hand, low masculinity or feminine society emphasizes on cooperation, modesty, caring of weak and quality of life (Gallén & Peraita, 2018; Insights, 2022). As a result, low masculine society or feminine society are expected to behave more sustainable toward society and environment. Williams (1999) find that countries with higher masculine culture produce lower level of social and environmental disclosure. Other studies show that countries with high masculine culture have lower level of social and environmental performance (Disli et al., 2016; Halkos & Skouloudis, 2017; Ringov & Zollo, 2007; Thanetsunthorn, 2015; Yu-Shu et al., 2014). From these discussions, we can assume that masculinity in culture may influence the association between environmental performance and environmental disclosure. Consequently, our next hypothesis is:

H<sub>9</sub>: The association between EP and ED depends on the high/low masculinity.

The long-term orientation shows the level to which members of a society put his or her effort toward the future. Higher long-term orientation society means the members of the society put more effort for future goals rather than present life (Gallén & Peraita, 2018; Insights, 2022). Orij (2010) predicts a positive relation between long-term orientation and CSR disclosure,

while other authors demonstrate a positive relation between long-term orientation and CSR practice (Disli et al., 2016; Halkos & Skouloudis, 2017). This assumes that long-term orientation has relation with both CSR performance and CSR disclosure. Based on this, we can assume that long-term orientation moderates the relation between environmental performance and environmental disclosure. Our next hypothesis is:

H<sub>10</sub>: The association between EP and ED depends on the high/low long term orientation.

## **4. Research methodology**

### **4.1 Sample**

We adopt a multistep process in order to identify the studies about the association between CSR disclosure and CSR performance. Firstly, we select a set of keywords that we find in the papers related to our research topic: "association between CSR performance and CSR disclosure", "CSR reporting and CSR performance", "effects of CSR reporting", "effects of sustainability reporting", "determinants of CSR reporting", "determinants of sustainability reporting", "effects of non-financial reporting", "determinants of non-financial reporting", "effects of CSR performance", "determinants of CSR performance", "Corporate Social Responsiveness", "Corporate Conscience", "Sustainable Responsive Business". Secondly, we use the above keywords to select the papers published in the major databases, such as Scopus, ScienceDirect, Emerald Insight, EJSEbsco, Blackwell, Springer, Web of Science, ProQuest, that are selected because of their extensive full-text coverage of the papers (see Doan and Sassen, 2020; Gupta and Das, 2021; Velte, 2021; Cho et al., 2016; Ali et al., 2017). Similarly, we identify a number of journals that have been consistently evaluated for their high quality and considered important outlets for academic research on our research topic (Patten and Shing, 2019; Malik, 2014) including Accounting, Organization and Society, Accounting, Auditing and Accountability Journal, Corporate Social Responsibility and Environmental Management, Journal of Business Ethics, Meditari Accountancy Research, Business Strategy and the Environment, Journal of Cleaner Production. The main criterion we have used to include a study in the meta-analysis, is that it analyzes the association between environmental disclosure and environmental performance. For this reason, we exclude one study regarding exclusively social disclosure and social performance. In addition, we exclude one non empirical study, one non peer-reviewed paper and cross-countries studies to analyze the effect of cultural characteristics on the association between environmental disclosure and environmental performance. The final sample is composed by 59 studies. Figure 1 describes the selection

process, while the Table I summarizes the results of our literature searching process. Appendix I provides the list of studies included in our meta-analysis, detailing the following information: (1) journal, (2) author(s) and year of publication, (3) title, (4) country, (5) composition of sample.

[Figure 1, Table I and Appendix I about here]

## 4.2 Research Methodology

The meta-analysis technique is a statistical analysis that synthesizes or merges the findings of independent studies, focused on the same question, which aims to generate a quantitative estimate of the studied phenomenon. In our paper we use the meta-analysis technique, developed by Lipsey and Wilson (2001), in order to find logical conclusions from papers, related to the association between environmental performance (EP) and environmental disclosure (ED). The meta-analysis technique requires the use of the effect size and its variance to measure the magnitude of the association between the EP and ED. We collect one effect size from each study that is measured by the Pearson correlation (Spearman correlation if Pearson correlation is not available). Where correlation is not available, we take the t-statistic from the regression result and converted it into correlation. When t-statistic is not available, we collect the p-value from the regression result and convert the p-value into t-statistic and then calculate correlation among environmental performance and environmental disclosure. Geyskens, Krishnan et al. (2009) also mention that artifact distribution involves collecting any artifact information available in the meta studies. We convert the t-statistic to r (correlation) following this formula:

$$R^2 = \frac{t^2}{t^2 + df}$$

As correlation is not normally distributed, there can be bias while calculating the variance. Therefore, we convert the correlation into Fisher's Z before using it as the input for meta-analysis, following this formula (Berben, Sereika et al. 2012):

$$\text{Fisher's Z, ESZr} = 0.5 \frac{1 + r}{1 - r}$$

We also calculate the variance of the effect sizes by the R software and the heterogeneity among the effect sizes in different individual studies, measured by Q statistic, tau<sup>2</sup>, I<sup>2</sup> and others. The formula of Q is given below:

$$Q = \sum(w \times ES^2) - \frac{[\sum(w \times ES)]^2}{\sum w}$$

We run random effect model in meta-analysis technique as it assumes that the true effect size in different studies may vary (Lipsey and Wilson 2001). Furthermore, we test the publication bias (Maier, VanderWeele et al. 2021) to see whether publication bias significantly affect the overall effect sizes among the studies.

#### 4.2.1 Moderators variables

The aim of our study is to find the moderating effects of study characteristics and national culture in the association between environmental performance and environmental disclosure. To identify the study characteristics, we collect the variables environmental performance and environmental disclosure from each sample study and find the characteristics of each variable through coding. Based on the previous studies, we identify the following characteristics of environmental performance: performance aspect, performance measurement technique and performance tone. The performance aspects are classified in environmental impact, regulatory compliance, organization process, ranking, mixed, media coverage and integrated aspect, while the performance measurement techniques are divided in three groups: qualitative, quantitative and mixed. The performance tone can be measured by a ratio that express the positive effect on environment (positive) or a ratio that express the negative effects on environment or in mixed way. The environmental disclosure is categorized by nature and measurement techniques. The nature of disclosure is qualitative when the information is presented in narrative manner, while is quantitative when the information is presented in numerical manner or in mixed manner. types of measuring techniques. The measurement techniques used by the studies analyzed in our paper are classified in these categories: content analysis, scoring

technique, survey, indexing and mixed of various methods. Appendix II reports the description of the study characteristics.

[Appendix II about here]

To identify the national characteristics of the studies, we take into account Hofstede's cultural dimensions (Hofstede 1984, Insights 2022) of the countries where the studies took place to see its moderating effect on the relationship between environmental disclosure and environmental performance. The Hofstede's model of national culture consists of six dimensions. These cultural dimensions symbolize separate preferences for one circumstances over another that distinguish countries, rather than individuals, from each other (Insights 2022). These dimensions are power distance, individualism, masculinity, uncertainty avoidance, long-term orientation and indulgence. However, we focus on power distance, individualism, masculinity and long-term orientation. We collect the numerical data about the scores of these 6 cultural dimensions of 112 countries from the website, <https://geerthofstede.com/research-and-vsm/dimension-data-matrix/> and calculate the median score for each of these dimensions. Power distance symbolizes a culture of a society where people accept the hierarchical order where every person has its own position (Insights 2022). The countries in our studies situated above the median score (for power distance) are shown as high power distance country and situated below the median as low power distance country. Individualism represents a culture of a society where people only take care of themselves or their immediate family members and on the opposite collectivist culture represent a society where people expect to get care from relatives and other groups where people of the society have strong bonding among themselves (Insights 2022). The countries above the median score of individualism are considered as high individualism countries and the countries below the median score are considered as low individualism countries. Masculinity represents the culture of a society where people have preference for achievement, heroism, material rewards opposite to femininity culture of a society where people prefer cooperation, caring for weak and the society is consensus based (Insights 2022). Like above, countries above the median score are considered as high masculinity countries and countries below the median score are considered as low masculinity countries. Long-term orientation represents the culture of a society that encourage thrift and effort in modern education as a way to prepare for future. On the other hand, low long term orientation or short term normative orientation society wants to stick with its traditions (Insights 2022). Countries are divided into high and low long-term orientation countries based on median score.

