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Environmentally sensitive disclosures and financial performance in a European setting

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Received 12 February 2009
Revised 25 May 2009,
11 August 2009,
19 October 2009
Accepted 29 October 2009

Abstract

Purpose – Is the natural environment a stakeholder of the firm? And is there a business case for achieving sustainability? The purpose of this paper is to trace a tripartite relationship, involving environmental disclosure, environmental performance, and financial performance of environmentally sensitive activities of companies in a European setting.

Design/methodology/approach – A sample of 60 of the largest European Union industrial business groups, extracted from the FTSEuroFirst 300, and an environmental disclosure index inspired by the Global Reporting Initiative Guidelines, form the basis for the content analysis of the most recent sustainability reports published before the end of 2008.

Findings – A significant association is found between contemporaneous environmental performance and disclosure, in that bigger polluters tend to disclose more on their activities, but only to a moderate statistical effect. However, no association is found between environmental performance and financial performance, as well as between environmental disclosure and contemporaneous firm performance.

Practical implications – This result suggests that even though big polluters tend to report more, the transparency level of their activities may not be sufficient for a viable assessment of sustainability. For such "environmentally challenged" companies, their reputation-building strategy is mainly focused on preserving or repairing legitimacy.

Originality/value – The paper considers two complementary aspects: first, that the relationship between sustainability commitment and financial performance may be so weak that it is barely detectable; and second, that cross-sectional studies may fail in capturing a relationship that is normally shaped over longer periods of time.

Keywords Environmental management, Disclosure, Sustainable development, Financial performance, Stakeholder analysis, Europe

Paper type Research paper

1. Introduction

Counting the non-human natural environment as a stakeholder is a controversial attempt. Traditional stakeholder theory is anthropocentric, in that it integrates only "the groups and individuals" that collide with the company's activity, by crossing trajectories and interests (Freeman, 1984). However, the natural environment may affect or be affected by the achievement of an organization's objectives, thus possessing the general attributes from the definition above. The natural environment

This work was supported by CNCSIS – UEFISCSU, project number PNII – RU type PD code 640/2010.

Journal of Accounting & Organizational Change
Vol. 6 No. 3, 2010
pp. 359-388

1832-5912
DOI 10.1108/18325911011075222

may exhibit an immediate and direct impact on organizational performance, as well as on the welfare of all human stakeholders. Resource depletion that leads to excessive purchase costs, extreme natural phenomena (e.g. storms, hurricanes, and draught), and various types of air emissions and water contamination, are undoubtedly results of economic activity, as well as easily measurable impact factors on society as a whole.

A more comprehensive definition of the concept of "stakeholder", while not popular in literature, encompasses "any naturally occurring entity which affects or is affected by organizational performance" (Starik, 1995). Each financial or non-financial element that is disclosed by organizations around the world as proofs of sustainability can be seen as nature's stakes in the success of the firm: the continuation of evolution, the preservation of species, habitats and systems, and a balanced global climate. Going green through self-regulation, technological innovation, industry-wide codes, and certification, is the most prominent way to acknowledge the natural environment as a stakeholder, albeit one that is placed low on the list when companies consider the prominence of stakeholders. However, it can be argued that stakeholder models that are anchored in a social-only paradigm and neo-classical economic rationality are not broad enough to acknowledge the interdependence between the business organization and ecological systems (Driscoll and Starik, 2004).

The natural environment can be subject to a stakeholder approach (Freeman and McVea, 2005) in formulating and implementing those processes that aim at eco-responsibility. Any stakeholder approach is focused on the active management of organizational inputs (natural resources) and outputs (air and water emissions, soil contamination, noise, and biosphere impact) with respect to the natural environment. A stakeholder approach to environmental performance has multiple dimensions, such as normative, instrumental, and descriptive. This contribution extends the conceptual framework developed by Donaldson and Preston (1995) through a detailed presentation of the above justifications of granting the natural environment the stakeholder status. The normative elements are connected to the companies' efforts to answer the informational demands of the external users; instrumental elements are to be found in the relation between environmental disclosure and firm financial performance; finally, descriptive elements conceptualize the passage from stakeholder theory to managerial practice, through self-regulatory initiatives.

The empirical contribution of this study rests on the use of a sample of 60 of the largest European industrial corporate groups, although many incremental improvements are also to be found in the methodological approach. This sample is unique in that prior scientific literature does not offer any empirical evidence on pan-European environmental disclosure and performance, since the vast majority of mainstream studies are focused on limited aspects of US data, which are in many cases severely outdated.

An environmental disclosure index, inspired by the Global Reporting Initiative (GRI) Guidelines, forms the basis for the content analysis of sustainability reports published before the end of 2008. Hence, the environmental disclosure in focus covers the period between 2005 and 2007, in line with the data collected for the contemporaneous environmental performance (greenhouse gas emissions and energy consumption) and financial performance indicators (accounting-based and market-based measures). Thus, the empirical approach rests on the previously developed conceptual framework, in that it is to be found at the intersection of two axes:

(1) the normative one, focused on devising a disclosure index that meets the criteria laid out by the triple bottom line (TBL) theory; and

(2) the instrumental axis, on which several measures of financial and environmental performance are identified, in order to establish a correlation between information supply and economic output.

In contrast with the previous literature, our hypotheses are two-tailed, i.e. they do not rely on a specification of the direction of the association between our main variables. The literature review and legitimacy theory support this more cautious approach to hypothesis development.

We find a significant association between contemporaneous environmental performance and disclosure, in that bigger polluters tend to disclose more on their activities, but only to a moderate statistical effect. Our results are inconsistent with previous literature (Clarkson *et al.*, 2008) on all predicted correlations. We also find no association between environmental performance and financial performance, as well as between environmental disclosure and contemporaneous firm performance. We construct a semi-log regression model relating sustainability disclosure to firm size and environmental performance; the results do exhibit a satisfactory level of explanatory power ($R^2 = 0.50$) for a moderate to large effect. Finally, we collect empirical evidence on which particular disclosure requirements significantly influence the amount of environmental disclosure for companies in our sample; we find that GRI Guidelines adoption, sustainability index inclusion, and financial quantification of environmental elements do differentiate superior environmental reporters from their less involved peers.

2. A background of sustainability dilemmas

2.1 Legitimacy theory and the sustainability contract

In the introductory section, we have attempted to suggest that any instance of environmental reporting relies on the hypothesis that the natural environment is ultimately a stakeholder, not just environmental capital from which investors' dividends are extracted. The natural environment is much more than a "relevant audience" for particular managerial decisions; it actually represents the other significant party involved in the "sustainability contract". The integration of stakeholder theory may not be complete in the absence of the crucial insights brought by legitimacy theory, also founded on the political economy basis. Legitimacy theorists claim that organizations are part of a broader system, which grants corporations no a priori rights to access resources, or even the right to exist. Corporations come into being and function within their environment as long as they can access the vital resource called legitimacy, the main result of an implicit social contract (Deegan, 2002).

The concept of the social contract is a common place in the relation between corporations and individual members of society; organizations extract social and ecological resources, and output goods and services to the community, and waste to the natural environment. The sustainability contract "stipulates" the maximum quantities of resources to be extracted and outputs to be reintegrated into the ecosystem, before a major disruption affects the ecological balance. The terms of this "contract" are the indicators which measure environmental performance. If an activity is sustainable, in principle it may go on indefinitely. However, there are no long-term guarantees

for sustainability, as long as a large number of factors remain unknown or unpredictable. The Brundtland Report of 1987 coined the notion of sustainable development as the development that meets present needs without compromising the ability of future generations to satisfy their own needs. Sustainable are those activities that improve the quality of life, while keeping the resource consumption and output levels within the limits of the ecosystem (Munro, 1991).

Through the lens of sustainable development, legitimacy is a social and subjective construct; it reflects the congruence between the legitimate entity's behaviour and the common values of social groups. Managers may exercise control over the process of gaining legitimacy, by appropriating and manipulating social symbols and rituals, in order to justify the underlying pragmatic realities of sales, profits, and budgets. Breaches of the sustainability contract are equivalent to legitimacy gaps, which surface whenever public perception is that the activities of an organization are not "desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs and definitions" (Suchman, 1995). Legitimacy gaps point to environmental underperformance, or to actions which are socially unacceptable.

Gaining legitimacy, as well as restoring lost confidence, is accomplished mainly through disclosure. Any corrective actions that target sustainability performance cannot be made public and validated except by going through a reporting process, destined to improve the audiences' perceptions. This is common ground for both legitimacy theory and stakeholder theory, considering that both emphasize the strategic potential of corporate disclosures, especially those included in annual reports. Sustainability reporting has been reshaped through an inspiring metaphor that challenges contemporary corporations to simultaneously deliver the TBL of economic prosperity, environmental quality, and social equity (Elkington, 1997). TBL is seen as potentially improving the quality of information reported to society. The natural environment as a stakeholder should be accounted for when drawing the TBL. The result of a real TBL report would be an annual report of a company comprising equal sections on financial, social, and environmental accountability – giving the environmental and social interactions equal billing with the financial.

