Three Essays on Corporate Environmental Disclosures and Environmental Performance

Hani Tadros

A Thesis in the John Molson School of Business

Presented in Partial Fulfillment of the Requirement

For the Degree of Doctor of Philosophy at

Concordia University

Montreal, Quebec, Canada

December 2014

CONCORDIA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

This is to certify that the thesis prepared

By: **Hani Tadros**

Entitled: **Three Essays on Corporate Environmental Disclosures and Environmental Performance**

and submitted in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY (Business Administration)

complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

Signed by the final examining committee:

Dr. Raymond Paquin Chair

Dr. Yue Li External Examiner

Dr. Bryan Campbell External to Program

Dr. Denis Cormier Examiner

Dr. Emilio Boulianne Examiner

Dr. Michel Magnan Thesis Supervisor

Approved by Dr. Harjeet Bhabra,
Graduate Program Director

December 11, 2014

Dr. Steve Harvey
Dean of John Molson School of Business

ABSTRACT

Three Essays on Corporate Environmental Disclosures and Environmental Performance

Hani Tadros
Concordia University, 2014

The objective of this dissertation is to study the incentives of firms to disclose their environmental information and examine the reliability of the information disclosed. To achieve this objective, there is a need to first understand what constitutes environmental disclosures. The first essay, a review of prior disclosure studies, provides a classification of the different types of environmental disclosures and a synopsis about the motivation to disclose each type of information, the reliability and the relevance of the information disclosed to different stakeholders. The outcome of this research shows that many types of environmental information are relevant to the financial and non-financial stakeholders; however, there are still other types of information that needs to be researched to finally achieve a comprehensive framework of environmental disclosures.

The second essay examines the association between environmental disclosures and firms' environmental performances. The study provides a framework to explain the disclosure process demonstrating the effect of economic and legitimacy factors, environmental performance, and the media communicating these disclosures on the amount and type of information reported. The results suggest that environmental reporting is biased; where firms with higher levels of environmental performance disclose more voluntary information while firms with low-environmental performance tend to meet the mandatory disclosure requirements. There is little evidence to suggest that firms with low-environmental performances use their environmental disclosures to maintain the legitimacy of their environmental operations.

The third essay examines the reliability of environmental performance indicators disclosed. The results suggest that the reporting of firms' EPIs might be free of bias as the study finds no association between the information disclosed and firms' environmental performance.

In general, the dissertation provides assurances over the reliability of environmental information disclosed. There is no denial that firms are subject to pressures from non-financial stakeholders to justify the impact of their operations on the environment. This dissertation shows that firms attempt to use their environmental disclosures to mitigate the effects of these pressures; however, it also suggests that the need to legitimize their operations is not the main driver behind the reporting of environmental information.

ACKNOWLEDGMENTS

Looking back to the day when I first decided to do my PhD and I realize that I have sailed on a journey that has changed my life forever. A journey that was full of challenge, learning, work, achievements, failures, joy, pain, and friendship. Today, I want to express my gratitude to my dissertation Chair, Professor Michel Magnan. His continuous support, guidance, patience, and generosity are the main reasons I was able to achieve this moment. I am especially grateful for his willingness to share his vast research experience and for developing my abilities to conduct research and write academic papers. I want to thank Professor Emilio Boulianne who provided me with a necessary technical and morale lift to complete my work. I am equally grateful to Professor Denis Cormier for his presence on my committee and for his valuable feedback that helped me improve my dissertation. Finally, I want to thank Professor Charles Cho for his early guidance and for introducing me to the field of environmental accounting research.

I want also to thank my PhD colleagues: Dia Bandaly, Ali Dirani, Louis Thwaites, Amr Addas, Osman Aktas, Mingzhi Liu, Jun Zhan, Tiemei Li, Haiping Wang and Michelle Rodrigue. Thank you for your friendship and for the great moments we shared together. I am also very grateful to everyone at the PhD and Accountancy department for the support you gave me all those years. I am thankful to Professors Harjeet Bhabra, Dominic Peltier-Rivest, Majidul Islam, George Kanaan, Sophie Audousset-Coulier, Darlene Himick, Elisabeth Peltier Wagner, and Mr. Stanley Mroz who provided me with valuable advice for my research and teaching work. I am also grateful for all the help I received from Karen Fada, Karen Fiddler, Silvana Mendicino, and Danièle Berthiaume.

I would like to thank the Fonds Québécois de la Recherche sur la Société et la Culture, Power Corporation of Canada, Hydro Quebec, Raymond Decarie Graduate Award, and Concordia University to whom I remain indebted for their financial support.

Finally, I dedicate this dissertation to my beloved wife, Dina, my son, Cherif, and my daughter, Sylvie, who provided me their unconditional love, support and encouragement and also gave me great moments of joy. I also dedicate it to my family; especially, my mother, Nadia, my father, Samir, and my sister, Nadine, who have always encouraged me to pursue my PhD.