## 5. Results

### 5.1. Meta-Analysis

Table II presents the value of the effect size and other statistics of the meta-analyses. The overall EP-ED association has a positive and significant overall summary effects size (effect size = 0.1981, z-value = 4.3093,  $p < 0.0001$ ). The positive sign of the overall effect size suggests that EP is negatively associated with ED. Most of the effect sizes collected from study samples contain negative tone to measure environmental performance with positive signs. Also, in the meta-regression analysis (which discussed later in this paper), negative tone in environmental performance characteristic shows significant moderating effect on the association between EP and ED. For this reason, through the overall effect size from meta-analysis, it can be concluded that there is significant negative association between EP and ED. Therefore, hypothesis H<sub>1</sub> is accepted. These findings are in line with the previous studies that support the socio-political theories (i.e. Bewley and Li, 2000; Hughes et al, 2001; Cho et al, 2010; Braam et al, 2016; Doan and Sassen, 2020), suggesting that poor performers have incentives to increase their disclosure. However, the Q-statistic is 2160.085 ( $p$ -value  $< 0.0001$ ),  $\tau^2$  is 0.1141 and the  $I^2$  is 96.86%, which means that the heterogeneity among the effect sizes is significant and high in 59 studies. Regarding the performance aspect, environmental impact, regulatory compliance, organizational process, ranking, media coverage and integrated aspect are positively significant, while mixed approaches are insignificant. These findings partially validate the definition of performance indicators by Delmas and Blass (2010), the importance of integrated approach suggested by Doan and Sassen (2020) and the specific environmental aspects. Concerning the performance measurement techniques, the qualitative technique has a higher effect size (0.3644,  $p$ -value  $< 0.0001$ ) than quantitative technique and shows significant heterogeneity, in contrast with the results of Doan and Sassen (2020). In terms of performance tone, negative and mixed tone have high effect size values, 0.1461 ( $p$ -value 0.0004) and 0.3039 ( $p$ -value 0.0043), suggesting that the adoption of negative impact proxy to measure the performance aspect demonstrates better the association between EP and ED. These findings are in line with Doan and Sassen (2020). Considering the disclosure characteristics, the results show that qualitative and mixed disclosure have a significant value in the effect size (0.2358 and 0.1671,  $p$ -value 0.0032 and 0.0049), while the content analysis has a higher effect size value (0.191,  $p$ -value 0.0027) than the others disclosure measurement techniques. In contrast, Doan and Sassen (2020) find a higher effect size for the third-party index technique.

Relating to the cultural factors, low power distance (effect size 0.2352, p-value <0.0001), high individualism (effect size 0.2063, p-value <0.0001), high masculinity (effect size 0.2245, p-value <0.0001) and both high and low long-term orientation (respectively effect size 0.1788 and 0.205, p-value 0.047 and 0.0002) have significant effect size values leading to a better association. The meta-analysis also shows significant heterogeneity with significant overall effect sizes. Through the forest plot and funnel plot, presented below in Figures 2 and 3, it is possible to visualize the heterogeneity and asymmetry between the size effects.

[Table II about here]

## 5.2. Meta-Regression

Table III provides the results of the meta regression, through which the moderating effects of various study characteristics and cultural dimensions on the association between environmental performance and environmental disclosure are analyzed.

Considering the studies characteristics, environmental impact (coefficient 0.1339, p-value 0.0409), media coverage (coefficient 1.3418, p-value 0.0002) and integrated aspect (coefficient 0.2738, p-value 0.0012) moderate the relationship. These results support H<sub>2</sub>. It suggests that environmental impact and integrated aspects influence the association between EP and ED more than the other aspects. Regarding the performance measurement technique, qualitative technique (coefficient 0.3602, p-value <0.0001) affects this relationship, supporting the hypothesis H<sub>3</sub>. These findings suggest that qualitative techniques used to measure environmental performance are more accepted by the preparer and users of environmental reports to describe the holistic view of the company about its sustainable approach. Relating to the performance tone, negative (coefficient 0.1502, p-value 0.0244) and mixed (coefficient 0.2959, p-value 0.0004) tone influence more than positive tone, consistent with hypothesis H<sub>4</sub>. Consequently, it implies that companies with a more negative effect on the environment produce more environmental reports and therefore use a more negative tone in their environmental reports. In relation to the nature of environmental disclosure, the qualitative (coefficient 0.2358, p-value 0.0022) and the mixed (coefficient 0.1674, p-value 0.0058) nature significantly influence the impact of environmental performance on environmental disclosure, supporting H<sub>5</sub>. The qualitative and mixed nature of environmental performance can be more informative and have a more significant influence from the stakeholder perspective. Regarding the disclosure measurement technique, the content analysis method (coefficient 0.19, p-value 0.0014) and survey method (coefficient 0.524, p-value 0.0344) also significantly moderate the



association, confirming H<sub>6</sub>. This could be explained by the fact that content analysis is becoming a standard in environmental disclosure research, while the survey technique is also an emerging disclosure measurement technique often used by researchers in the field of environmental disclosure.

Regarding the moderating effect of national culture on the impact of environmental performance on environmental disclosure, low power distance (coefficient 0.2359, p-value <0.0001), high individualism (coefficient 0.2084, p-value <0.0001), high masculinity (coefficient 0.2241, p-value <0.0001), high and low both long term orientation (coefficient 0.1788, 0.205 p-value 0.0493, 0.0001) significantly moderate the impact of environmental performance on environmental disclosure. This might suggest that societies with these characteristics strengthen the relationship between environmental performance and environmental disclosure, confirming hypotheses H<sub>7</sub>, H<sub>8</sub>, H<sub>9</sub> and H<sub>10</sub>. The results regarding the moderating effect of low power distance confirm that in contexts where people accept the hierarchical order and each person has his or her own position, the relationship between environmental performance and environmental disclosure is more significant. Based on the legitimacy theory, in a context of high individualism, companies with a negative environmental performance are inclined to disclose better environmental information to try to cover up their bad image, influencing the relationship between environmental performance and environmental disclosure. Again, through the legitimacy theory, it is possible to explain how, in a context of high masculinity and thus a greater preference for achievement, societies can present characteristics that strengthen the relationship. Finally, our results show that companies with a low long-term orientation significantly moderate the relationship compared to those with a high long-term orientation. This evidence contrasts with the general implication that companies with a high long-term orientation should be more significant in moderating the relationship. This contradictory result suggests that future research should investigate this issue further.

Analyzing the publication bias using selection model (Maier, VanderWeele et al. 2021), the unadjusted overall summary effect size is 0.198, while, after adjusting the publication biasness, the overall summary effect size is 0.2604. Considering the likelihood ratio, the p-value is 0.28201, which implies that the difference in the overall summary effect size is not significant and therefore there is no publication bias in these studies.

Through a robustness check implemented to verify the reliability of the applied methodology, it is possible to discover whether there are influential studies in our research

sample (Viechtbauer and Cheung 2010). The Brown and Deegan (1998)'s study considered in the sample is an outlier. The influence of this study could derive from the fact that it considers media coverage as an aspect of performance in the environmental performance variable of their study. Removing the above-mentioned study from the sample, we conduct the meta-analysis, meta-regression and other tests again, for both overall and subsets of studies. After the exclusion of the outlier, the results of both the meta-analysis and the meta-regression do not change significantly. Moreover, the p-value of the likelihood ratio is 0.38073, meaning that there is no publication bias in these studies. Figure 4 and Figure 5 show graphs of the deleted residual, DFFITS, Cook's Distance, Covratio (log scale) and other values, respectively including and excluding the outlier.