TBL reporting seeks to engage moral legitimacy (Gray, 2006). Unlike pragmatic legitimacy, moral legitimacy rests not on judgments about whether a given corporate activity benefits the investor, but rather on judgments about whether that activity provides real improvements in the quality of human life and at the same time conserves the vitality and diversity of the Earth. At its core, moral legitimacy reflects an eco-centred logic that differs fundamentally from narrow self-interest, and consequently, moral concerns prove more resistant to self-interested manipulation than do purely pragmatic considerations. There seems little question that to undertake TBL reporting would expose the extent to which conflict might exist between environmental and social accountability and the pursuit of economic self-interest. The organization's interactions with society and the natural environment will therefore be more readily documented, probably at the expense of financial information which at the moment dominates any kind of bottom line in capitalism.

The main difficulty in drawing the hypotheses of an empirical study is clarifying the relationship between the real phenomena and the corresponding variables or proxies. In this literature review section, our aim is to demonstrate that there is no

direct and unequivocal relationship between environmental reporting, environmental performance, and financial performance.

Consequently, we will come to agree that the purpose of environmental reporting is gaining, preserving or repairing legitimacy, either for the organization as a whole, or for particular products or services. Legitimacy is a function of the public perception on environmental performance, thus resulting in an indirect relationship of an unspecified sign between the quality of reporting and environmental performance. On the other hand, financial performance is strictly related to the added value of goods and services on the market. The hypothesis behind TBL reporting is that only goods and services whose quality is acknowledged, and thus legitimized, will survive on the market. Although it is tempting to say that legitimacy is a necessary, though not sufficient, condition for responsible value creation, there is no definitive empirical evidence on this matter.

2.2 A survey of empirical literature

As far as our knowledge goes, the first study to use an indexing methodology in relation to environmental disclosure (Wiseman, 1982) employed a sample of 26 US companies in the steel, oil, and pulp and paper industries. The author turned to the environmental performance measures used by the Council of Economic Priorities (CEP), regarding pollution magnitude. An indexing procedure was constructed to evaluate the contents of the annual report environmental disclosures. The items of information included economic factors, environmental litigation, and pollution abatement. Rating of the disclosures was based on the presence or absence and the degree of specificity of each of the information items. The author concluded that, overall, there appeared to be no relationship between the measurable information companies disclose about environmental performance in their annual reports and their actual environmental performance. Analysis of the completeness, lengths, and items of information included in voluntary environmental disclosures was considered not to be a representative measure of actual environmental performance, imposing in fact a misrepresentation of the firm's performance compared to its industry peers.

Similar results were found by using an enhanced sample, industry-specific control groups and the logit analysis (Cochran and Wood, 1984). Social performance was measured on a tripartite scale, rating a number of firms as "outstanding", "honourable mention" or "worst" in terms of reputation. The authors' conclusion is that within industry groups the financial variable the most strongly correlated with corporate social responsibility (CSR) is asset age, and that omission of that variable results in a spurious correlation of CSR and financial performance.

An early literature review on the relationship between social disclosure and economic performance (Ullmann, 1985) reports conflicting results. On the relationship between social disclosure and social performance: of seven studies, four reported no correlation, two found positive correlations, and one yielded a negative correlation; on the relationship between social performance and economic performance: of 13 studies, eight found positive correlations, four found no correlation, and one reported a negative correlation; and finally, on the relationship between social disclosure and economic performance: of 11 studies, seven found positive correlations, the rest reported no correlation. The author considers that measuring social performance is a formidable task in that it requires mapping the external constituencies' influence, followed by measuring

constituent satisfaction that could be eventually integrated into an overall performance index. At the same time, it is particularly difficult to separate actual social and environmental performance from perceived performance. This is due to the fact that the observed differences in the quantity of voluntary disclosure may be very well linked with the sophistication of the public relations gestures of companies with poor reputational capital. By applying Ullmann's model, where stakeholder power (i.e. stakeholder control over organizational critical resources) tends to be positively correlated with social and environmental performance, we expect a pivotal stakeholder like the environment to benefit from disclosures on an ever-increasing area of interest, way beyond the ordinary data on emissions and waste.

A subsequent 1980s study (McGuire *et al.*, 1988) hypothesised that since high firm risk must be balanced by high returns, firms with low social responsibility should earn high returns to justify business risk. The empirical results suggest that firms low in social responsibility also experience lower ROA and stock-market returns than do firms high in social responsibility. However, it must be noted that the degree of risk is not solely dependent on social responsiveness, just as high returns are not invariably a function of risk, thus invalidating the original hypothesis.

A study published almost a decade later (Preston and O'Bannon, 1997) tied the loose ends and reported results consistent with stakeholder theory, in that all the evidence suggested that there was a positive association between social and financial performance in large US corporations. Moreover, the authors found evidence that financial performance either precedes or is contemporaneous with social performance. Balabanis *et al.* (1998) considered that one major drawback of most 1980s empirical studies is that they had failed to frame CSR in the temporal context of economic performance, thus making impossible to draw reliable inferences about the direction of causation. The latter authors obtained CSR ratings of UK corporations from the publication *Changing Corporate Values* produced by the New Consumer Group. Their findings partially support the US evidence (McGuire *et al.*, 1988): CSR disclosure was found to be associated with concurrent financial performance, and a combination of high CSR disclosure combined with good CSR performance was found to have positive effects' on a firm's overall profitability; surprisingly, capital market seems to be rather indifferent to firms that undertake some CSR activities.

Neu *et al.* (1998) continue Wiseman's (1982) effort by unpacking the "public pressure" that shape the differential responses of organizational managers to the demands of the various relevant publics, mostly the financial stakeholders and regulators. Environmental disclosure may be read as an attempt to change the "misperception" of stakeholders that profitability and environmental responsibility are a zero-sum game (i.e. profit at the expense of environmental capital). The relationship between environmental disclosure and the organization's methods of operation and output is equivocal mainly because of partiality of this type of disclosure, thus leading to a problematic interpretation of environmental reporting. This equivocal and partial character has made it difficult for both researchers and relevant publics to disentangle the association between environmental disclosure and environmental performance. The empirical illustration that accompanies the above analysis is focused on 33 publicly traded Canadian companies over the 1982-1991 period. Environmental disclosure is measured by the number of words in the annual report, on the firm's environmental activities. The authors are assuming that environmental disclosures will vary over time

in response to financial stakeholder concerns, regulatory challenges and societal concerns. The significant associations found in the relationship between environmental disclosure and the pressures of relevant publics suggest that textually mediated disclosures contained in annual reports provide organizations with an effective method of managing public impressions. This type of communication also benefits from its proximity with financial numbers and the credibility halo of audited accounting statements.

A 25 year literature review (Roman *et al.*, 1999) reported 33 studies that suggest a positive relationship between corporate social performance and financial performance, 14 studies that found no effect or were inconclusive, and only five studies that found a negative relationship. Thus, the authors conclude that "the vast majority of studies support the idea that, at the very least, good social performance does not lead to poor financial performance" (Roman *et al.*, 1999, p. 121). However, things are not as simple as they appear to be: results may be inconclusive in that the relationship between social performance and financial soundness could be confounded by other variables that the authors might not have controlled for. Second, the underlying reality may have changed in 25 year time, which is just as likely as the fact that social awareness of companies may vary from country to country. Establishing causation between social and financial performance is a risky endeavour.

Legitimacy theory can be seen as a less distant relative of environmental disclosure than shareholder value maximization theory. However, prior to the year 2000, legitimacy theory has not been successfully tested or given support in the context of environmental reporting within annual reports. It is expected that not only may management be called on to explain their actions, but also environmental disclosures may pave the way for a better relationship with their stakeholders, thus linking stakeholder theory and legitimacy theory under one comprehensive framework (Deegan, 2002). An early paper (Wilmshurst and Frost, 2000) report a significant explanation of the actual disclosure of environmental information found in annual reports of Australian companies, with a positive contribution by customer concerns, and a negative contribution by the influence of competitors' response to environmental issues. The result provides some support for the argument that environmental reporting is used as a means of legitimizing corporate activities, but the research design does not address the issue of overall environmental performance, nor does the word count on environmental issues in the annual report provide any real evidence on the extent and quality of disclosure. The authors themselves admit that the number of words disclosed is only representative of the responsiveness of corporate management in regard to legitimizing environmental performance.