TABLE OF CONTENTS

LIST OF TABLES

Chapter 2 – Literature Review

Chapter 3 – Reexamining the Association between Environmental Disclosure and Environmental Performance

LIST OF FIGURES

Chapter 2 - Literature Review

Chapter 3 – Reexamining the Association between Environmental Disclosure and Environmental Performance

Chapter 4 - The Determinants of Disclosure of non-Financial Environmental Performance Indicators

Appendix E: Analysis of information disclosed in annual reports, 10-K reports, and sustainability reports

Chapter 1 - Introduction

Due to increased levels of pollution, environmental issues have gained importance over the last three decades. All society members are required to act responsibly to help reducing the amount of hazards disposed in different media: air, water, and soil. Attention is mainly focused on businesses as industrial emissions represent the largest portion of pollutants emitted. The attention is translated into tighter regulations that produce stringent environmental standards, increased scrutiny over corporate activities which ends in severe penalties if environmental standards are not met, and larger demand for corporate environmental information from different stakeholders as corporate environmental responsibility has increased over the years.

As a result of this continuously growing importance of corporate environmental activities, the supply of environmental information increased over the last two decades as evidenced by the growth of environmental disclosures from less than a page in annual reports (Patten, 1991) to a full stand-alone report discussing corporate environmental activities (Clarkson et al., 2008); in addition to firms using their websites to disseminate large amounts of information (Aerts et al., 2008). The disclosure of environmental information has increased beyond the level required by the regulators and the voluntary disclosure created demand for accounting research to understand the different incentives and consequences of this type of disclosure.

The literature revolves around three main research questions. First, researchers attempt to understand the motivation of firms to voluntarily disclose information beyond legal requirements (see Aerts et al., 2006; Cho et al., 2006; Cho, 2009; Clarkson, 1995; Guthrie & Parker, 1989; Neu et al., 1998; Patten & Trompeter, 2003). Second, researchers study the reliability of

environmental information by examining whether the information disclosed is a good indicator of firm's performance (see Al-Tuwaijri et al., 2004; Cho & Patten, 2007; Clarkson et al., 2008; Freedman & Wasley, 1990; Hughes et al., 2001; Patten, 1991; Patten, 2002; Rockness et al. 1986; Rockness, 1985; Wiseman, 1982). Finally, researchers examine the relevance of environmental information to investors and different stakeholders of the firm (Aerts et al., 2008; Belkaoui, 1976; Chen et al., 1980; Ingram, 1978; Spicer, 1978).

This dissertation attempts to answer the first two questions: (1) what are the determinants of corporate environmental disclosure? (2) are environmental disclosures reliable measures of firms' environmental performance? The two questions are intertwined in the larger debate about whether environmental disclosures are informative or deceptive. Proponents of economic theory provide support to the argument that environmental disclosures are informative and that the disclosure of environmental information is driven by market forces of supply and demand for information (see Li et al., 1997; Barth et al., 1997; Cormier & Magnan, 1999; Cormier & Magnan, 2003; Al-Tuwaijri et al., 2004). They argue that firms will increase their disclosure in response to increased demand for environmental information to reduce the investor's research costs and avoid discounting of their market values (Diamond, 1985). Verrecchia (1983) argues that costs associated with the disclosure of proprietary information act against firms disclosing their full set of private information. Hence, firms will usually adopt a partial disclosure strategy that will maximize the benefits and minimize the costs of disclosure (Li et al., 1997; Cormier & Magnan, 1999; Cormier & Magnan, 2003).

A second string of literature adopts the view that environmental disclosures could be explained through the legitimacy framework (see Patten, 1991; Neu et al., 1998; Buhr, 1998; Patten, 2002; Cho & Patten, 2007; O'Donovan, 2002; Deegan, 2002, Deegan et al., 2002; de

Villiers & van Staden; 2006; Cho, 2009). Advocates of the legitimacy theory argue that firms use their environmental disclosures to mitigate the threats to their environmental operations legitimacy. The legitimacy framework predicts different disclosure outcomes (O'Donovan, 2002; Lindblom, 1994; Buhr, 1998); and research using the legitimacy framework strongly suggests that environmental disclosures are used as an impression management tool to portray a positive image of the firm's environmental operations.

The findings of these research studies create more questions than answers due to the different methodologies used and the lack of consistent definition of what constitutes environmental disclosure (Deegan, 2002). There have been calls for examining the disclosure determinants and value relevance of the different components of environmental disclosure (Berthelot et al., 2003). Although environmental disclosure is an aggregation of separate but interrelated themes, prior disclosure models mostly examine the impact of legitimacy and economic factors on aggregate disclosure measures – i.e. disclosure indices (see Neu et al. 1998; Cormier & Magnan, 1999; Cormier & Magnan, 2003). These models suggests that all types of information are either derived by legitimacy or economic incentives. For better assessment of firms' disclosures, there is a need to dissect these disclosures into its different constituents and to understand why firms disclose different types of environmental performance information.