[Table III about here]

### 5.3. Sensitivity tests

Table IV and Table V present the results of the sensitivity analysis that divide the studies analyzed on the basis of their results. Table IV provides the results of meta-regression applied to the studies, providing a negative association between EP and ED, while Table V presents the results of meta-regression applied to the studies, providing a positive association between EP and ED. Table IV shows that environmental impact and media coverage under the performance aspect have a significant moderating effect (coefficients 0.1141, 1.3418 and z-values 2.2131, 4.9186), while in Table V the integrated aspect has a significant moderating effect (0.3505 and z-value 2.0624). These results suggest that environmental impact and media coverage play a more vital role in communicating environmental performance when the legitimacy theory prevails, and the integrated aspect is significant when the voluntary disclosure theory prevails. Regarding the performance measurement techniques, in presence of negative association, both qualitative and quantitative techniques have a significant moderating effect on the relationship (coefficients 0.2869, 0.1288 and z-values 3.0388, 2.3317, reported in Table IV). On the other hand, considering the positive association, the relationship between environmental performance and environmental disclosure is significantly influenced only by qualitative technique (coefficient of 0.4355 and a z-value of 3.4436, Table V). Thus, it can be deduced that when the legitimacy theory prevails, both qualitative and quantitative measurement technique play a significant role in the relationship between environmental performance and environmental disclosure, while in the case of the prevalence of voluntary disclosure theory, it is only the qualitative measurement technique that is significantly

important in the relationship between environmental performance and environmental disclosure. Concerning the nature of disclosure, Table IV provides that the mix of quantitative and qualitative disclosure has a significant moderating effect on the association between environmental performance and environmental disclosure (coefficient of 0.2121 and a z-value of 3.7667), while Table V shows that it is exclusively the qualitative disclosure that significantly influences the relationship. Thus, if the legitimacy theory prevails, companies are more likely to use a mixed nature of environmental disclosure, whereas if the voluntary disclosure theory prevails, companies are more willing to disclose a qualitative type of environmental information. This indicates that qualitative environmental reporting can use inaccuracy management to mislead report users (Fialho et al., 2021; Talbot & Barbat, 2020). Both Table IV and Table V show that the content analysis technique significantly moderates the relationship between environmental disclosure and environmental performance in both groups of studies (coefficient 0.1761 and z-value 2.9654 from Table IV, coefficient 0.3216 and z-value 2.4717 from Table V). Therefore, researchers should carefully follow the content analysis method as this influences the relationship mentioned above.

Considering the national factors, in both Tables, the culture of low power distance significantly influences the relationship between environmental performance and disclosure (coefficient 0.19 and z-value 3.9975 from Table IV, coefficient 0.3268 and z-value 2.6801 from Table V). Table IV shows that the values of the low power distance culture are more significant when the legitimacy theory prevails more than the voluntary disclosure theory. Furthermore, it provides that the culture of high individualism significantly influences the relationship between environmental performance and environmental disclosure (coefficient of 0.1804 and a z-value of 3.788, from Table IV), suggesting that countries with a culture of high individualism or low collectivism persist with the legitimacy theory. In contrast, Table V both high and low individualism significantly influence the relationship between environmental performance and environmental disclosure (coefficients 0.2396 and 0.5901 and z-values 2.2746 and 2.6193). Table IV and Table V provide evidence that the high masculinity culture significantly influences the relationship between environmental performance and environmental disclosure (coefficient 0.1847 and z-value 4.0778 from Table IV, coefficient 0.3663 and z-value 3.2468 from Table V). Unexpectedly, high-masculinity countries are inclined to both theories of legitimacy and voluntary disclosure. This result contradicts the idea that societies with high feminism culture are more inclined to voluntary disclosure theory, in the light of the fact that they are more concerned about society than societies with high

masculinity culture (Insights, 2022). Finally, Table IV shows that the culture of low long-term orientation significantly influences the relationship between environmental performance and environmental disclosure (coefficient 0.1981 and z-value 4.0693). In contrast, considering Table V, both high long-term orientation culture and low long-term orientation culture significantly influence the relationship (coefficients 0.3504 and 0.2696 and z-values 2.2469 and 2.0249); however, the high long-term orientation culture is more significant than the low long-term orientation culture. These findings imply that the culture of low long-term orientation is dominated by legitimacy theory, while voluntary disclosure theory prevails more in the society with high long-term orientation.

[Table IV and V about here]

## **.6. Conclusions**

The aim of this paper is to summarize the results of the studies that analyze the association between environmental performance and environmental disclosure, employing the meta-analysis technique. Our findings confirm a negative significant association, suggesting the prevalence of socio-political theories over the economic-based theories. The analysis of studies attributes provide evidence that several performance aspects, qualitative measurement techniques, negative performance tone, qualitative disclosure and the content analysis methodology influence significantly the association between EP and ED. Also, it depends on the high individualism, high masculinity, low power distance and low long term orientation dimensions. The sensitivity test shows some differences when we classify the studies on the basis of their results. If the association between EP and ED is positive, also the high long-term orientation and low individualism influence this association.

Our study adds to the previous literature testing if the relationship between EP and ED depends on the moderating variables. Additionally, our meta-review results contribute to the present studies on the association between environmental performance and environmental disclosure by adding study characteristics and cultural dimensions as the moderating variables which uncovered several new outlooks. The significant moderating effect of qualitative disclosure nature suggests that company managers need to put more care on qualitative part of the environmental disclosure. The negative association part of sensitivity analysis recommends that low power distance, high individualism and high masculine societies are more exposed toward probable opportunistic behavior by the company managers. Consequently, these group of societies need more awareness about the greenwashing, impression management and other

benefit seeking behavior by the companies. Simultaneously, sustainability reporting standard setters are suggested to formulate more well-defined standards for societies which are more subjected to probable advantage taking behavior from companies. Synchronously, the same results suggest for the opposite societies characterized by high power distance, low individualism and low masculinity need more cognizance about environmental disclosure and its importance in general as safeguard, as negative association between environmental performance and environmental disclosure still exist in these societies.

Our study has several limitations. Firstly, we do not test the endogeneity problems in the association between EP and ED. Secondly, we consider only the cultural characteristics without analyzing the effect of other institutional characteristics such as the level of legal enforcement and economic development. Additionally, we do not study all research characteristics. Furthermore, we only considered one effect size from each study based on judgement and ignored other effect sizes and the overall result of the study.

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Figure 1: Study selection process