Most of the studies published in the first years of the twenty-first century investigate an economic reality that was becoming obsolete, namely social and environmental disclosures being made in the early 1990s. However, some of them make an interesting contribution in terms of methodology. That is the case of Hughes *et al.* (2001) who analysed whether annual reports of US firms could be used to differentiate good performers from poor performers, based on CEP rankings. The content analysis method was also based on Wiseman (1982) and employed four categories of disclosure information: "economic factors", "litigation", "pollution abatement", and "other environmentally related information". Content was classified as quantitative, descriptive, vague, and immaterial, and coded as such. The results indicate that there

are differences in the extent to which different groups of environmental performers disclose environmental information. Overall, it is the poor performer who makes the most disclosures; this is a consequence of the fact that poor environmental performers are subject to more remediation than those who have not engaged in environmental degradation. Although disclosures differed between groups in terms of quantity, there were no significant differences in the content of disclosures of good and mixed performers; hence the information provided did not convey the actual environmental performance levels. More surprisingly, the authors conclude that companies had not used discretionary disclosures to legitimize their activities, the information being confined to the standardized sections of the annual report.

The issue of whether environmental disclosures serve to mitigate negative market reactions to regulatory threats has been investigated by Freedman and Patten (2004). Under their approach, the public exposure of poorer environmental performers was supposed to lead to negative market adjustments that should serve as an incentive to change pollution performance. Individual firm pollution performance was based on the pounds of toxic chemicals released into the air under the 1987 US Toxics Release Inventory (TRI). Using an eight-point content analysis scheme, the study provides evidence that the market does reward higher environmental disclosure as a tool to manipulate market perceptions and reduce the negative impact of actual pollution performance.

Research exploring the relationship between social environmental disclosures and market performance is still extremely limited. Murray *et al.* (2006) consider that it is not possible to undertake a conventional event study to seek to establish responsiveness of returns to social and environmental disclosures – not least because a plethora of other announcements made by companies have a far greater price sensitivity than environmental disclosures. The results were inconclusive when data on annual returns were used. However, the authors found that UK companies with high returns over a period of time are significantly the same companies that also produce high volumes of social and environmental disclosures, even after adjusting for the size effect. The key significant results arose as a consequence of coding the data, both for returns and for disclosures, in terms of relative ranking over a ten-year time in order to catch the companies' predisposition or predilection to disclose.

Very recent studies display a greater methodological complexity than the studies of the 1990s, but sometimes at the expense of theoretical insight and subtleness. This is the case of the two studies discussed below, which are also very similar in their use of disclosure indexes and financial performance indicators. Plumlee *et al.* (2007) examine the relationship between a firm's stock price and its voluntary disclosures; they also investigate the relationship between the two components of firm value (cost of capital and expected future cash flows) and disclosure quality, using analysts' forecasts to provide proxies for the former. To obtain a measure of voluntary disclosure quality, a detailed index based on the GRI Guidelines was considered reliable enough to capture subtle variations in voluntary environmental disclosures. The authors document a negative relation between firm value – and both its components – and the quality of its voluntary disclosures; however, the authors fail to provide a convincing explanation or to investigate further. Similarly, Clarkson *et al.* (2008) make reference to stakeholder theory and legitimacy theory in order to derive predictions on the sign of the association between environmental performance and the level of discretionary disclosures.

Their study focuses on purely voluntary disclosures and employs the same type of content analysis. They found a positive association between environmental performance, based on TRI data, and the level of discretionary disclosures. However, their preliminary evidence that socio-political theories are robust is not theoretically sound, given the fact that legitimacy theory and the like do not make predictions regarding the sign of the relation between performance and disclosure. The correct assumption – as used in our study – is that we cannot hypothesize the direction of association between these variables.

As a final highlight for the literature survey section, Cho and Patten (2007) are among the few authors that have investigated the prevalence and impact of monetary environmental disclosure. They argue that:

> [. . .] monetary disclosure about capital expenditures and/or operating costs associated with environmental compliance activities are likely to be viewed by management as having higher proprietary value than non-monetary disclosures, and as such, will be less preferred as a disclosure tool than other types of environmental disclosures (Cho and Patten, 2007, p. 640).

They use content analysis of environmental reports, correlated with the performance indicators from the KLD proprietary database, and report to have found evidence in support of the hypothesis that worse performers in less polluting industries do not fancy monetary disclosures. Conversely, the data support the contention that monetary disclosure will be higher for worse performers in environmentally sensitive industries. The evidence provided by Cho and Patten is valuable to the present investigation, given that we also investigate correlations between monetary environmental disclosure measures (e.g. environmental provisions, capital expenditure and cash outflows), and the actual level of performance and disclosure.

3. Measurement criteria and statistical procedures

3.1 Sample selection

The original sample was extracted by selecting industrially oriented company groups from the FTSEurofirst 300 Index Constituents (July 2007 edition). The FTSEurofirst 300 Index is the definitive benchmark of blue chip pan-European equities. The index contains the 300 largest companies by full market capitalisation in the FTSE Developed Europe Index. Under the "industrials" and "basic resources" categories, the primary date source sample comprised 67 companies quoted on European stock exchanges. After discarding the subsidiaries of other companies, the final sample comprised 60 company groups of which the parent company is incorporated in the European Union. No previously used classifications or ISO codes are applicable, since the sampled industrial company groups are well diversified and sometimes integrate even financial and consulting services in their portfolio.

3.2 The environmental disclosure index

Much research in the field of environmental reporting was conducted through the lens of organisational legitimacy. The management signals its efforts towards the welfare of particular stakeholders (i.e. the natural environment) and, consequently, communicates a congruency of actions and values with those of stakeholders seen as important in the legitimation process (Stanton and Stanton, 2002). Reporting should be contemplated as a corporate communications tool which helps companies to be judged as "legitimate"

by most, if not all, of their stakeholders in order to survive and prosper. Conceived as communications tools, annual reports and sustainability reports must focus on the organization as a whole and the task of how its operations are presented to all of its key stakeholders, both internal and external (Nielsen and Thomsen, 2007).

In our study, contemporaneous financial and sustainability reports were content analysed using the methodology described below. However, even if the most recent annual reports – issued for 2007 – were readily available on companies' web sites, sustainability reports for the respective fiscal year were present to a lesser extent. That is why the analysis sought to match the financial performance information with the environmental performance data present in the appropriate sustainability reports, and resulted in a quantitative study spanning a two-year period, from 2006 to 2007. Note that consolidated financial statements are International Financial Reporting Standards (IFRS) compliant beginning with fiscal year ending 31 December 2005.

The extant literature adopts a variety of approaches to the analysis of narratives in annual reports (Beattie *et al.*, 2004), with the implicit underlying construct being the "quality" of disclosure. The semi-objective approaches specify *ex ante* a list of items and scrutinise the text for their presence, ignoring sections of the text that do not relate to this list. This is the approach taken by the large body of disclosure index studies and it is characterised in this paper as a partial type of content analysis. It is a fairly objective, form-oriented content-analytic method.

Disclosure index studies assume that the amount of disclosure on specified topics is a proxy for the quality of disclosure. Coding schemes incorporate ordinal measures, to allow for the "quality" of the specific disclosure to be assessed (e.g. is the disclosure on topic X merely qualitative or is it quantified?). This is the approach adopted by Botosan (1997), who observes that "disclosure quality is also important but very difficult to assess. As a result, researchers tend to assume quantity and quality are positively related".

Disclosure index studies are based on the general principles of content (or thematic) analysis, which involves classifying text units into categories. Following coding, the form of analysis and interpretation that is undertaken can vary along a continuum from purely qualitative and verbally descriptive methods, to primarily quantitative methods that permit statistical analysis. The use of quantitative methods requires that the units of coding be scored in some way. The researcher can then aggregate the counts in various categories to form a measure of "the intensity of concern with each category" (Weber, 1990).

Sustainability reports offer a window into corporate environmental and social strategy and performance, and make it possible to evaluate it as an adjunct to more familiar financial performance metrics. Depending on what companies choose to include in environmental and social performance reports, the reader can assess the degree of compliance with regulations, and compare performance with peer companies and across industries. Reports on corporate sustainability are generally prepared based on reporting criteria established by an outside organization or the company's internal guidelines. The dominant reporting guidelines are those of the GRI.

The most comprehensive TBL reporting framework is undoubtedly the GRI Guidelines. In 2001, the European Commission (Green Paper "Promoting a European framework for corporate social responsibility" – COM (2001) 366 final) acknowledged that, on the environmental side, the GRI Guidelines were seen as best practice. The GRI

was formed by the US based non-profit Coalition for Environmentally Responsible Economies and Tellus Institute, with the support of the United Nations Environment Programme in 1997. It released an "exposure draft" version of the sustainability reporting guidelines in 1999, the first full version in 2000; the second version was released at the World Summit for Sustainable Development in Johannesburg in 2002.