This dissertation includes three research studies with an objective of (1) better defining environmental disclosure, (2) understanding why firms disclose environmental information, and (3) examining whether the information disclosed is indicative of the firm's environmental performance. To achieve this objective I conduct three distinct but interrelated research studies examining corporate environmental disclosure over time. In the first essay, I review prior studies that examine the determinants and value relevance of the different types of environmental

disclosure (i.e. environmental expenditures, liabilities and litigations, performance indicators, etc...). The purpose of this essay is to provide an environmental disclosure framework composed of the different types of information. The second essay examines the determinants of environmental disclosures and whether these disclosures are biased The purpose of this essay is to understand the extent to which legitimacy and economic factors affect the disclosure of environmental information. It also tests the interaction between these factors and the firm's environmental performance. The third study examines the determinants for firms to disclose environmental performance indicators (EPIs) voluntarily. The purpose of this study is to understand whether firms disclose their EPIs to inform different stakeholders about their environmental performance or use EPIs as an impression management tool.

The findings of this dissertation complement but also contradict the extant previously studies. On one hand, it reconciles both views that environmental disclosures could be motivated by economic and legitimacy factors at the same time. However, it refutes the notion that these disclosures are totally informative or totally illusive. There is strong evidence, throughout the three essays, that the economic forces explain the supply and demand for some types of environmental information – for example, the disclosure of environmental liabilities (see Li et al, 2007) - and it would be difficult to explain how firms would use this type of disclosure to manage impressions in the presence of the existing accounting regulations. Furthermore, the findings of the second study show that in the presence of disclosure regulation and SEC enforcement actions, firms' environmental disclosures become less biased.

On the other hand, the first essay shows that there is still a need for more research to explain the determinants of some types of environmental disclosures - such as environmental governance and management systems or vision and strategy information. The second essay

provides evidence that these types of environmental disclosure have been increasing over time; however, there is a lack of evidence on whether firms disclose this information in response to market demand or as a reaction to societal threats to the operations' legitimacy.

In brief, there is indication that, over time, firms have increased their disclosure by revealing more information about the environmental management systems, performance indicators, and environmental vision and strategy beside the mandated economic disclosures. The dissertation provides evidence that these new types of disclosures could be considered as a faithful representation of the firm's environmental performance. Although there is still evidence that firms may use environmental disclosures as an impression management tool, the author still believes that the discretion available to firms to do so has been reduced by tightening of disclosure regulation, demand for information from the financial market, and provision of voluntary reporting guidelines such as the Global Reporting Initiative (GRI).

Finally, this dissertation does not examine the consequences of environmental disclosure – i.e. the third research question in the environmental disclosure literature. At this stage, there is a need to first understand how to define and measure environmental disclosures before studying the relevance of these measures. Needless to say that disclosures need to pass the reliability test – i.e. information disclosed provides reliable measures of the firm's environmental performance – before undergoing the relevance test. In the meantime, the first essay providing a review of the different environmental disclosure measures still shows that the different disclosure measures included in this dissertation have either economic or social implications.

1. First Essay

The first essay is a review of previous literature in the area of corporate environmental disclosure. The objective of this essay is to provide a structure or a framework of environmental disclosure. There is no clear definition of what constitutes environmental disclosure as there is a lack of normative research in this area; this sentiment has been echoed by Berthelot et al. (2003) and Deegan (2002). Therefore, the objective of this study is to provide a classification of previously researched disclosure themes that could guide future research in environmental disclosure.

Environmental disclosure is composed of separate but interrelated themes or subjects. The relevance of these themes to the user of environmental information differs according to the information content of each subject and the interests of the user. Therefore, to define environmental disclosure there is a need to assess each subject matter separately to understand the importance and the relevance of each theme to different stakeholders, to know the stakeholder's interests in this information, and to understand the reliability of the reported information (Berthelot et al., 2003).

Furthermore, environmental reporting should include all relevant topics related to the firm's environmental performance and should satisfy the information needs of all stakeholders and not only investors. Therefore, there is also a need to assess firms' total environmental disclosures to understand whether firms are biased towards the requirements of certain stakeholders; which could lead to an unbalanced disclosure by focusing on certain subject matters rather than others.

In this study, I separately review different disclosure themes to answer questions about the interested parties in each subject matter, the relevance of the information disclosed and the

ability and willingness of the firm to disclose reliable information that portrays an objective picture of the firm's environmental performance. Furthermore, I review four properties of environmental disclosure that would enable users of this information to assess the completeness, the specificity, the relevance and the objectivity of firms' reporting practices. Completeness is related to the amount of information that the firm is willing to voluntarily report above and beyond what is required by the regulators. Specificity of environmental disclosures is associated with the firm's ability to provide information in a form that could impact the audience decision making; such as making quantitative rather than narrative disclosures. Environmental disclosures are relevant when they provide the users with information about the firm's future plans and expected performance beside information about its past performance. Finally, objectivity of disclosures is related to the firm's willingness to disclose negative information related to its performance and not only positive information.