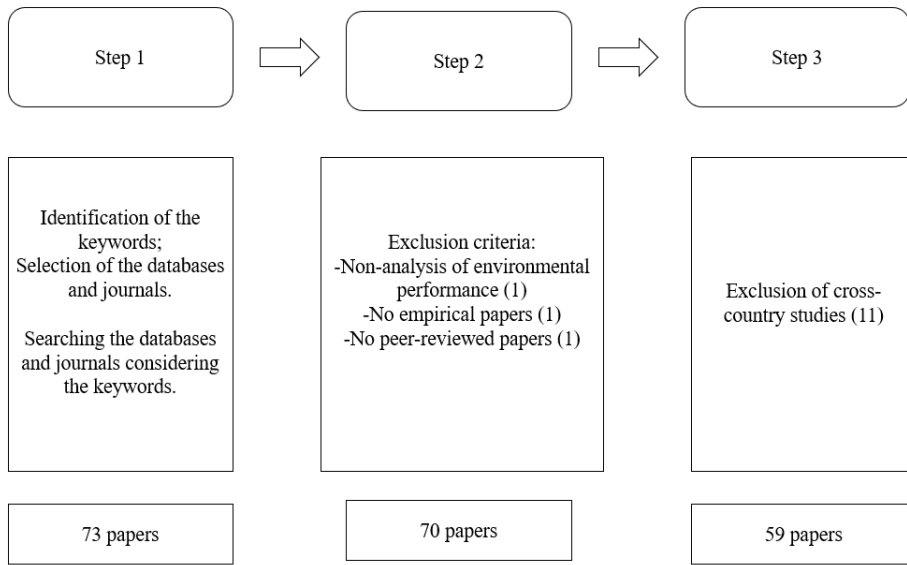


Figure 2: Forest Plot of the Meta Analysis Result

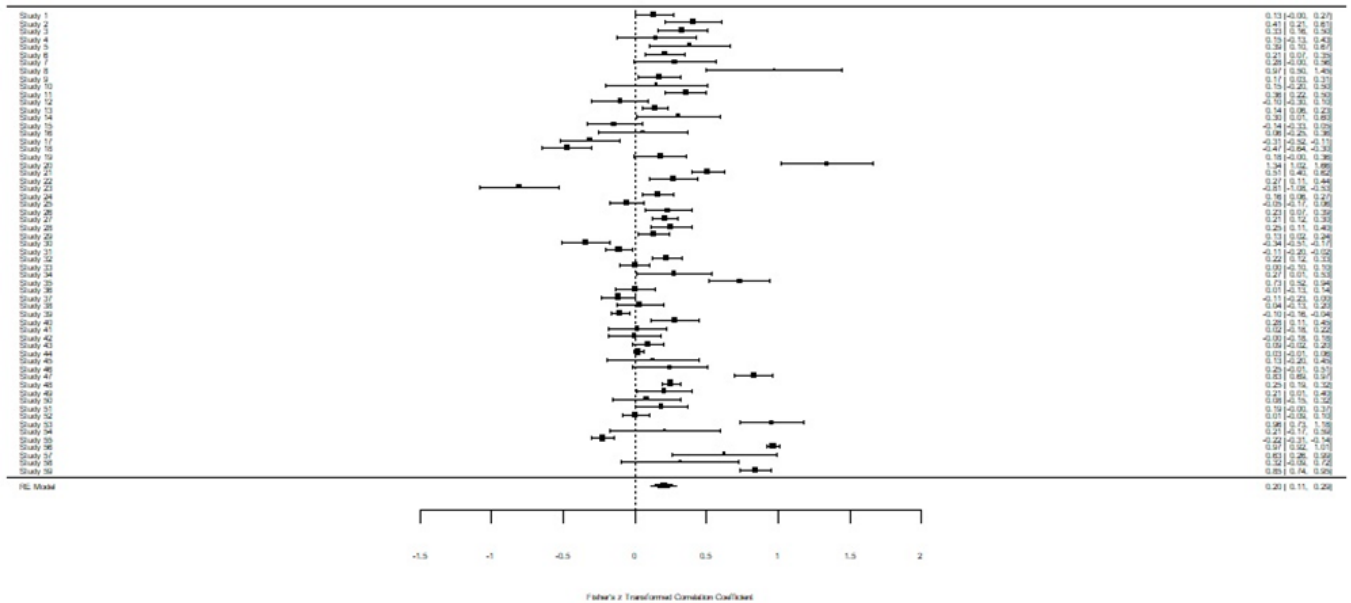


Figure 3: Funnel Plot of the Meta-Analysis Result

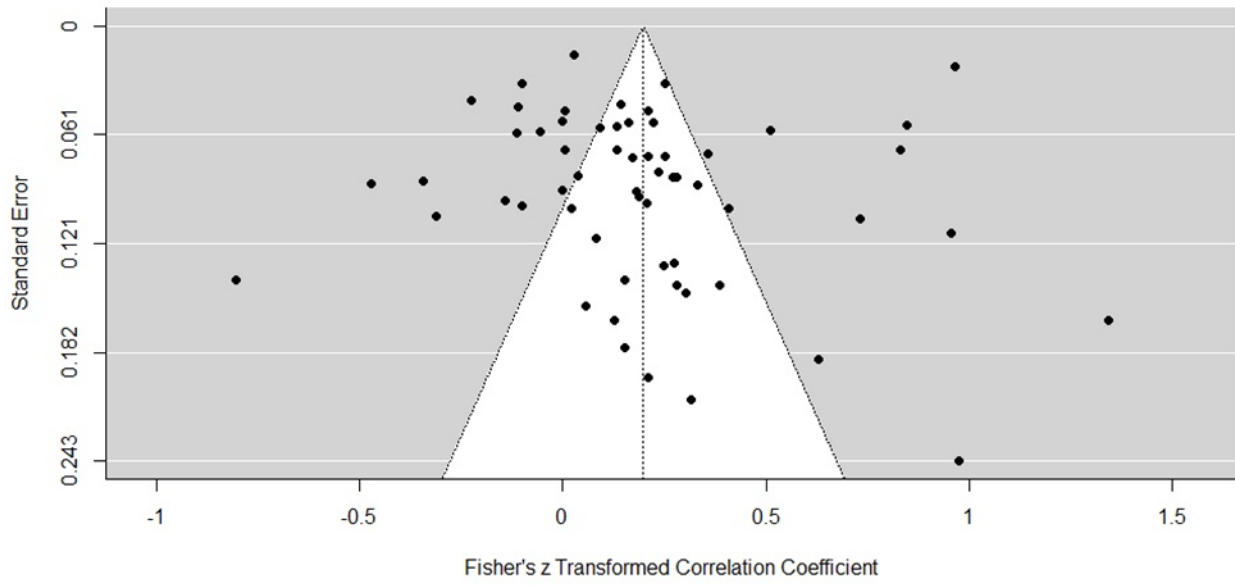


Figure 4: Plot of studentized deleted residual, DFFITS, Cook's Distance & other values

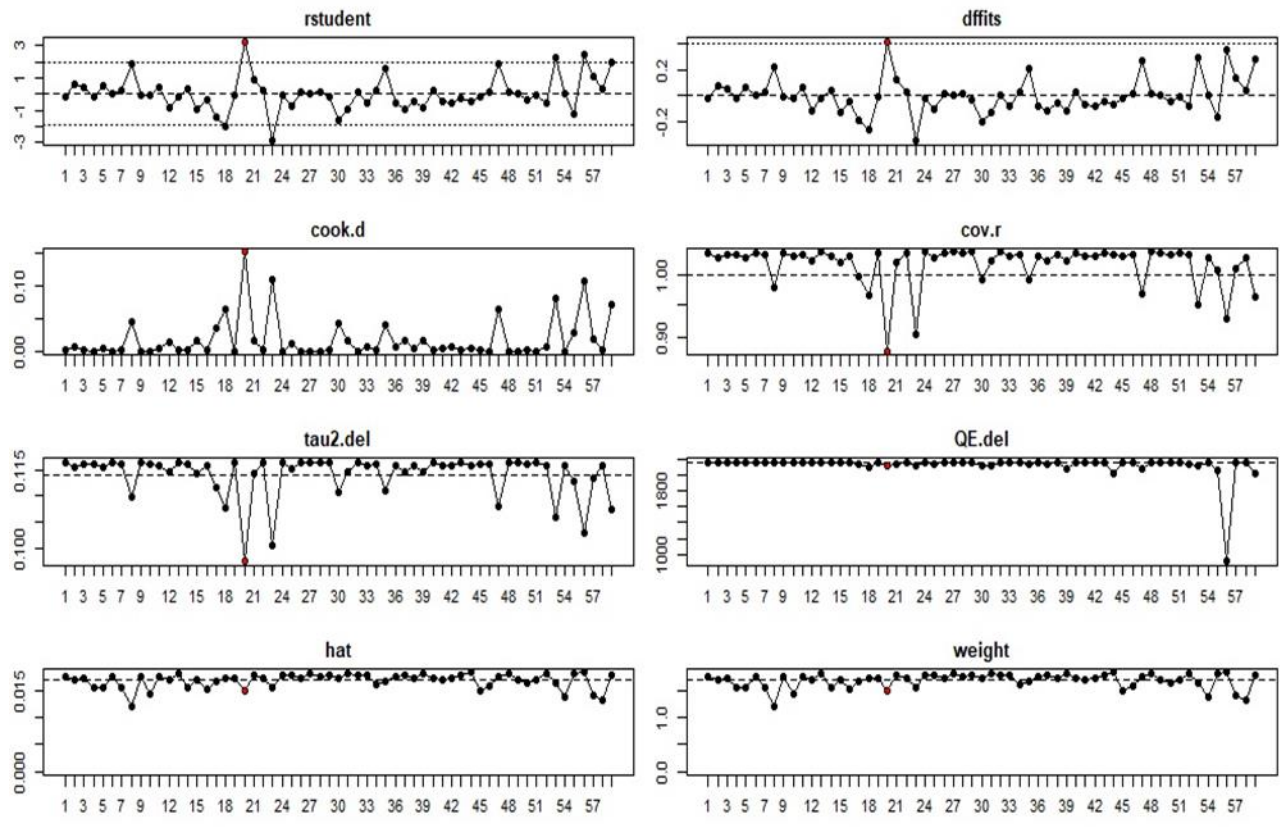


Figure 5: studentized deleted residual, DFFITS, Cook's Distance & other values (after excluding the influential study)