Given the rapid increase in the number of companies around the world adopting GRI standards and issuing corporate sustainability reports, and considering that they can now be considered generally accepted, the third version (G3) of environmental indicators are the necessary framework for the reporting index developed in this study. Reporting Guidelines are an incipient scoring system and most of the topics in these guidelines are capable of being treated at various levels of comprehensiveness, ranging from being mentioned briefly to being fully documented quantitatively (Morhardt *et al.*, 2002). Thus, when incorporated into a scoring system, they can be assigned a range of points indicating how thoroughly the topics were discussed. The present study uses a five-level ordinal scale to measure the degree of voluntary environmental disclosure, ultimately seeking to award quantitative, comparable and benchmarked information against vague narratives (Table I and Figure 1).

To construct a scoring system from these guidelines, we systematically identified every item called for in environment performance indicators section of the GRI

	For each indicator in the disclosure index, points are awarded according to the scheme below
0	Performance data not present (including any non-quantitative references to performance)
1	Performance and/or governance information is presented only for the current period
2	The report and the information contained within it can be compared on a year-to-year basis
3	The criteria above, plus the data measurement techniques and bases for calculations are adequately described, and can be replicated with similar results
4	The criteria above, plus the organization's performance can be compared with appropriate benchmarks

Table I.
The scoring scale of environmental performance data

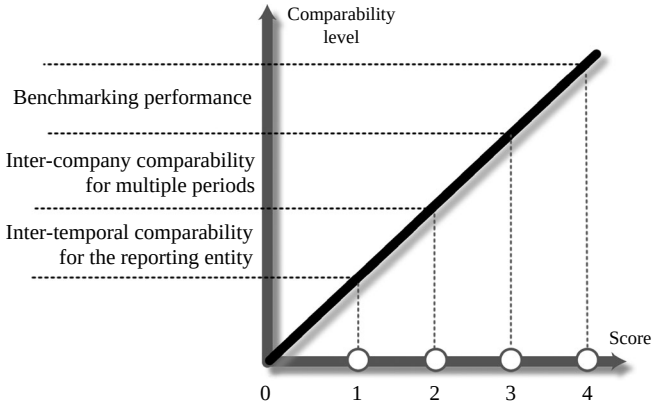

Figure 1.
A graphical interpretation of the scoring scale used for assessing environmental disclosure quality

documentation – resulting in 26 items of disclosure, for a possible 62 points. The nature of the GRI topic list required to assign more points to some topics than to others, so in several cases we allowed a topic to be worth four points (see Table II) and in a few others only one point (dichotomous variable). The environmental topics are grouped into six categories, which include general information on corporate governance for sustainability issues and five classes of performance indicators or aspects: materials, energy, water, biodiversity, emissions and waste, and product impact.

The following discussion of the key performance indicators is a critical perspective on companies' compliance with the G3 Guidelines, with a heavy emphasis on objective measures of performance as opposed to soft and unreliable claims of commitment to environmental protection.

The environmental governance and credibility aspect focus on disclosures pertaining to a firm's governance structure and management systems put in place with respect to environmental protection. For instance, firms, whose board of directors have an environmental committee or firms that have obtained independent verification of their environmental reports. This type of soft disclosures adds up to only 9 percent of the final score, if all criteria are met.

The materials aspect describes the reporting organization's contribution to the conservation of the global resource base and efforts to reduce the material intensity, and increase the efficiency of the economy. In our sample, the quantity of information provided for EN1 is usually very scarce: construction companies usually report only final output quantities of materials, while chemical companies do not report compounds claiming production process privacy; similarly, industrial product manufacturers seldom report the total quantities of raw materials used to produce engines, buses, trucks, and so on. Eight points awarded for materials are responsible for 13 percent of the maximum score of 62.

The energy aspect highlights the ability of the reporting organization to use energy efficiently, which can be revealed by calculating the amount of energy it consumes relative to the amount it saves due to efficiency improvements. As a general trend, companies tend to report more comprehensively on indicators EN5-7 which tend to be soft disclosures, pertaining to commitment rather than performance, which makes then less valuable in terms of transparency. Moreover, this suggests that communication on energy efficiency is more specific to the "green wash agenda" of companies that rank as significant consumers and therefore polluters. Energy makes up for 22 percent of the total score.

The systematic effort to monitor and improve the efficient use of water in the reporting organization is directly linked to water consumption costs. In our sample, companies seem to be highly deficient in estimating the sum of all water drawn into the boundaries of the reporting organization from all sources (including surface water, ground water, rainwater, and municipal water supply) over the course of the reporting period. Almost all do not specify the sources of water withdrawal and most of them do not disclose on discharges.

Industrial activities undisputedly impact biodiversity; monitoring which activities are taking place in both protected areas and areas of high biodiversity value outside protected areas makes it possible for the reporting organization to reduce the risks of impacts. Companies in the sample exhibit scarce reporting on the following information required by the guidelines for each operational site: geographic location; subsurface

G3 link	Aspects concerning environmental inputs and outputs	Scale
	Environmental governance and credibility (M = 4.03, SD = 1.58)	Max. 6
4.9	Existence of management positions for environmental protection and pollution control	0-1
4.1	Existence of an environmental and/or public issues committee in the board	0-1
4.8	Existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices	0-1
3.13	Independent verification/assurance about environmental information in annual reports	0-1
2.10	External environmental performance awards	0-1
4.13	Memberships in industry associations and advocacy organizations to improve environmental practices	0-1
	Materials (M = 4.30, SD = 2.39)	Max. 8
EN1	Materials used by weight or volume (core)	0-4
EN2	Percentage of materials used that are recycled input materials (core)	0-4
	Energy (M = 9.00, SD = 3.78)	Max. 14
EN3	Direct energy consumption by primary energy source (core)	0-4
EN4	Indirect energy consumption by primary source (core)	0-4
EN5	Energy saved due to conservation and efficiency improvements (add)	0-2
EN6	Initiatives to provide energy-efficient products and services (add)	0-2
EN7	Initiatives to reduce indirect energy consumption and reductions achieved (Add)	0-2
	Water (M = 4.55, SD = 3.28)	Max. 11
EN8	Total water withdrawal by source (core)	0-4
EN9	Water sources significantly affected by withdrawal of water (add)	0-1
EN10	Percentage and total volume of water recycled and reused (add)	0-2
EN21	Total water discharge by quality and destination (core)	0-4
	Biodiversity (M = 1.60, SD = 1.67)	Max. 4
EN11	Location and size of land owned, leased, managed in areas of high bio-diversity value outside protected areas (core)	0-2
EN12	Description of significant impacts of activities, products, and services on biodiversity in areas of high biodiversity value (core)	0-2
	Emissions, Effluents, and Waste (M = 9.28, SD = 4.19)	Max. 16
EN16,17	Total direct and indirect greenhouse gas emissions by weight (core)	0-4
EN18	Initiatives to reduce greenhouse gas emissions and reductions achieved (add)	0-2
EN19,20	Emissions of ozone-depleting substances and other significant air emissions (core)	0-4
EN22	Total weight of waste by type and disposal method (core)	0-4
EN23	Total number and volume of significant spills (core)	0-2
	Products, Services, and Transport (M = 2.33, SD = 0.83)	Max. 3
EN26	Initiatives to mitigate environmental impacts of products and services (core)	0-2
EN29	Significant environmental impacts of transporting products and other goods and materials, and members of the workforce (add)	0-1
Total	(M = 35.10, SD = 12.90)	Max. 62

Table II.
Index assessing the quality of discretionary reporting on environmental matters

and/or underground land that may be owned, leased, or managed by the organization; position in relation to protected area (in the area, adjacent to, or containing portions of the protected area) and high biodiversity value area outside protected area; type of operation (office, manufacturing/production, or extractive); and biodiversity value. Biodiversity accounts for 7 percent of the total environmental disclosure score.

The emissions, effluents, and waste aspect includes indicators that measure standard releases to the environment considered to be pollutants. EN18 addresses the emissions reductions achieved and initiatives to reduce emissions. This aspect is generally better documented in the context of sustainability reports, mostly in conjunction with energy consumption and alternative fuels. A high score in the emissions area of disclosure should be worth more than a quarter (26 percent) of the maximum score of 62 points.

Mitigating the environmental impact of products and transportation is generally a highly publicised concern for all companies. Companies generally report quantitatively the extent to which environmental impacts of products and services have been mitigated during the reporting period; however, these figures are usually disclosed at the expense of data in absolute figures. The number of points awarded for this type of soft disclosure does not exceed three out of 62, thus reducing the overall significance of the "green washing" agenda within annual reports.

The scores within each aspect of the reporting index are summarized in Table II. The overall maximum of 62 points is identical to the maximum specified value of the index, but the minimum score of 5 indicates that a minimal level of sustainability reporting was present across the sample.