2. Second Essay

The second essay includes two empirical studies of the reliability of environmental disclosures. The first one is a longitudinal quantitative study of the relationship between environmental disclosure and environmental performance. Previous research lands some controversial results when examining the relationship between the two variables. Some studies suggest that poor performers tend to disclose more environmental information that paints a misleading picture in order to maintain the legitimacy of their operations (Hughes et al., 2001; Patten, 2002; Rockness, 1985). Other studies find that environmental disclosure is associated with firms characterized by superior environmental performance (Al-Tuwaijri et al., 2004; Clarkson et al., 2008). Such firms have a real economic incentive to disclose such information.

I reexamine this research question using a longitudinal panel data analysis of 78 firms in environmentally sensitive industries. The main objective of this study is to determine whether the disclosure determinants are different between of high and low performers. I examine whether disclosures of the two groups are driven by economic incentives, legitimacy incentives or both. In addition, I study the association between environmental disclosure and environmental performance using a more comprehensive content index that measures the properties of the information disclosed, not just the amount of information disclosed. This content index measures the firm's willingness to disclose specific, objective and verifiable information.

Finally, among the contributions of this study, I measure environmental disclosures of firms in three different disclosure media (annual reports, 10-K reports, and sustainability reports) and find that disclosures made in these reports complement each other which contradicts previous arguments that annual report' disclosures are the main source of environmental information.

3. Third Essay

In the third study, I examine one of the main themes of voluntary environmental reporting; that is the disclosure of environmental performance indicators (EPI). EPI are meant to provide the users of environmental information with an objective picture of the firm's environmental performance. This information is relevant to different stakeholders of the firm. From an investor point of view, Ittner & Larcker (1998) show that non-financial measures are indicative of the firm's accounting and market returns. Regulators may also use this information to assess whether more stringent regulations should be imposed (Government Accounting Office (GAO), 2004). However, previous research by Clarkson et al. (2008) shows that the level of EPI

disclosure is still very low. In this study, I examine the determinants of EPI disclosure to understand the factors driving firms to disclose this essential information. Prior research shows that firms' disclosures are motivated by economic costs and benefits, as well as firms' need to legitimize their actions and to show that their performance does meet society's expectations (Cormier & Magnan, 1999; Cormier & Magnan, 2003; Neu et al., 1998). Studies also show that firms avoid the disclosure of negative environmental information (Rockness et al., 1986; Deegan & Rankin, 1996). Therefore, I examine whether the information content included in EPI disclosures is a disclosure determinant. In other words, I study whether firms disclose their EPI when the information content provides positive news to the relevant users. Although researchers could study the information content of disclosing firms, they could not assess those who did not disclose. Using the Trucost database of environmental disclosure and performance, I study the determinants of EPI disclosure. The Trucost database provides the opportunity to examine the information content of disclosing and non-disclosing firms. Trucost gathers EPI information from annual and sustainability reports and provides the external cost of pollution for firms listed on the FTSE index. In case of non-disclosure, Trucost contacts the firm to request EPI information or estimates this information using an econometric model. Therefore, using the information provided by Trucost, I am also able to examine the determinants of disclosure of firms who do not publicly divulge their EPI information.

Chapter 2 - Literature Review

1. Introduction

The economic competitiveness of businesses is bounded by its corporate social and environmental responsibilities. Over the last three decades, environmental responsibility has gained special importance (Deegan, 2002; Gamble et al., 1995; Gray et al., 1995; Parker, 2005) due to pressures on businesses to operate in a responsible manner that contributes to the preservation of the environment[1]. This increased awareness about environmental problems has placed firms under the public eye and require them to spend considerable amounts to meet environmental standards (Clarkson et al., 2004; Johnston, 2005); thus imposing a strain on their cash flows. On the revenue side, the growing trends of environmentally conscious consumers mean that businesses may also risk losing sales if they do not adopt a "green" production strategy (Ambec & Lanoie, 2008).

The increased demand for more environmental responsibility raises the importance of environmental disclosures. The last three decades witnessed significant developments in environmental reporting including increased disclosure regulation, the issuance of standalone environmental reports, and the emergence of reporting guidelines; which led to a large increase in disclosure of environmental information. With the large amount of discretion allowed to firms over the disclosure of environmental information, researchers attempt to understand the motivation of firms to disclose as well as the reliability and relevance of the information

[1] For example, the adoption of the Kyoto protocol in 1997 implies that firms have to reduce their greenhouse emissions by 5% of their 1990 levels over the period 2008-2012.

disclosed. However, it seems that environmental disclosure research brings up more questions than answers and some of the studies land contradicting results about the motivation of firms to disclose environmental information. For example, research on the reliability of environmental disclosure creates a debate about whether low or high environmental performers disclose more information (see Al-Tuwaijri et al., 2004; Fekrat et al., 1996; Hughes et al., 2000; Hughes et al., 2001; Patten, 2002; Cho & Patten, 2007). There are many reasons for the inconsistent results; including a lack of consistent measurement of environmental disclosure in these studies.