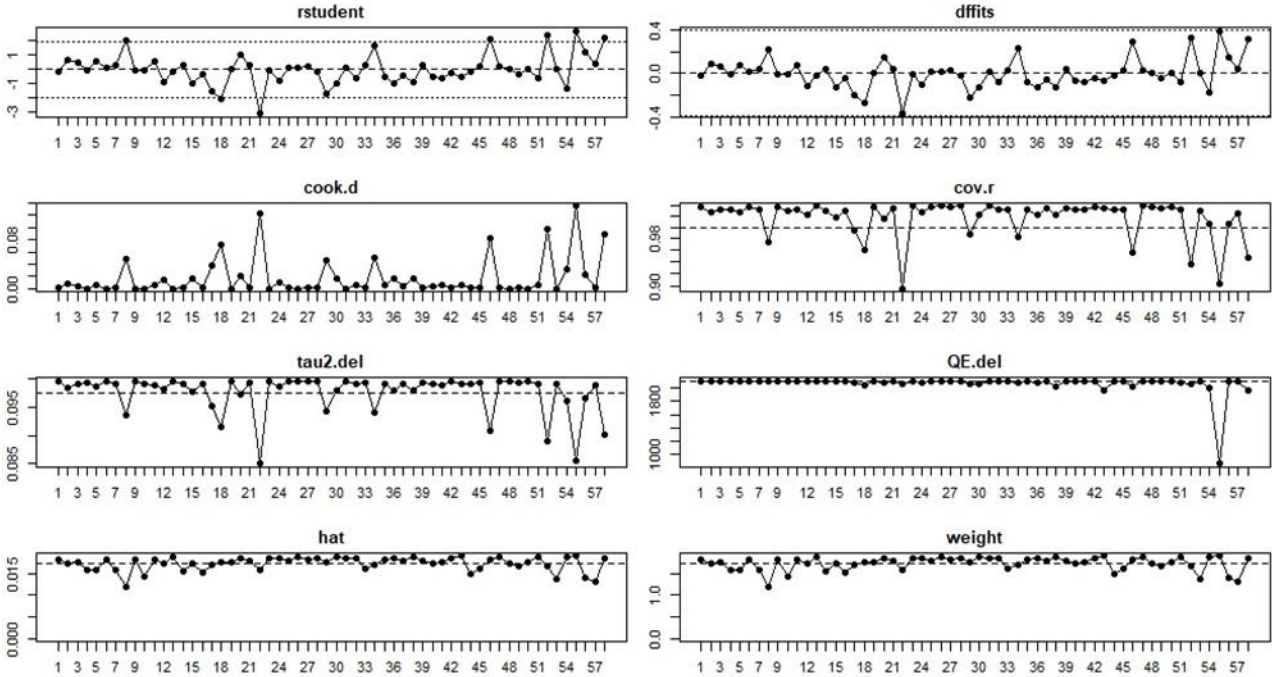


Table I: Literature searching procedure

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Initial sample	73
<hr/>	
Criteria leading to exclusion of studies	
– No empirical papers	1
– No peer-reviewed papers	1
– Cross-country studies	11
– Non-analysis of environmental performance and environmental disclosure	1
Final sample	59

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Table II: Results of Meta-analysis

Particulars		k	Summary Effect Size	Confidence Interval		Z	p-value	Q Statistic	I <sup>2</sup>	Tau <sup>2</sup>
<b>Overall meta analysis</b>		59	0.1981	0.108	0.2881	4.3093	<.0001	2160.085	96.86%	0.1141
<b>Environmental Performance</b>	<b>Performance Aspect</b>									
	Environmental Impact	25	0.1339	0.0297	0.2382	2.5183	0.0118	312.1422	93.92%	0.0624
	Regulatory Compliance	5	0.2043	0.1281	0.2806	5.2526	<.0001	5.0384	31.62%	0.0022
	Organizational process	1	0.6281	0.2642	0.9921	3.3827	0.0007	0	0.00%	0
	Ranking	6	0.1857	0.0612	0.3103	2.9219	0.0035	17.3247	74.11%	0.0161
	Media Coverage	1	1.3418	1.0196	1.664	8.1618	<.0001	0	0.00%	0
	Integrated aspect	15	0.2748	0.0705	0.479	2.6366	0.0084	1187.64	97.81%	0.154
	Mixed	6	0.0195	-0.3853	0.4243	0.0945	0.9247	92.9997	96.60%	0.2428
	<b>Performance Measurement Technique</b>									
	Qualitative	20	0.3644	0.1857	0.5431	3.9973	<.0001	1086.275	97.49%	0.1531
	Quantitative	28	0.116	0.0279	0.204	2.58	0.0099	243.006	92.05%	0.0472
	Mixed	11	0.1085	-0.1525	0.3695	0.8147	0.4152	328.2064	97.72%	0.1869
	<b>Performance Tone</b>									
	Positive	8	0.2064	-0.0471	0.4598	1.596	0.1105	126.8125	95.76%	0.1241
	Negative	29	0.1461	0.0658	0.2264	3.5663	0.0004	198.816	85.47%	0.0379
	Mixed	18	0.3039	0.0951	0.5127	2.8528	0.0043	1596.874	98.90%	0.1949
Others	4	0.065	-0.6063	0.7362	0.1897	0.8496	194.2068	98.56%	0.4582	
<b>Environmental Disclosure</b>	<b>Disclosure Nature</b>									
	Qualitative	21	0.2358	0.0789	0.3928	2.945	0.0032	1676.404	98.19%	0.1272
	Quantitative	3	0.2807	-0.0732	0.6346	1.5546	0.12	11.7316	82.36%	0.0788
	Mixed	35	0.1671	0.0507	0.2835	2.8136	0.0049	418.5448	95.08%	0.1117
	<b>Disclosure Measuring Technique</b>									
	Content Analysis	37	0.191	0.0663	0.3158	3.0012	0.0027	1506.859	96.73%	0.1376
	Scoring	11	0.165	0	0.3299	1.9603	0.05	124.4734	95.89%	0.0698
	Index	6	0.213	-0.073	0.499	1.4597	0.1444	226.1328	96.36%	0.1201
Survey	2	0.5248	-0.0685	1.1181	1.7336	0.083	47.2185	97.88%	0.1794	
Mixed	3	0.1391	-0.0414	0.3197	1.5105	0.1309	6.3629	65.50%	0.0162	
<b>National Culture</b>	Power Distance-High	12	0.0525	-0.1708	0.2758	0.4605	0.6451	251.1796	98.26%	0.1486
	Power Distance-Low	47	0.2352	0.1388	0.3317	4.7805	<.0001	1772.582	95.62%	0.1024
	Individualism-High	50	0.2063	0.1195	0.2931	4.6585	<.0001	1767.96	95.30%	0.0873
	Individualism-Low	9	0.1391	-0.2189	0.4971	0.7613	0.4464	273.1694	98.69%	0.2916
	Masculinity-High	51	0.2245	0.1247	0.3243	4.4095	<.0001	2070.78	97.00%	0.1211
	Masculinity-Low	8	0.0379	-0.1334	0.2092	0.4339	0.6643	75.9785	92.70%	0.054
	Long Term Orientation-High	15	0.1788	0.0024	0.3552	1.9864	0.047	285.1354	96.70%	0.1137
	Long Term Orientation-Low	44	0.205	0.099	0.3111	3.7893	0.0002	1853.612	96.84%	0.1172