3.3 Measures of environmental performance

A key research design issue in this study is to develop a reliable proxy for a firm's environmental performance. The following two measures were employed after being normalized for firm size (see control variables below for details):

(1) Group-level direct and indirect energy consumption data were collected from corporate sustainability reports in gigawatt-hours (GWh), and normalized by company size. However, some companies reported in tonnes of oil equivalent (toe) or in mega-joules, for which the figures were converted to GWh using the tool available on the International Energy Agency's web site (www.iea.org). There were only 46 valid observations in this category.

(2) Group-level greenhouse gas emissions in kilotons of CO_2 equivalent were collected from data presented in annual sustainability reports. Although CO_2 emissions are indisputably linked to industrial activity, the gaps in the available data are more prominent than in the aforementioned measure of environmental performance. This indicator was also normalized by company size, and there were only 49 valid observations in this category.

The regulatory framework – mainly Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading – was especially designed to ensure sound reporting and robust verification for the activities of the operators which fall under the national allocation plan. However, of greatest interest to our research is the discussion of how companies can fulfil a complete, consistent, transparent, and accurate monitoring and reporting of greenhouse gas emissions, in accordance with the guidelines laid down in the Decision 2004/156/EC, as amended by Decision 2007/589/EC.

In the aforementioned Decision, the European Commission describes the calculation and measurement-based methodologies for the determination of emissions, alongside a detailed monitoring plan to be prepared by the operator (company or plant management), and checked and approved by the competent authority. Specific CO_2 emissions calculation formulae are also provided for combustion emissions (based on fuel consumption) and process emissions (based on material consumption). Finally, control and verification procedures require that the operators shall establish, document, implement, and maintain effective data acquisition and handling activities for the monitoring and reporting of greenhouse gas emissions. Overall, the European Commission has created the regulatory framework for the provision of reliable data, produced by certified measurement systems employing transparent methodologies.

3.4 Comparative perspectives on environment-related financial elements

As a consequence of a lack of harmonised guidelines, the European Commission acknowledged (Recommendation 2001/453/EC) that stakeholders are unable to adequately assess environmental risks affecting the financial position of a company. When companies do disclose environmental information, it is often the case that the information is devalued by the absence of a common and recognised set of disclosures, along with the necessary definitions and concepts. In spite of sensitivity or confidentiality issues, users of financial statements need information about the impact of environmental risks and liabilities on the financial position of the company, and on the company's attitude towards the environment.

The recommendation took as a source of reference several international accounting standards (IAS) that had been published by the former International Accounting Standards Committee and which were of specific relevance to environmental issues, in particular IAS 36 on impairment of assets, IAS 37 on provisions, contingent liabilities, and contingent assets and IAS 38 on intangible assets. Balance sheets should contain details of provisions and environmental liabilities and the notes to the annual accounts and consolidated accounts should contain details of valuation methods applied to environmental issues, extraordinary environmental expenditures, details relating to provisions in the balance sheet as well as details about contingent environmental liabilities and costs incurred as a result of fines and penalties for non-compliance with environmental regulations and compensations paid to third parties.

Each of the elements enumerated above is investigated comparatively in the fourth section of this study, in relation to the environmental performance of companies in the sample. Table III shows the frequencies of these accounting elements as reported by sample companies for the fiscal year. Fixed assets were classified as environmental assets in connection to their contribution to environmental protection.

Environmental protection and expenditure captured in monetary form and included in the annual reports cannot be seen as an indicator of environmental performance,

Table III. The presence of environmental accounting elements within the financial statements

	Environmental elements			
	Provisions	Expenditure	Liabilities	Assets
Number of observations				
Valid	25	18	7	16
Percentage	40	30	11	26

although some elements (e.g. environmental fines) have a particular significance on this matter. However, subsequent analyses only capture their existence, and not their substance, i.e. their actual purpose for recognition and implications for measurement.

Financial quantification is the binary variable which accounts for the existence of any of the elements above as reported in the notes to the financial statements for a given fiscal year. The actual amounts resulted from provision estimation were not taken into consideration given the fact that they are incomparable across units and that the estimation methods are not disclosed. Through an intergroup analysis, we tried to answer the following question: are companies that quantify environmental risks and expenditures better reporters than companies that omit these financial elements?

3.5 Measures of financial performance and control variables

Several measures of financial performance were employed in this study. Griffin and Mahon (1997) recommend using more than one "convenient" financial measure, in order to encompass information on a broader set of performance issues, such as profitability, growth, asset-utilization, and return on investment.

While it is a common place that accounting ratios and indicators are considered to capture the performance characteristics of the quasi-controlled internal environment of the company, market-based indicators rely on the aggregated nature of information impounded in stock price. In assessing firm performance and monitoring top managers, stakeholders cannot simply rely on stock price changes to provide necessary information about the source of changes to firm value. The accounting system facilitates boards' efforts to separate controllable from uncontrollable events, while stock returns aggregate the implications of all events.

3.5.1 Accounting-based and market-based performance indicators

- Tobin's Q is computed as an approximate of Q (Chung and Pruitt, 1994) computed as:

$$Tobin's\ \ Q = \frac{MVE + Debt}{TA}$$

  where MVE (market value of equity) is the product of a firm's share price and the number of common shares outstanding; Debt is the value of the firm's short-term debt (excluding non-monetary elements and pension liabilities) net of short-term assets, plus the book value of its long-term debt; and TA is the book value of the total assets of the firm. The influence of market performance has an expected sign of $\pm$.

- Share returns (RT) were computed following Murray *et al.* (2006) as follows:

$$RT_{i,t} = \frac{P_{i,t}}{P_{i,t-1}}$$

  Where $RT_{i,t}$ is the return earned by company i during year t; $P_{i,t}$ is the price of share i at the end of year t; and $P_{i,t-1}$ is the price at the beginning of the year. This analysis was conducted for the fiscal year for which environmental and financial data were reported. Share returns are rightly considered an explanatory variable, considering the fact that annual reports and sustainability reports are issued at least four months after the conclusion of the fiscal year. In this sense,

corporate reports may serve as tools for maintaining or repairing legitimacy, in case last year's returns demand such intervention from management.

- Return on equity (*ROE*) measures the rate of return on the ownership interest (shareholders' equity) of the common stock owners. ROE is equal to a fiscal year's net income (after preferred stock dividends but before common stock dividends) divided by total equity (excluding preferred shares), expressed as a percentage:

$$ROE = \frac{Net\ \ income}{Total\ \ equity}$$

For capital-intensive businesses such as those included in the sample, high entry barriers generally limit competition; thus, as with many financial ratios, ROE is best used to compare companies in the same industry. Expected sign $\pm$.

- Leverage (*LEV*) is the leverage ratio, measured as the ratio of consolidated total debt divided by consolidated total assets for the fiscal year:

$$LEV = \frac{Total\ \ debt}{Total\ \ assets}$$

Total debt is more restrictive than total liabilities, in that it excludes non-monetary elements (i.e. provisions, deferred taxes, etc.). The rationale behind this measure is that agency costs of debt are higher for firms with relatively more debt in their capital structure (Jensen and Meckling, 1976), thus leading to an increase in voluntary disclosure to compensate for the higher demand of information. Expected sign. +:

- Return on assets (*ROACHG*) – an accounting-based measure of contemporaneous performance – is computed by dividing total assets by consolidated net income (including minorities) for the period:

$$ROACHG = \%\ \ change\left(\frac{Total\ \ assets}{Net\ \ income}\right)$$

The measure employed in correlational analysis is the percentage change in ROA on a prior-to-current basis. Several authors (Balabanis *et al.*, 1998; McGuire *et al.*, 1988) employ an average of accounting-based measures over several periods, the rationale being that ROA as a contemporaneous measure of asset efficiency is only relevant in a temporal and inter-industry context. Since the figure for total assets of the company depends on the historical cost and depreciation methods of fixed assets, some caution is required for companies whose carrying value may not correspond to the actual market value. At the same time, asset value may be influenced by conversion rates and inflation of book values, especially for group companies that operate in a large number of countries.

- Growth in earnings per share (*EPSgrowth*) is based on the disclosed figures for the current and the previous fiscal year. The "earnings per share" (EPS) indicator equals the entity's net profit for a particular period divided by the number of ordinary shares:

$$EPSgrowth = \%\ \ change\left(\frac{Income\ \ from\ \ continuing\ \ operations}{Weighted\ \ average\ \ common\ \ shares}\right)$$

EPS is a standard measure often used to assess an entity's profitability. Our computation uses basic EPS computed according to IAS 33 by dividing net profit or loss attributable to ordinary shareholders by the weighted average number of ordinary shares outstanding during the period. Moreover, the basic EPS figure is restricted to income from continuing operations and before exceptional items, as reported under IAS 1 "Presentation of financial statements". This restriction often substantially alters the indicator, as global basic EPS may have a different dynamic due to discontinued operations and their specific profitability.