It is well documented that previous research studies use different measures to proxy for environmental disclosure, thus potentially contributing to conflicting research findings[2]. Substantial differences and a lack of consensus about the elements of environmental reporting are also apparent among the content indexes[3]. These differences raise questions about the validity of environmental disclosure measures and the strength of the reported findings. Research on environmental disclosure remains as good as its weakest link; meaning that weak proxies for environmental disclosure may lead to doubtful findings. Therefore, there is a need for convergence towards generally accepted measures of environmental reporting to find more robust and comparable answers for the different research questions in that domain.

---

[2] Some studies use volumetric measures – such as number of words, lines, or pages – to proxy for environmental reporting (Gray et al., 1995; Neu et al., 1998; Patten, 1992), while other studies use content indexes as a measure of disclosure (Al-Tuwaijri et al., 2004; Clarkson et al., 2008; Wiseman, 1982)

[3] For example, (Clarkson et al., 2008) use a comprehensive content index based on the GRI guidelines that includes 45 disclosure themes. In contrast, (Al-Tuwaijri et al., 2004) use a four-theme content index that measures negative disclosures that the firm is operating to the detriment of the environment such as disclosures on PRP designation, toxic waste, oil and chemical spills, environmental fines and penalties.

The major challenge facing environmental accounting research is to define and measure environmental disclosure (Clarkson, 1995; Deegan, 2002). According to Deegan (2002, p.288):

> *"When describing what is disclosed, there has been much debate about how to measure and classify social environmental disclosure."*

In fact, there is an ongoing debate about the difference between "environmental accounting" and "accounting for the environment" (see Thornton, 2013; Deegan, 2013; Cho & Patten, 2013; Gray, 2013; Spence et al., 2013). The former is a process that is still undefined – according to Deegan (2013) – where firms are held accountable to different members of the society for environmental damages caused by their operations. On the other hand, accounting for the environment is a practice engrained in financial accounting whereas firms are held accountable to their shareholders for any misdeeds - including noncompliance with environmental standards – that could affect the firm's cash flow. The difference between the two practices explains the difficulty of defining environmental disclosures. While "accounting for the environment" necessitates firms to disclose a set of information required by the regulator, the rules of "environmental accounting" are still unwritten; making its disclosure requirements unclear. Therefore, I adopt a broad definition of environmental disclosures that includes all sets of relevant information that fulfils the demand of different stakeholders (i.e. investors, environmentalist groups, members of the society, regulators, etc).

The objective of this study is twofold: (1) to define and measure the various types of disclosures that constitute firms' environmental reporting and (2) to study the reliability and relevance of these disclosures. By achieving these objectives, the study would provide a tentative framework of environmental disclosures to consolidate the different types of environmental

information – or environmental themes – used by firms to communicate with investors and different members of the society.

To acieve these objectives, I primarily focus on conducting a review of prior research on corporate social and environmental responsibility in traditional accounting journals; which have been the main channel for environmental disclosure research. The purpose of this study is not to provide an exhaustive review of environmental disclosure research; but rather a focused review of prior research that examine the different constituents – or themes – of corporate environmental disclosure. Research in traditional accounting journals focuses on examining the determinants and the value relevance of certain environmental disclosures; primarily in the context of firm valuation. The list of such journals include *Accounting, Organizations and Society, Contemporary Accounting Research, Journal of Accounting and Public Policy, Journal of Accounting Research, Journal of Accounting & Economics, Accounting, Auditing & Accountability Journal, The Accounting Review, Journal of Accounting, Auditing & Finance,* and *Accounting and Business Research.* These journals have published a significant amount of research on the role of environmental disclosures in establishing corporate accountability (see Deegan, 2002; Berthelot et al., 2003).

I complement my review with other research examining the broader impact of corporate operations on the environment. This type of research focuses on information that is of interest to non-financial stakeholders of the firm such as firms' environmental goals, vision, and governance and management systems. The list of such journals include *Journal of Business Ethics, Ecological Economics, Business Strategy & the Environment, The Academy of Management Review, Advances in Environmental Accounting & Management , Corporate Social*

- *Responsibility and Environmental Management, Environmental and Resource Economics,* and *Management Science.*

In this study, I review prior literature with a focus on measurement issues and the objective of defining environmental disclosure. Environmental information is composed of different but interrelated themes[4]. To develop proxies for environmental disclosures, researchers either aggregate these themes in content indices or they use volumetric measures such as number of words, lines, or pages. This comprehensive and volumetric approach of assessing environmental disclosure is not indicative of the importance of the information disclosed since it does not guarantee that relevant information is disclosed nor insure that all disclosures made are relevant. Therefore, there is a need to assess the information disclosed by examining its constituents separately as well as comprehensively (Berthelot et al., 2003).