Table III: Results of Meta-regression

Moderators		Coefficient	Standard Error	z-value	p-value	Confidence interval		Tau <sup>2</sup>
Environmental Performance	<b>Performance Aspect</b>							
	Environmental Impact	0.1339	0.0655	2.0441	0.0409	0.0055	0.2623	0.0988
	Regulatory Compliance	0.1703	0.1507	1.1295	0.2587	-0.1252	0.4657	0.0988
	Organizational process	0.6281	0.365	1.7209	0.0853	-0.0873	1.3436	0.0988
	Ranking	0.2408	0.1357	1.7746	0.076	-0.0252	0.5068	0.0988
	Media Coverage	1.3418	0.3547	3.7833	0.0002	0.6467	2.0369	0.0988
	Integrated aspect	0.2738	0.0846	3.2367	0.0012	0.108	0.4396	0.0988
	Mixed	0.0213	0.1364	0.1564	0.8757	-0.246	0.2886	0.0988
	<b>Performance Measurement Technique</b>							
	Qualitative	0.3602	0.077	4.6769	<.0001	0.2092	0.5111	0.1059
	Quantitative	0.1188	0.0643	1.847	0.0648	-0.0073	0.2449	0.1059
	Mixed	0.1111	0.1018	1.0919	0.2749	-0.0883	0.3106	0.1059
	<b>Performance Tone</b>							
	Positive	0.2062	0.1259	1.6377	0.1015	-0.0406	0.4529	0.1172
	Negative	0.1502	0.0667	2.2514	0.0244	0.0194	0.2809	0.1172
Mixed	0.2959	0.0837	3.5341	0.0004	0.1318	0.4599	0.1172	
Others	0.0816	0.1787	0.4566	0.648	-0.2687	0.4319	0.1172	
Environmental Disclosure	<b>Disclosure Nature</b>							
	Qualitative	0.2358	0.077	3.0638	0.0022	0.085	0.3866	0.1169
	Quantitative	0.2896	0.2132	1.3588	0.1742	-0.1282	0.7074	0.1169
	Mixed	0.1674	0.0606	2.7611	0.0058	0.0486	0.2863	0.1169
	<b>Disclosure Measuring Technique</b>							
	Content Analysis	0.19	0.0595	3.1943	0.0014	0.0734	0.3067	0.1188
	Scoring	0.1701	0.1076	1.5816	0.1137	-0.0407	0.381	0.1188
	Index	0.213	0.1452	1.4675	0.1422	-0.0715	0.4975	0.1188
Survery	0.524	0.2477	2.1159	0.0344	0.0386	1.0095	0.1188	
Mixed	0.1444	0.2075	0.6961	0.4864	-0.2622	0.551	0.1188	
National Culture	Power Distance-High	0.0545	0.0994	0.5482	0.5835	-0.1403	0.2493	0.1115
	Power Distance-Low	0.2359	0.0512	4.6121	<.0001	0.1357	0.3362	0.1115
	Individualism-High	0.2084	0.0504	4.1365	<.0001	0.1097	0.3072	0.116
	Individualism-Low	0.1421	0.1176	1.2087	0.2268	-0.0883	0.3726	0.116
	Masculinity-High	0.2241	0.0492	4.5587	<.0001	0.1277	0.3204	0.1121
	Masculinity-Low	0.0368	0.1222	0.3011	0.7634	-0.2027	0.2762	0.1121
	Long Term Orientation-High	0.1788	0.091	1.9656	0.0493	0.0005	0.3571	0.1163
	Long Term Orientation-Low	0.205	0.0539	3.8022	0.0001	0.0993	0.3106	0.1163



Table IV: Sensitivity Analysis- Meta-regression results for studies with negative association

Moderators		Coefficient	Standard Error	z-value	p-value	Confidence interval		Tau <sup>2</sup>
Performance Aspect	Integrated Aspect (All)	0.1076	0.108	0.9962	0.3191	-0.1041	0.3194	0.0474
	Environmental Impact (EI)	0.1141	0.0515	2.2131	0.0269	0.013	0.2151	0.0474
	Media Coverage (Med)	1.3418	0.2728	4.9186	<.0001	0.8071	1.8765	0.0474
	Mixed	0.1672	0.1082	1.5453	0.1223	-0.0449	0.3792	0.0474
	Regulatory Compliance (RC)	0.1943	0.1502	1.2937	0.1958	-0.1001	0.4886	0.0474
	Ranking (RNK)	0.1909	0.1346	1.4186	0.156	-0.0729	0.4548	0.0474
Performance Measurement Technique	Mixed	0.0873	0.1363	0.6402	0.5221	-0.1799	0.3544	0.0665
	Qualitative	0.2869	0.0944	3.0388	0.0024	0.1018	0.4719	0.0665
	Quantitative	0.1288	0.0552	2.3317	0.0197	0.0205	0.2371	0.0665
Disclosure Nature	Qualitative	0.0597	0.0744	0.8024	0.4223	-0.0861	0.2055	0.0644
	Quantitative	0.3034	0.2943	1.0309	0.3026	-0.2734	0.8803	0.0644
	Mixed	0.2121	0.0563	3.7667	0.0002	0.1017	0.3225	0.0644
Disclosure Measurement Technique	Content Analysis	0.1761	0.0594	2.9654	0.003	0.0597	0.2925	0.0721
	Index	0.0415	0.14	0.2961	0.7672	-0.233	0.3159	0.0721
	Mixed	0.2204	0.2063	1.0681	0.2855	-0.184	0.6248	0.0721
	Scoring	0.1647	0.099	1.6631	0.0963	-0.0294	0.3587	0.0721
National Culture	Power Distance-High	-0.024	0.1172	-0.2049	0.8376	-0.2536	0.2056	0.0633
	Power Distance-Low	0.19	0.0475	3.9975	<.0001	0.0968	0.2832	0.0633
	Individualism-High	0.1804	0.0476	3.788	0.0002	0.087	0.2737	0.0658
	Individualism-Low	0.0032	0.1325	0.0245	0.9805	-0.2565	0.2629	0.0658
	Masculinity-High	0.1847	0.0453	4.0778	<.0001	0.0959	0.2735	0.0612
	Masculinity-Low	-0.1245	0.1518	-0.8203	0.4121	-0.4221	0.173	0.0612
	Long Term Orientation-High	-0.0037	0.1004	-0.037	0.9705	-0.2004	0.193	0.0625
Long Term Orientation-Low	0.1981	0.0487	4.0693	<.0001	0.1027	0.2935	0.0625	

Table V: Sensitivity Analysis- Meta-regression results for studies with positive association

Moderators		Coefficient	Standard Error	z-value	p-value	Confidence interval		Tau <sup>2</sup>
Performance Aspect	Integrated Aspect (All)	0.3505	0.1699	2.0624	0.0392	0.0174	0.6836	0.1953
	Environmental Impact (EI)	0.2229	0.2251	0.9903	0.322	-0.2183	0.6641	0.1953
	Organizational Process (OP)	0.6281	0.4794	1.3103	0.1901	-0.3115	1.5678	0.1953
	Regulatory Compliance (RC)	0.1386	0.317	0.4374	0.6618	-0.4826	0.7599	0.1953
	Ranking	0.3271	0.2673	1.224	0.221	-0.1967	0.8509	0.1953
Performance Measurement Technique	Mixed	0.1909	0.1978	0.965	0.3346	-0.1968	0.5786	0.1484
	Qualitative	0.4355	0.1265	3.4436	0.0006	0.1876	0.6833	0.1484
	Quantitative	0.0185	0.2285	0.0808	0.9356	-0.4294	0.4663	0.1484
Disclosure Nature	Qualitative	0.4984	0.1594	3.1268	0.0018	0.186	0.8107	0.1467
	Quantitative	0.289	0.2873	1.006	0.3144	-0.2741	0.8521	0.1467
	Mixed	0.1701	0.1325	1.2834	0.1994	-0.0897	0.4299	0.1467
Disclosure Measurement Technique	Content Analysis	0.3216	0.1301	2.4717	0.0134	0.0666	0.5766	0.1754
	Mixed	0.0054	0.4245	0.0127	0.9898	-0.8265	0.8373	0.1754
	Score	0.1889	0.2514	0.7512	0.4525	-0.3039	0.6816	0.1754
	Survey	0.5248	0.2994	1.753	0.0796	-0.062	1.1115	0.1754
National Culture	Power Distance-High	0.2509	0.1845	1.3597	0.1739	-0.1108	0.6127	0.1658
	Power Distance-Low	0.3268	0.1219	2.6801	0.0074	0.0878	0.5658	0.1658
	Individualism-High	0.2396	0.1053	2.2746	0.0229	0.0331	0.446	0.1447
	Individualism-Low	0.5901	0.2253	2.6193	0.0088	0.1485	1.0317	0.1447
	Masculinity-High	0.3663	0.1128	3.2468	0.0012	0.1452	0.5873	0.1535
	Masculinity-Low	0.1069	0.1987	0.5378	0.5907	-0.2826	0.4963	0.1535
	Long Term Orientation-High	0.3504	0.1559	2.2469	0.0246	0.0447	0.656	0.1641
	Long Term Orientation-Low	0.2696	0.1331	2.0249	0.0429	0.0086	0.5305	0.1641