3.5.2 Control variables. Size of company consists of two measures: number of employees for the parent company and all its subsidiaries, and total assets. Owing to the fact that consolidated statements are filed with respect to the national currency, the amount for total assets was converted to euro at the appropriate exchange rate for the end of the fiscal year, in order to ensure comparability. However, the distortions caused by the difference in inflation rates at national level and/or fluctuations in exchange rates between 2005 and 2007 were not accounted for.

Company size, or the scale of operations in an organization, is a controversial control variable. Orlitzky (2001) tests the hypothesis that firm size would confound the relationship between CSR and financial performance. CSR and firm size may be positively related because larger firms have greater visibility, and, thus engage in more and better social performance initiatives than smaller firms. At the same time, firm size could be positively related to financial performance because firm size may lead to net economies of scale in manufacturing processes, and greater control over resources. The empirical analysis demonstrated that when firm size is controlled for, the positive correlation between CSR and financial performance still holds. Therefore, the failure to have firm size confound the positive relationship between CSR and firm performance is reassuring, since the above paper suggests that both large and small firms can benefit from CSR.

Inclusion in a sustainability index (i.e. Dow Jones Sustainability Index (DJSI), FTSE4Good) is a dummy variable which equals one for the group belonging to one of these indexes. In this sample, 24 companies were not included in any index, while 36 were part of at least one index.

The Dow Jones Sustainability Group Indexes launched in 1999 are the first global indexes to track the financial performance of leading sustainability-driven companies worldwide. The DJSI are a cooperation of Dow Jones Indexes, STOXX Limited, and Sustainable Asset Management (SAM) Group. The constituent components and weightings are reviewed annually and are based on SAM research and feedback from third party consultants, NGOs, international bodies, and academics. SAM supplements these company reports with a "media and stakeholder" analysis that comprises a review of internal and external company documents. These documents include: annual reports, environmental reports, health and safety reports and reviews, press releases, articles, and media and stakeholder commentaries on the company. The final weights attached to the result of this review are a controversial topic. Researchers (Fowler and Hope, 2007) have noted that the over-emphasis on economic factors (30.6 percent of the weighting) and the under-emphasis on environmental factors (9.2 percent) is difficult to reconcile with the definition of sustainable development.

Adoption of GRI guidelines is a pretty straight-forward control variable; hence we expect organizations that have chosen to follow the reporting guidelines compiled by the GRI to obtain better environmental disclosure scores. Some commentators might argue that choosing the GRI guidelines as a benchmark for disclosure quality will introduce a bias towards companies that follow the GRI principles. However, their global fame as the leader among voluntary worldwide sustainability reporting systems recommended the G3 as an approximation of the maximal disclosure requirements for 2007. In the final sample, 29 companies were GRI indifferent, while 31 were GRI compliant.

4. Hypotheses, empirical results, and discussion

The purpose of this study is two-fold: first, it seeks to offer the reader a perspective on contemporary environmental reporting in the context of European industrial group companies; second, it investigates the relationships between the three main variables of interest, namely the reporting index, the environmental performance, and the financial performance of the sampled companies. A cross-sectional design was considered appropriate and in line with the existing literature, although the limitations of this particular design are not to be underestimated. The risks associated with attempting to generalize these results will be discussed as a conclusion of this study.

4.1 Descriptive and inferential statistics tests employed with the entire sample

Besides the usual descriptive statistics (Table IV), the tests described in this section attempt to evaluate some hypotheses regarding the shape of the population distribution from which the sample was extracted. A standard test of normality was applied to selected variables: the Shapiro-Wilk test compares the scores in the sample to a normally distributed set of scores with the same mean and sample deviation. A non-significant statistic ($p > 0.05$) indicates that the distribution of the sample is not significantly different from that of a normal distribution (Field, 2005).

The two measures of company size (i.e. total assets and number of employees) are both positively skewed. Companies classified by total assets (M = € 27,624 million, SD = 27,885 million) are in 88 percent of the cases under 50,000 million. Similarly, companies with at most 100,000 employees (M = aprox. 79,000, SD = aprox. 87,000) occupy 73 percent of the distribution. A logarithmic transformation was applied to Total assets in order to normalize the data (Shapiro-Wilk = 0.985, $p = 0.89$ indicating a normal distribution).

The environmental reporting scores are normally distributed, with a mean of 35 (SD = 12.9). The lowest score of five indicates that all companies in the sample report at least rudiments of environmental concern. The normality of the reporting index variable is probably the most unexpected result of this study, considering that, despite the heterogeneity of the sample, the majority of companies in the selected sectors are aware of their environmental risks and benefits. At the same time, the presence of the maximum score of 62 (one case) suggests that the GRI requirements are not unrealistic and that compliance is feasible. On the other hand, the normal distribution of the reporting index is one indication that, although the companies are the largest in their industry, their reporting habits have a certain degree of randomness and lack of standardization. This result proves that future research in this area is still necessary.

The environmental performance indicators are positively skewed, in either their absolute or normalized units. Relating pollution and consumption to economic activity

Table IV.
Descriptive statistics for study variables

	Descriptive statistics				
	Min.	Max.	Mean	Median	SD
Environmental reporting index	5	62	35.10	38.00	12.90
Total assets in million euro	2,732.57	171,893.00	27,624.95	20,827.51	27,885.97
Number of employees	3,323	502,545	79,796	55,445	87,908
Tobin's Q	0.78	3.17	1.47	1.33	0.55
EPS (EPS growth) percent	−566	350	23	18.60	109
Annual share returns (*RT*)	0.23	2.26	1.14	1.07	0.34
Return on assets (ROACHG) percent	−530	9673	174	6.46	1251
Financial leverage (LEV)	0.02	0.86	0.52	0.53	0.19
Return on equity (ROE)	−0.03	1.91	0.24	0.18	0.25
$C0_2$ emissions (kilotons)	18	239,000	17,469.90	1,300	39,579.53
Energy consumption (GWh)	38	712,500	36,948.97	5,293	107,888.34
$C0_2$ emissions per employee	0.0002	1.3492	0.2088	0.0263	0.3450
Energy consumption per employee	0.0016	2.2910	0.4279	0.0568	0.6643
$C0_2$ emissions /total assets	0.0006	4.8893	0.5798	0.0751	1.0240
Energy consumption/total assets	0.0014	7.8482	1.0437	0.2448	1.6640

(total assets) and human resources (number of employees) has not managed to normalize the data, which remains positively skewed. However, for statistical purposes, the logarithmic transformation has improved the distribution of energy consumption per employee, although the Shapiro-Wilk statistic (value = 0.941) is still significant at $p = 0.019$.

4.2 Correlational analysis

The data for the correlational study seem to violate parametric assumptions such as the normality of distribution. Instead of Pearson's correlation coefficient, which relies on the normality assumption, we use Spearman's rho. The results of correlational analysis are reported in Table V. Environmental disclosure quality is significantly correlated with all environmental performance indicators (in normalized units). In other words, bad performance is associated with good reporting, considering that higher levels of CO_2 emissions per employee or energy consumption per total assets are an indication of an intensively polluting activity. The rank-order correlation coefficients between 0.42 and 0.62 should be cautiously interpreted as a moderate to large effect (Cohen, 1988).

Caution is essential in assessing these results, simply because the employed non-parametric procedure disregards the relative scaling of the data, which may indicate (for the remaining unexplained variance) high reporting scores associated with relatively low pollution levels. Additionally, when controlling for company size expressed by total assets (in logs), reporting index and energy consumption per employee (in logs) exhibit a strong partial product-moment correlation ($r = 0.660$, $p < 0.001$), which confirms the results obtained through the rank-order correlation technique. Very strong correlations between the four environmental performance indicators suggest that they may not be substantially different in quantifying pollution intensity.

An unexpected finding suggests that there is a moderate rank-order correlation between environmental performance and financial leverage, in that bigger polluters tent to have lower debt-to-assets ratios. This result cannot be properly explained due to sample heterogeneity, but we suspect that asset intensive businesses also exhibit poor environmental performance, so that it may have less to do with the numerator Figure (debt) than with the denominator (total assets).

By applying the Bonferroni correction, we intended to reduce the chance of committing a Type I error. This was done by using a significance level for each individual test equal to $\alpha' = 0.05/n$, where $n = 16$ is the number of variables tested. Thus, the adjusted α rules out any correlation previously significant at the 0.05 level. Eventually, the significant rank-order correlations that are reported by this study include the inverse association between environmental performance and reporting, and the positive relationship between reporting quality and company size, which is consistent with prior literature.

4.3 Inferential statistical tests employed with two independent samples

In this section, we seek evidence to test whether environmental reporting quality is significantly influenced by the sustainability and accounting disclosure requirements imposed by financial markets. Moreover, we hypothesize that financial performance is significantly better for companies included in a sustainability index, than for those deemed "un-sustainable".