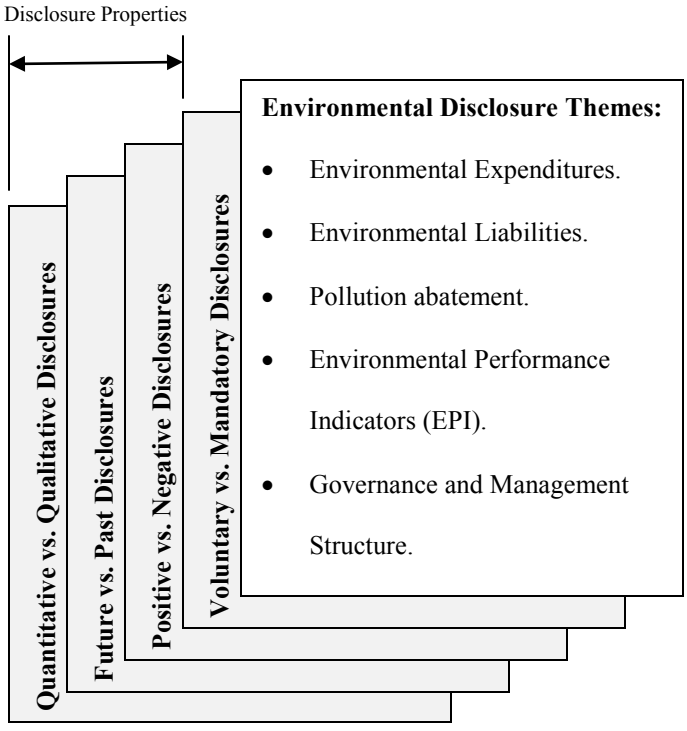
In this study, I review research on different disclosure themes and different properties of environmental reporting. Environmental disclosure is composed of many themes (such as the disclosure of environmental liabilities, capital expenditures, performance indicators, etc…) that have different properties that would later define the importance of the information disclosed. Through the review of prior literature, I find that four different properties define environmental information: the disclosure of future vs. past, positive vs. negative, quantitative vs. qualitative, and mandatory vs. voluntary disclosures. For a better assessment of the comprehensiveness of firms' environmental reporting, I suggest that future research should evaluate if disclosures include the different themes and satisfy the different properties. Recent research studies integrate some of these properties in their assessment of environmental disclosure; primarily the disclosure

[4] Economic factors, key performance indicators, environmental management system and others are among these themes.

of quantitative information (Aerts & Cormier, 2009; Cho & Patten, 2007; Walden & Stagliano, 2004).

Figure 1 shows the different themes and properties that define corporate environmental reporting. Environmental disclosure is a multi-dimensional construct having four different properties. The themes disclosed by the firm will define the properties of the information disclosed. For example, if a firm provides information about their past expenditures and liabilities, then the firm is oriented towards the disclosure of mandatory, quantitative, and past information. Further disclosure of a forecast of their future expenditures will make the firm expand their disclosure range to include forward looking information. An explanation of how these expenditures are allocated means that the firm is providing a qualitative aspect to help the relevant parties assess how these expenditures will improve the firm's environmental performance.

Figure 1: Themes and Properties of Environmental Disclosure



Expected contributions

Berthelot et al. (2003) review the reliability and relevance of environmental disclosures classified as mandatory or voluntary. Berthelot et al. (2013) reckon that environmental disclosures have been measured in a comprehensive manner. They suggest that separate examination of each disclosure item will provide better assessment of the reliability and the relevance of each item. In this review, I extend the work of Berthelot et al. (2003) by examining the reliability and relevance of each element of environmental disclosure separately. The study provides a review of prior research of five disclosure themes: environmental expenditures, litigation and liabilities, pollution abatement, environmental performance indicators, and governance structure and management system. Furthermore, the study introduces three additional dimensions that could be used to assess firms' environmental reporting: future vs. past, positive vs. negative, and quantitative vs. qualitative disclosures. This review essay suggests that some environmental disclosure themes are relevant to the financial and non-financial stakeholders of the firms (such as disclosures of capital expenditures, litigation and liabilities, pollution abatement, environmental performance indicators, and governance and management of environmental operations). These relevant themes could provide a disclosure framework that could be used in future research in environmental disclosures in a comprehensive manner.

Furthermore, a theoretical debate exists among researchers as to what is the motivation of firms to disclose their proprietary environmental information. One string of research advocates that firms use their environmental disclosures to legitimize their actions and gain wide acceptance for their environmental operations (see Patten, 2002; Cho & Patten, 2007; Deegan, 2002; O'Donovan, 2002). This line of research suggests that environmental disclosures are self-laudatory and serve to portray a positive image of the firm's environmental operations. The other

string of research argues that environmental disclosures are valuation relevant and that firms' disclosure decision is driven by the market's demand for information (see Li et al., 2007; Cormier & Magnan, 1999; Cormier & Magnan, 2003). To a great extent, the outcome of that debate determines whether firms' disclosures are informative or opportunistic. By reviewing the disclosure determinants of the different environmental themes, this study contributes to that debate about which theory better explains the determinants of environmental information.