Appendix I - List of Studies Included In This Meta-Review

Serial	Name of Journal	Author	Title	Country	Sample
1	Int. J. Technology Management	Cormier & Magnan (2004)	The impact of the web on information and communication modes: the case of corporate environmental disclosure	Canada	214 observations from Canada for the year 2000
2	Accounting, Organizations and Society	Cho & Patten (2007)	The role of environmental disclosures as tools of legitimacy: A research note	USA	25 KLD listed companies (ESI & non-ESI by SIC code like `13xx etc.)
3	Accounting, Organizations and Society	Patten (2002)	The relation between environmental performance and environmental disclosure: a research note	USA	132 US companies in 1990s (TRI listed)
4	Australasian Journal of Environmental Management	Sutantoputra et al. (2012)	The relationship between environmental performance and environmental disclosure	Australia	53 ASX200 Australian listed companies for the year 2006. NPI dataset and GRI guidelines were used.
5	ABACUS- A journal of accounting, finance and business studies	Clarkson et al. (2011)	Environmental Reporting and its Relation to Corporate Environmental Performance	Australia	51 listed Australian firms that reported pollutant emissions data to the National Pollutant Inventory (NPI) in both 2001–2 and 2005–6
6	Accounting, Organizations and Society	Clarkson et al. (2008)	Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis	USA	191 firms covered by the EPATRI database for 2003 with adequate variables available in Compustat and CRSP (5 most polluting industries in US)
7	Journal of Accounting and Public Policy	Hughes et al. (2001)	Corporate Environmental Disclosures: are they useful in determining environmental disclosure	USA	51 US companies from the year 1992 and 1993
8	Advances in Environmental Accounting & Management	Hughes et al. (2015)	DO ENVIRONMENTAL DISCLOSURES IN U.S. ANNUAL REPORTS DIFFER BY ENVIRONMENTAL PERFORMANCE?	USA	1992 annual reports of the 20 U.S. firms named by Fortune (Rice, 1993) as the ten leaders and ten laggards in environmental performance

9	Advances in Environmental Accounting & Management	Bewly & Li (2000)	DISCLOSURE OF ENVIRONMENTAL INFORMATION BY CANADIAN MANUFACTURING COMPANIES: A VOLUNTARY DISCLOSURE PERSPECTIVE	Canada	In this study, we focus on the annual reports of 1993 of the 196 manufacturing firms from Canada
10	Environmental Accounting	Alciatore & Dee (2006)	ENVIRONMENTAL DISCLOSURES IN THE OIL AND GAS INDUSTRY	USA	34 US firms from oil and energy sector, for the year 1989 and 1998
11	Accounting, Organizations and Society	Al-Tuwaijri et al. (2004)	The relations among environmental disclosure, environmental performance, and economic performance: a simultaneous equations approach	USA	198 firms in IRRC Environmental Profiles Directory in 1994
12	International Journal of Law and Management	Giannarakis et al. (2017)	The relation Between Voluntary Carbon Disclosure and Environmental Performance: The case of S&P 500	USA	102 companies from S&P 500 from the year 2009 to 2013
13	Journal of Environmental Management	Meng et al. (2014)	The relationship between corporate environmental performance and environmental disclosure: An empirical study in China	China	533 Chinese firms (poor, good, mixed performer) for the year 2009-2010 (not properly sure about year)
14	Re-Inventing Realities	Freedman and Jaggi (2004)	CARBON DIOXIDE EMISSIONS AND DISCLOSURES BY ELECTRIC UTILITIES	USA	US electric utility companies for year 1990 and 1998
15	Management of Environmental Quality: An International Journal	Ahmadi & Bouri (2017)	The relationship between financial attributes, environmental performance and environmental disclosure; empirical investigation on French firms listed on CAC 40	France	The sample used in this study consists of the 40 largest companies operating in French (index CAC 40) for the year 2011 to 2013
16	Measuring Business Excellence	Fontana et al. (2015)	Does environmental performance affect companies' environmental disclosure?	Italy	44 firms listed in Milan Stock Exchange from the year 2007 to 2009
17	Accounting, Organizations and Society	Cho et al. (2012)	Do actions speak louder than words? An empirical investigation of corporate environmental reputation	USA	92 firms (28 from basic materials, 30 from oil and gas, and 34 from utilities) for year 2009
18	International journal of emerging markets	Acar & Temiz (2020)	Empirical analysis on corporate environmental performance and environmental disclosure in an emerging market context	Turkey	Our sample consists of 133 publicly traded Turkish companies that are operating in seven most polluting industries for the year 2016

19	Journal of Accounting and Public Policy	Villers & Staden (2011)	Where firms choose to disclose voluntary environmental information	USA	120 firms, consisting of 60 crisis firms and 60 non-crisis firms, and simultaneously consisting of 60 bad environmental reputation firms and 60 firms that do not have a bad environmental reputation for they year 2004
20	Accounting and Business Research	Brown & Deegan (1997)	The public disclosure of environmental performance information—a dual test of media agenda setting theory and legitimacy theory	Australia	26 companies from nine industries from the year 1981 to 1994 (p-16) in Australia
21	Pacific Accounting Review	Bae Choi et al. (2013)	An analysis of Australian company carbon emission disclosures	Australia	The largest 100 companies listed on the Australian Securities Exchange as of June 2009 for the year 2006 to 2008
22	Sustainability	Christian Danisch (2021)	The Relationship of CSR Performance and Voluntary CSR Disclosure Extent in the German DAX Indices	Germany	241 GRI reports from German companies for the year 2015 to 2018
23	Journal of Environmental Accounting and Management	Abba et al. (2018)	The Relationship Between Environment Operational Performance and Environmental Disclosure of Nigerian Listed Companies	Nigeria	53 companies listed in Nigerian stock exchange for the year 2015
24	Asian Academy of Management Journal of Accounting and Finance	Adinehzadeh et al.(2018)	THE MEDIATING ROLE OF ENVIRONMENTAL PERFORMANCE ON THE RELATIONSHIP BETWEEN CORPORATE GOVERNANCE MECHANISMS AND ENVIRONMENTAL DISCLOSURE	Malaysia	338 listed and non-listed companies in Malaysia for the year 2013 who got charged by court
25	Corporate Social Responsibility and Environmental Management	Arena et al. (2014)	Environmental Reporting: Transparency to Stakeholders or Stakeholder Manipulation? An Analysis of Disclosure Tone and the Roleof the Board of Directors	USA	96 US listed firms from 2008 to 2010

26	Journal of Cleaner Production	Bram et al. (2016)	Determinants of Corporate Environmental Reporting: the importance of environmental performance and assurance	Netherlands	A sample of 209 observations was compiled covering a 3-year period (2009-2011) for 100 Dutch public and private companies that voluntarily disclosed corporate environmental reports in accordance with the GRI-guidelines
27	Business Strategy and the Environment	Brammer & Pavelin (2006)	Factors Influencing the Quality of Corporate Environmental Disclosure	UK	447 FTSE listed companies. Disclosure data for the year 2000. Other data for the year 1999
28	Accounting, Organizations and Society	Cho et al. (2010)	The language of US corporate environmental disclosure	USA	190 US companies under S&P 500 and with 2002 10-K report available on the US Securities and Exchange Commission for the year 2002
29	University of Massachusetts Boston-Scholar Works at UMass Boston	Gao & Connors (2011)	Corporate Environmental Performance, Disclosure and Leverage: An Integrated Approach	USA	Sample is comprised of companies in the electric utility (SIC 49) industry that file with reportable TRI emissions and have information available in the Compustat database between 2001 and 2007.
30	Management Decision	Cormier et al. (2011)	The informational contribution of social and environmental disclosures for investors	Canada	The sample comprises 137 observations of web disclosure for the year 2005 (Canada)
31	Accounting Research Journal	Datt et al. (2019)	Corporate voluntary carbon disclosure strategy and carbon performance in the USA	USA	487 US companies that participated in the CDP survey program and disclosed their carbon information in the reports for 2011 and 2012
32	Journal of Business Ethics	Dawkins & Fraas (2011)	Coming Clean: The Impact of Environmental Performance and Visibility on Corporate Climate Change Disclosure	USA	344 companies under S&P 500, (evaluated by KLD, Truscot, CDP) for the year 2008
33	Journal of Business Ethics	Dawkins & Fraas(2011a)	Erratum to: Beyond Acclamations and Excuses: Environmental Performance, Voluntary Environmental Disclosure and the Role of Visibility	USA	363 firms under S&P 500 (evaluated by KLD) for the year 2005-2006
34	J. Account. Public Policy	De Velliers & Staden (2011)	Where firms choose to disclose voluntary environmental information	USA	120 firms (S&p 500, KLD evaluated) for the year 2004
35	Business Strategy and the Environment	Delmas & Blass (2010)	Measuring Corporate Environmental Performance: the Trade-Offs of Sustainability Ratings	USA	15 US chemical industry companies from the year 2000 to 2005