Table V. Nonparametric correlation matrix (Spearman's ρ) for variables describing environmental reporting quality (INDEX), environmental performance, firm size, market performance and accounting-based performance

	Environmental performance indicators				Firm size		Market performance		Accounting-based performance indicators		
	CO_2EMP	CO_2TA	ECEMP	ECTA	TA	EMP	TQ	RT	ROE	LEV	EPSgr
INDEX	0.568**	0.422**	0.625**	0.509**	0.502**	0.153	−0.171	0.151	−0.097	−0.105	0.002
CO_2EMP	1	0.933**	0.886**	0.826**	0.246	0.024	−0.093	0.167	0.104	−0.507**	0.011
CO_2TA		1	0.790**	0.881**	0.153	0.172	−0.016	0.142	0.129	−0.498**	0.056
ECEMP			1	0.914**	0.209	−0.061	−0.196	0.033	0.050	−0.572**	−0.144
ECTA				1	0.155	0.138	−0.099	0.024	0.110	−0.594**	−0.089
TA					1	0.703**	−0.386*	0.265	−0.301	0.250	0.147
EMP						1	−0.199	0.126	−0.199	0.183	0.166
TQ							1	0.250	0.555**	−0.134	0.168
RT								1	0.297	−0.006	0.301
ROE									1	−0.269	0.297
ROACHG										−0.231	0.639**
LEV										1	0.182
EPSgr											1

Notes: Significance at: $^{*}p < 0.05$, and $^{**}p < 0.01$; Levels (two-tailed), respectively; the Bonferroni correction was applied, $\alpha' = 0.05 / n$, where $n = 14$ is the number of variables tested

Four independent *t*-tests were conducted for group comparisons of environmental reporting quality. A Bonferroni correction for four comparisons ($\alpha' = 0.05/4 = 0.0125$) was used to determine significance. Companies that quantify their environmental financial elements exhibit higher quality environmental reporting ($M = 39.13$, $SD = 12.05$) than companies who do not include environmental provisions into their IFRS-compliant statements ($M = 28.14$, $SD = 11.48$), which translates into a large effect ($d = 0.93$). Companies that follow the GRI guidelines are also better environmental reporters ($M = 40.19$, $SD = 12.17$) than companies that do not ($M = 29.66$, $SD = 11.52$), generating a large effect ($d = 0.88$). The results are similar in the case of sustainability index inclusion; a large effect of $d = 0.89$ is obtained by comparing reporting habits of companies that are included in a sustainability index ($M = 39.39$, $SD = 11.55$) against companies that are not included ($M = 28.67$, $SD = 12.32$).

Before correcting for inflated Type I errors, the results suggest that companies with higher levels of energy consumption tend to legitimize themselves by being included in one or more sustainability indexes; however, the statistical effect can be regarded as small to moderate (Rosenthal's $r = 0.29 < 0.30$ threshold for a moderate effect). Subsequently, the Bonferroni correction was also applied to the non-parametric Mann-Whitney tests conducted on the average energy consumption per employee between groups of companies classified according to their disclosure requirements. For the other disclosure requirements, we have found no significant differences in energy consumption intensity between companies with poor and with higher levels of sustainability disclosure.

There is a growing body of literature concerning the relationship between financial performance and perception of sustainability as reflected by the inclusion in a sustainability index. Lo and Sheu (2007) examined whether corporate sustainability has an impact on market value using large US non-financial firms from 1999 to 2002; they took Tobin's *q* as the proxy for firm value and found that a positive relation exists between a firm's value and DJSI inclusion, with a statistically significant sustainable premium. Thus, those companies actively maintaining sustainable development are more likely to be rewarded by investors, resulting in a higher valuation on the stock market.

Our data serve as a partial illustration of Lo and Sheu's (2007) results. We document only one small to medium effect between sustainability index inclusion and annual share returns (Mann-Whitney's $U = 303$, $p < 0.10$). All the other financial performance indicators do not differ significantly across the two independent samples, suggesting that investors may be inclined to assign a higher value to "sustainable" shares, despite mixed indicators on accounting performance. On the other hand, this result may imply that, to a limited extent, corporate reputation does drive the market and inflates the annual share returns with often irrational expectations.

4.4 Regression analysis

Regression analysis was used to assess the influence of several performance variables on the outcome variable reporting index. First, we tested the assumptions underlying ordinary least squares regression. The assumptions for multiple regression include the following: that the relationship between each of the predictor variables and the dependent variable is linear and that the error, or residual, is normally distributed and uncorrelated with the predictors. A condition that can also be extremely problematic is multicollinearity, which can lead to misleading and/or inaccurate results.

Multicollinearity occurs when there are high intercorrelations among some set of the predictor variables. In other words, multicollinearity happens when two or more predictors contain much of the same information.

The results of correlation analysis led us to suspect that the relationship between the study's variables may not be linear (Lang and Lundholm, 1996). Thus, using a curve-fitting procedure, we tested logarithmic, quadratic, and cubic simple regression models on the untransformed data, using environmental reporting quality (INDEX) as a dependent variable. For all financial performance variables and firm size expressed as the number of employees (EMP), the results are qualitatively identical with those from the linear models, i.e. no significant relationship is to be found. However, for all other variables (i.e. the environmental performance indicators and firm size expressed as total assets), the alternative non-linear models fit the data better, in that the logarithmic, quadratic, and cubic specifications display a significantly higher R^2 than the linear model. Thus, transformation of the data can sometimes lead to linearity and enable the standard use of multiple regression.

Although the relationship between the untransformed variables was non-linear, the relationship between the transformed variables turned out to be linear. The plot of log(total assets), and of log(energy consumption per employee) against reporting index indicates that the logarithmic transformation is appropriate, since the pattern is now decidedly linear. The logarithmic transformation also had a desirable effect on influential cases within the sample, by eliminating outliers and normalizing the data.

The results of the hierarchical multiple regression analysis are shown in Table VI. The proportion of variance explained by the model in Step 1 is 50 percent, while the difference between R^2 and the adjusted R^2 is of only 2 percent. This shrinkage means that if the model in Step 1 was derived from the population rather than the sample it would account for approximately 48 percent of the variance in the outcome. The model in Step 2 was constructed based on the hypotheses tested in the previous sections. The GRI adoption and financial quantification dummies were found to indicate

Dependent variable: reporting index	Unstandardized coefficients B	SE	Standardized coefficients β	Collinearity statistics Tolerance
Step 1				
Constant	4.51	15.96		
Total assets (log)	4.19	1.57	0.29*	0.96
Energy consumption per employee (log)	3.28	0.60	0.59**	0.96
Step 2				
Constant	16.02	16.90		
Total assets (log)	2.34	1.74	0.16	0.73
Energy consumption per employee (log)	3.08	0.60	0.55**	0.89
GRI guidelines adoption (dummy)	4.03	2.68	0.16	0.89
Financial quantification (dummy)	5.09	2.94	0.19	0.85
Annual share returns (log)	2.99	4.66	0.07	0.79

Table VI.
Summary of hierarchical regression analysis predicting environmental disclosure quality

Notes: Significance at: $^{*}p < 0.05$ and $^{**}p < 0.01$; $R^2 = 0.50$ and adjusted $R^2 = 0.48$ for Step 1; $\Delta R^2 = 0.06$ for Step 2 ($p = 0.13$); F (2, 44) = 22.05** for Step 1 and F (5, 41) = 10.61** for Step 2; multicollinearity is considered a problem when tolerance $< (1 - R^2)$, which is not the case for Steps 1 and 2

independent samples coming from significantly different populations. Additionally, annual share returns was included as a proxy for financial performance, on the criterion that it does not correlate with any other covariate in the model.

The model in Step 2 accounts for 6 percent more variance than the former model, but the change in F is not significant at $p = 0.13$. Thus, the model in Step 2 has not significantly improved over the model in Step 1, indicating that explanatory power of the two predictors (total assets and energy consumption per employee in logs) cannot be improved by adding other independent variables. Moreover, the model in Step 1 does not violate the assumption of no perfect multicollinearity, unlike the model in Step 2 which is affected by a weak form of multicollinearity. Hierarchical regression analysis was conducted in order to assess the strength of the model including only the significant covariates.

The fitted model has a lin-log specification, where the slope coefficients are interpreted as an absolute change in the dependent variable corresponding to a percentage change in the regressors. The absolute change in the outcome variable is obtained by dividing the β unstandardized coefficients by 100, in order to be able to make correct inferences (Gujarati, 2004, p. 183). For Step 1, 1 percent change in total assets triggers an absolute change of $4.19/100 = 0.0419$ in the environmental reporting score, only if we hold constant the effects of pollution. Similarly, if we keep total assets fixed, a 1 percent increase in energy consumption per employee determines a $3.28/100 = 0.0328$ increase in the environmental reporting scores.