The findings of this review provide regulators with feedback about firms' environmental reporting practices in response to existing regulations. The findings of this paper suggest that disclosure regulation plays a positive role as evidenced by the continuous increase of the amount and quality of environmental reporting over time. Furthermore, there is also evidence that mandating the disclosure of different information about the firm's environmental information may lead firms to change their behavior towards their environmental responsibilities. This research could also be useful to practitioners such as organizations that issue disclosure guidelines – i.e. the Global Reporting Initiative (GRI) – to prepare a reporting framework of environmental disclosure based on a scientific approach.

Furthermore, this review study provides researchers with a guideline to the measures and properties of environmental disclosures that need to be considered when assessing firms' environmental reporting. Converging towards a generally accepted framework of disclosure and eliminating differences of construct measurements ensures more consistent and comparable research findings.

2. Conceptual Framework

Environmental reporting research suggests that disclosures have been motivated by institutional factors, financial market demand for information, and firms need to legitimize their action to conform to society's expectations. There is an ensuing debate among researchers as to how these factors influence firms' reporting practices and the quality of the information reported.

Evidence exists that internal and external institutional factors influence firms' environmental reporting practices. Many studies show that disclosure regulations by the SEC and FASB induces firms to disclose more information over the years to the extent that - in certain cases - firms may disclose information that is deemed irrelevant to ensure compliance (Barth et al., 1997; Stanny, 1998; Alciatore et al., 2004). In the absence of disclosure regulation and with the increased uncertainty about what to disclose, there is also evidence that firms follow industry common practices and reporting guideline (Aerts et al., 2006).

Economic costs and benefits of disclosure are also a determining factor of firms' disclosure decisions. In the absence of information, investors will involve in costly information gathering, which leads firms to reveal their private information to avoid adverse market reaction (Diamond, 1985). Verrecchia (1983) argues that firms' disclosures of their proprietary information threaten their competitive positions. Environmental disclosure research provides evidence that those two opposing factors impact firms' reporting practices by setting a disclosure threshold that will maximize the benefits and reduce the costs of disclosure (Li et al., 1997; Cormier & Magnan, 1999; Cormier & Magnan, 2003).

A third string of researchers advocate that firms' environmental disclosures are motivated by their needs to legitimize their operations. The argument is that, to gain legitimacy, firms are under pressure to comply with societal norms and expectations. Firms with low-environmental

performance are risking their legitimacy which may expose them to increased scrutiny from regulators and other relevant parties. Hence, these firms may use disclosure tactics to ensure they maintain the legitimacy of their operations. However, it is not evident how attempts to maintain legitimacy would impact firms' environmental disclosures as there are many courses of action that firms may adopt (Lindblom, 1994; O'Donovan, 2002). Some studies cast the doubt over the effectiveness of environmental reporting by claiming that environmental disclosures are self-laudatory and that there is a decoupling between firms' environmental performance and the information contained in their environmental reports (Patten 2002, Cho & Patten, 2007; Cho et al., 2012). On the contrary, Mobus (2005) provides evidence that mandatory disclosure of environmental information obliges firms to improve their environmental performance to avoid the continuous disclosure of negative news; concluding that disclosure may lead to a change in behavior.

How these three factors interact and shape firms' environmental disclosures is still unknown. In this study, I attempt to review research about the different types of information (i.e. disclosure of environmental expenditures, liabilities, performance indicators, etc) to understand the disclosure determinants of each of these types. I also review the reliability and relevance of these different types of disclosures. In an attempt to find whether disclosure is indicative of the firm's real performance or not, previous studies have defined the reliability of environmental disclosures using the association between the disclosures and firms' actual environmental performance (Berthelot et al., 2003). Concerning the relevance of the information disclosed, I provide a review of research examining the association between the information disclosed and the response of the financial market to these disclosures. This association is indicative that the different types of environmental disclosure carry relevant information that prompts the market to

revise its expectations about the firm's future financial performance. In addition, I attempt to understand whether environmental disclosures are also relevant to non-financial stakeholders of who are mainly interested in firms' future environmental performance (i.e. regulators, environmentalists, and other members of the society). For this purpose, there are few studies that examine the association between the information disclosed and the firm's future environmental performance (see Mobus, 2005).

In Section 3, I review the different themes and dimensions of environmental disclosure. In Section 4, I review the different properties of environmental disclosure. Section 5 provides a discussion of research findings and recommendations for future research.

3. Environmental Disclosure Themes

Environmental accounting research uses different measures to proxy for environmental disclosure. The ambiguity of defining environmental disclosure stems from the elusiveness of the firm's environmental responsibility which is defined by legal and ethical mandates to preserve the environment. Clarkson (1995) suggests that ethical responsibilities are hard to define – let alone enforce - which makes it difficult to determine which environmental information should be disclosed.

In the absence of a disclosure framework, the majority of environmental disclosure studies measure disclosure using the number of words, lines, or pages of environmental information (Gray et al., 1995; Neu et al., 1998; Patten, 1991; Patten, 1992) or using disclosure indexes (Aerts, Cormier, & Magnan, 2008; Clarkson et al., 2008; Guthrie & Parker, 1989; Ingram & Frazier, 1980; Patten, 2002; Wiseman, 1982) to proxy for total environmental disclosure. Other studies (see Belkaoui, 1976; Li et al., 1997; Rockness et al., 1986) focus on

specific measures they deem relevant to the operation of the firm to proxy for environmental disclosure. The results of these studies are difficult to compare due to the underlying differences between the constructs used.