36	Social Responsibility Journal	Deswanto & Siregar (2018)	ASSOCIATION BETWEEN ENVIRONMENTAL DISCLOSURES WITH FINANCIAL PERFORMANCE, ENVIRONMENTAL PERFORMANCE, AND FIRM VALUE	Indonesia	211 Inodonesian listed companies for the year 2012-2014
37	Omega	Jaggi & Freedman (1982)	Pollution Disclosures, Pollution Performance and Economic Performance	USA	37 US firms for the year 1972-73
38	Accounting and the Public Interest	Freedman & Stagliano (2008)	Accounting Disclosures of Toxics Release Inventory for 2002	USA	227 US firms for the year 2002
39	Business Strategy and the Environment	Giannarakis et al. (2017)	The Impact of Carbon Performance on Climate Change Disclosure	UK	119 FTSE 350 index firms for the year 2014
40	International Journal of Accounting and Economics Studies	Hassan & KOuhy (2014)	Time-series cross-sectional environmental performance and disclosure relationship: specific evidence from a less-developed country	Nigeria	11 nigerin companies from 1997 to 2009
41	Pacific Accounting Review	He & Loftus (2014)	Does environmental reporting reflect environmental performance? Evidence from China	China	100 Chinese listed companies for the year 2010
42	Journal of Business Finance and Accounting	Heflin & Wallace (2017)	The BP Oil Spill: Shareholder Wealth Effects and Environmental Disclosures	USA	123 US frims for the year 2010
43	Journal of Industrial Ecology (research and analysis)	Hora & Subramaniam (2018)	Relationship between Positive Environmental Disclosures and Environmental Performance	USA	316 annoucnements by 204 US firms for the year from 2004 to 2006
44	Emerging Markets Review	Iatridis (2013)	Environmental disclosure quality: Evidence on environmental performance, corporate governance and value relevance	Malaysia	529 Malysian listed companies from theyear 2005 to2011
45	Journal of Accounting Research	Ingram & Frazier (1980)	Environmental performance and corporate disclosure	USA	40 firms from USA from 4 industries for the year 1970s to 1974

46	International Journal of Business and Management Inventi	Iqbal et al. (2013)	EFFECT OF ENVIRONMENTAL ACCOUNTING IMPLEMENTATION AND ENVIRONMENTAL PERFORMANCE AND ENVIRONMENTAL INFORMATION DISCLOSURE AS MEDIATION ON COMPANY VALUE	Indonesia	59 Indonesian listed firms for the year 2014
47	International Journal of Production Economics	Lai et al. (2015)	Sharing environmental management information with supply chain partners and the performance contingencies on environmental munificence	Hongkong	210 responses from firms based in HongKong
48	Human and Ecological Risk Assessment: An International Journal	Li et al. (2017)	Corporate Environment Performance, Environmental Information Disclosure and Financial Performance: Evidence from China	China	950 observations from 475 chinese firms for the year 2013-2014
49	Contemporary accounting reserach	Li et al (1997)	Corporate Disclosure of Environmental Liability Information: Theory and Evidence*	Canada	191 spill records in Ontario
50	Competitive strategy, voluntary environmental disclosure strategy, and voluntary environmental disclosure quality	Ling (2007)	COMPETITIVE STRATEGY, VOLUNTARY ENVIRONMENTAL DISCLOSURE STRATEGY, AND VOLUNTARY ENVIRONMENTAL DISCLOSURE QUALITY	USA	74 chemical compaines from US for the year 2004
51		Liu et al. (2017)	Corporate Carbon Emissions and Financial Performance: Does Carbon Disclosure Mediate the Relationship in the UK?	UK	62 environmentally sensitive FTSE 100 firms in the United Kingdom (UK) over the period 2010-2012
52	Asian Review of Accounting	Lu et al. (2018)	A study of the relationships among environmental performance, environmental disclosure, and financial performance	USA	450 US firms from 20 industries for the year 2011 & 2012



53	Pakistan Journal of Commerce and Social Sciences	Mahmud et al. (2017)	Does environmental disclosure relate to environmental performance? Reconciling legitimacy theory and voluntary disclosure theory	Pakistan	78 companies from pakistan for the year 2014 and 2015
54	Australian Journal of Corporate Law	Mitchel et al. (2004)	Voluntary Environmental Reporting Practices: A Further Study of 'Poor' Environmental Performers	Australia	29 reports by 20 Australian companies from the year 1994 to 1998
55	Meditari Accountancy Research	Shima & Fung (2019)	Voluntary disclosure of environmental performance after regulatory change	USA	578 US firms from the year 2003 to 2011
56	Sustainability Accounting, Management and Policy Journal	Tadros & Magnan (2019)	How does environmental performance map into environmental disclosure? A look at underlying economic incentives and legitimacy aims	USA	1092 annual reports and 376 sustainability reports from the year 1997 to 2010 of US firms
57	The British Accounting Review	Vand staden & Hooks (2007)	A comprehensive comparison of corporate environmental reporting and responsiveness	Newzealand	32 companies from newzealand for the year 2002
58	Accounting, Organizations and Society	Wiseman (1982)	AN EVALUATION OF ENVIRONMENTAL DISCLOSURES MADE IN CORPORATE ANNUAL REPORTS	USA	26 US firms from the year 1972 to 1976
59	Corporate Social Responsibility and Environmental Management	Wang et al. (2017)	CSR Performance and the Readability of CSR Reports: Too Good to be True?	USA	331 standalone CSR reports issued by 168 US-based large companies from 2009 to 2012

Appendix II : Description of Study Characteristics with Coding Example

Variable	Characteristics	Proxy	Code	Description	Example
Environmental Performance	Performance Aspect	Environmental Impact	EI	Variable represents the action of firm impacting to the environment	Level of toxic release
		Regulatory Compliance	RC	Variable represents the compliance of the law by the firm to protect environment	Environmental regulation related fines or rewards
		Organizational process	OP	Variable represents the improvement of organizational function by the firm to improve environmental performance	Survey regarding organization environmental management system
		Ranking	Rnk	Variable represents the ranking of firm based on its environmental performance	Analysis of environmental leading firms and environmental laggard firms
		Media Coverage	Med	Variable represents the coverage by media regarding the environmental performance of firm	Media coverage about the environmental responses by corporations
		Integrated aspect	All	Variable represents the evaluation of the firm's environmental performance by third party	KLD ratings
	Measurement Technique	Mixed	Mix	Variable represents the mix of performance aspect characteristics mentioned above	Using more than one methods mentioned above
		Qualitative	Qual	Variable represents the environmental performance of firm which are expressed in non-numeric or qualitative way	Using dummy variable if companies were poor or good performing companies
		Quantitative	Quant	Variable represents the environmental performance of firm which are expressed in numeric way	Using quantitative emission data
	Performance Tone	Mixed	Mix	Variable represents the environmental performance of firm which are expressed in both qualitative and quantitative way	Using both of the methods mentioned above
		Positive	Pos	Variable represents the environmental performance of firm that has positive effect on environment	Using waste recycle as environmental performance
		Negative	Neg	Variable represents the environmental performance of firm that has negative effect on environment	Using emission data as environmental performance
		Mixed	Mix	Variable represents the environmental performance of firm that includes both positive and negative effect on environment	Using the mix of the methods mentioned above
		Others	Oth	Variable represents the environmental performance of firm that is difficult to conclude that has specific positive or negative impact on environment	Survey question about environmental operations
		Environmental Disclosure	Disclosure Nature	Qualitative	Qual
Quantitative	Quant			Variable represents the quantitative representation of environmental performance by the firm in the environmental disclosure	Quantitative disclosure used in the studies
Mixed	Mix			Variable represents the mixed representation of environmental performance by the firm in the environmental disclosure	Mixed disclosures mixed in the studies
Measuring Technique	Content Analysis		Con	Variable represents the content analysis technique used by the researcher to study the environmental disclosure of the firm	Researchers used content analysis to measure disclosure
	Scoring		SCOR	Variable represents the scoring technique used by the researcher to study the environmental disclosure of the firm	Researchers used scoring technique to measure disclosure
	Index		Index	Variable represents the indexing technique used by the researcher to study the environmental disclosure of the firm	Researchers provided score based on multiple disclosure items
	Survey		SURV	Variable represents the survey technique used in environmental disclosure to collect information	Researchers used survey questionnaire to measure disclosure
	Mixed		Mix	Variable represents the mixed technique used by the researcher to study the environmental disclosure of the firm	Researchers mixed methods mentioned above