The β coefficients give the estimate of the average number of standard deviations change in the outcome that will be produced by a change of one standard deviation in the regressors. As revealed by a comparison of the standardized regression coefficients, the effect exerted by changes in total assets ($\beta = 0.29$) are half than that of the pollution level ($\beta = 0.59$). This result, which is in apparent contradiction with the absolute effects of the unstandardized coefficient, is supported by the fact that pollution levels have higher variability than company size, thus exerting a greater influence on reporting index.

The assumptions of linearity and homoscedasticity for the model in Step 1 are tested using a plot of the standardized residuals against the standardized predicted values. The essentially shapeless pattern is indicative of a situation in which these assumptions have been met. The normality of the residuals was tested using a formal test like the Shapiro-Wilk; the model does not violate the assumption of normally distributed residuals (statistic = 0.954, $df = 47$, $p = 0.063$). We can conclude that the model in Step 1, for a large effect of $f^2 = 0.92$ (Cohen, 1988), and achieved power of 0.99 (Faul *et al.*, 2007) is a satisfactory model that shows a strong connection between environmental performance and reporting quality.

Finally, we conducted several sensitivity analyses, having recourse to hierarchical stepwise regression. Qualitatively identical results as above are obtained when using log(CO_2 emissions per employee) instead of log(energy consumption per employee), with an adjusted R^2 of 0.481 ($F = 20.42$, $p < 0.001$). Moreover, we conducted a backwards elimination procedure on all of the study's variables (i.e. "full" model including financial performance, environmental performance, firm size, and control dummy predictors). No improvement was found in any of the resulting models compared to the basic model constructed above (with log of total assets and log of energy consumption per employee). Therefore, we can conclude that the model presented in Table VI – Step 1 – is the only satisfactory specification given the present data.

5. Discussion and conclusions

One of the major temptations for researchers is to overestimate the significance of their results. The assessment of the inherent limitations of any chosen design is a first step in moderating the psychological effect of the $p < 0.01$ threshold. Content analysis, as the missing link between qualitative inquiry and the positivist epistemology, poses a series of challenges that should be acknowledged before offering a final interpretation of the results.

For the purpose of this study, environmental data within the annual or sustainability reports were content analysed against a transparent classification scheme. Several topics of environmental concern were identified, and the amount of pertinent information was coded on a five-point scale. Thus, the central problems of content analysis originate mainly in the data-reduction process by which the many words of text are classified into much fewer content categories. One set of problems concerns the consistency or reliability of text classification.

Three types of reliability are pertinent to content analysis: stability, reproducibility and accuracy (Krippendorff, 2003, pp. 130-54). Stability refers to the extent to which the results of content classification are invariant over time. The results of the coding process are stable in that the initial coding of environmental information was subject to a later verification. However, because only one person is coding, stability is considered the weakest form of reliability.

Reproducibility, sometimes called intercoder reliability, refers to the extent to which content classification produces the same results when the same text is coded by more than one coder. In this case, reproducibility cannot be assessed, since there was only one coder involved. However, several arguments can be brought in favour of this particular research design. First, the recording unit is virtually a whole chapter in the annual or sustainability report; this form of coding is labour intensive, but leads to much more detailed and sophisticated comparisons. At the same time, it is difficult to achieve high reliability when coding complete texts. That is why we can argue that the researcher who has established the coding scheme is at the same time the most capable person to conduct a viable classification of the reporting themes. Such a comparatist approach is not a group task; thus, conflicting coding that may result from cognitive differences among the coders are generally insurmountable, and disagreements cannot be reliably resolved. A research design with only one coder surpasses this limitation.

Accuracy is considered to be the strongest form of reliability (Weber, 1990, p. 17) and refers to the extent to which the classification of text corresponds to a standard or norm. Our study exhibits accuracy, in that the coding scheme corresponds to the GRI environmental indicators. Not surprisingly, the analytic accuracy was enhanced by the presence of the GRI index at the end of each sustainability report compiled in compliance with the guidelines. For example, the GRI index of one particular sustainability report may indicate that the information pertaining to the indicator EN16 (total direct greenhouse gas emissions by weight) is to be found at page X. Thus, content analysis for this indicator is restricted to page X, which reduces the effort of assigning a score of 0-4 related to the quality and comprehensiveness of the disclosed data. Accuracy is also important, in that later verification of the scores becomes feasible.

Correspondence between what is being measured and the classification scheme, as well as generalizability, are themes that run throughout the following discussion of validity (Neuendorf, 2002, pp. 114-18). A basic form of internal validity is the

assessment of the correspondence between the classification scheme and the abstract concepts it addresses. In this study, we measure the quality of environmental reporting by classifying sustainability statements according to their wealth of comparable and benchmarked information. Thus, our classification scheme benefits from face validity, involving the obvious correspondence between the definitions of concepts and the definitions of the categories that measured them. We dare say that other coding schemes, such as those provided by the sustainability indexes, do not exhibit even the weakest form of face validity, considering that they tend to confound environmental performance with the quality of a company's disclosure.

However, construct validity, which measures the extent to which the resulting scores are correlated with other indicators of the same construct, can be assessed in the context of sustainability indices. We showed in Section 4.3 that companies with quality environmental reports are also those companies which collect reputational benefits from inclusion in a sustainability index. The moderate effect resulting from the correlation between index inclusion and environmental performance indicates that sustainability indexes are designed to assess public perception rather than actual sustainability performance.

Another type of external validity – hypothesis validity – relies on the correspondence among variables and the correspondence between these relationships and theory. A measure has hypothesis validity if in relationship to other variables it "behaves" as it is expected to. The reporting index measure of disclosure quality can be considered valid since better reporters are also those who have adopted the GRI Guidelines, and those who quantify their environmental elements through the application of the dedicated IAS/IFRS provisions (Section 4.3). These results are consistent with the theoretical arguments connecting legitimacy theory and the TBL reporting that generates high quality sustainability reports designed to show managerial commitment to environmental protection.

The investigation into the degree of reliability and validity of this research design has led us to conclude that the results are credible, while at the same time acknowledging the inherent limitations of content analysis, with or without intercoder reliability. As a final point of discussion, we would like to point to several possible drawbacks of the overall design, as well as to the possible lack of statistical power generated by the sampling method.

Sample heterogeneity may be regarded as a major flaw of the final output. During data collection, we noticed the diversity of business activities for each company, as well as the lack of comparability between several business segments. However, a crucial thing to mention is the fact that some corporate activities have little impact on the environment, thus reducing the necessity of companies to disclose their sustainability practices. Nevertheless, an important finding of this study is the discrepancy between the statistical distributions of the main variables: environmental reporting is normally distributed, while environmental performance is positively skewed. This suggests that there are a number of low polluting companies which issue large amounts of sustainability information in order to build or preserve corporate legitimacy.

At micro level, a statistical study cannot capture the characteristics of legitimacy engagement. Hence, a generic limitation of any correlational study is the impossibility to specify the causal direction of relationships. The reported Spearman's rhos, capturing the association between the environmental performance and disclosure variables,

have an average of 0.50, indicating a medium to strong relationship. However, environmental performance accounts for roughly 25 percent to 30 percent of the variance of environmental reporting across companies. We are left with approx. 70 percent of unexplained variability in the environmental disclosure scores. This result suggests that even though big polluters tend to report more, the transparency level of their activities may not be sufficient for a viable assessment of sustainability. Thus, on the one hand, companies with relatively good environmental performance are engaging in legitimacy preserving practices, while, on the other hand, heavy polluting sectors may lag behind the transparency efforts of their "greener" counterparts. For such big polluters, their reputation-building strategy is mainly focused on preserving or repairing legitimacy.

The limitations induced by the cross-sectional design are the source of our inconclusive findings on the relationship between environmental performance disclosure and financial performance. None of the financial performance variables correlates with either disclosure scores or pollution levels. This may suggest two complementary things: first, that the relationship between sustainability commitment and financial performance may be so weak that it is barely detectable; and second, that one-period studies are prone to fail in capturing a relationship that might be shaped over longer periods of time, like years or decades. Legitimacy as an intangible asset is founded on the synergy of responsibility practices and sustainability reporting, and may very well be crucial for the survival of any business.

There are a number of reasons for not reporting; amongst them, the most prominent are: the doubts concerning the advantages it might bring, the already good reputation of the company, the cost-benefit considerations, or the difficulty to gather consistent data. However, when the organization does chose to report on sustainability, the worst scenario usually involves strategic disclosure. Some authors (O'Dwyer and Owen, 2005) have expressed concern that reporting processes could become prone to "managerial capture". In their view, corporate management has taken control of the entire process of reporting, thus resulting in information disseminated only when deemed appropriate to collect reputational benefits, rather than seeking true transparency and accountability to stakeholders. Lack of completeness, little coverage of negative impacts, or insufficient evidence on sustainable development, all these are signs of a dead end in the chain of accountability.

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