3.1. Disclosure Themes

According to Berthelot et al. (2003), content indexes provide a compilation of various disclosure themes with different value relevance. Prior research shows that some of these themes are relevant to the investor (Belkaoui, 1976); however, aggregated disclosure measures do not provide enough evidence that environmental disclosure as a whole is relevant (Al-Tuwaijri et al., 2004). In this section, I review studies about how these themes are measured and reported, the decision to disclose this information, the reliability of these disclosures and the relevance of these themes to different users of environmental information. The main themes I review are the disclosure of environmental expenditures, environmental liabilities, pollution abatement, environmental performance indicators, and governance and environmental management.

3.2. Environmental Expenditures

Measurement and reporting

The disclosure of environmental expenditures is regulated by the SEC. Item 101 and SAB 92 requires firms to disclose past and future environmental expenditures in 10-K reports (Gamble et al., 1995; Alciatore at al., 2004). This theme is included in many content indexes[5]

[5] See Aerts & Cormier, 2009; Aerts et al., 2008; Azzone, Manzini, & Noci, 1996; Blacconiere & Patten, 1994; Cho, Patten, & Roberts, 2006; Cho & Patten, 2007; P. Clarkson et al., 2008; Fekrat et al., 1996; Freedman & Wasley, 1990; S. B. Hughes et al., 2000; S. B. Hughes et al., 2001; Patten, 1992; Patten, 2002)

which are inspired by the Wiseman (1982) index. In their research studies, Gamble et al. (1995), Ingram (1978), Ingram & Frazier (1980) and Rockness et al. (1986) also use environmental capital expenditure to measure the cost of compliance to environmental regulation.

In regards to research on the disclosure of environmental capital expenditures, there are two measurement issues that need to be taken into consideration. First, some disclosure indexes do not differentiate between the disclosure of past and future expenditures (Clarkson et al., 2008; Azzone et al., 1996; Ingram & Frazier, 1980). In general, a separation between the two types of disclosures should be accounted for due to the difference in value relevance and the reliability in measuring past versus forecasted investments. Second, there are questions over the quality of investments made and whether firms spend to comply with regulations or to over-comply. In a study about the value relevance of environmental expenditures, Johnston (2005) separates between mandatory spending (expenditures that enable the firm to comply with environmental regulations) and voluntary spending (expenditures that ensure the firm is improving its environmental performance beyond the regulatory requirements). Table-1 provides a summary of the different measures of environmental expenditures.

Decision to disclose environmental expenditures

Regulation by the SEC and FASB has a major influence on disclosure of environmental expenditures information over the years. Alciatore et al. (2004) study the impact of increased regulation on the reporting of environmental information. They examine the disclosures of 34 firms between 1989 and 1998; a period where the SEC and FASB issued several regulations that

affect firms' environmental reporting[6]. They find a substantial increase in the number of firms reporting their past and future capital expenditures in their 10K-reports (from 10 firms in 1989 to 18 firms in 1998). Most importantly, the average capital expenditures disclosed declined from 101 million dollars in 1989 to 7 million dollars in 1998. The increase in number of reporting firms and the decline in the average reported capital expenditure may suggest that the introduction of new regulation has pressed firms with lower levels of environmental capital expenditures to disclose their private information. Similar results are found with the disclosure of future capital expenditure.

In contrast, the study finds a decline in the number of firms reporting environmental operational expenditures (from 7 firms in 1989 to 3 firms in 1998). This decline in the number of firms coincides with an increase in the average reported amount (195 million dollars in 1998 to 267 million dollars) implying that only firms with higher expenses continued reporting following the issuance of environmental regulation. The latter findings raise questions of whether firms refrain from disclosing operational expenditures information in response to their increased disclosure of capital expenditure; taking into consideration that SAB 92 does not clearly mandate the disclosure of environmental operational expenditures.

Another study by Cho et al. (2012) examines the determinants of disclosing environmental capital expenditures in 10-K reports. Using a sample of Fortune 500 firms, the authors examine whether the discrepancy between firms' disclosures is due to the immateriality of capital expenditures made by firms or due to firms non-compliance with disclosure

---

[6] The SEC issued the SAB 92 in 1993 providing guidelines to firms on reporting environmental capital expenditures in the MD&A sections of their 10K –reports.

regulations. They find that the amounts disclosed are mostly immaterial leading the authors to suggest that disclosure of capital expenditures information is not motivated by the need for regulatory compliance but rather a discretionary decision made by firms' management.

The authors further study the association between the information disclosed and future environmental performance to understand the firms' motivation to disclose environmental capital information. They suggest that a positive association between disclosure and future performance implies that the disclosure is used to signal the firm's strategy to deal with pollution issues and improve its environmental performance. On the other hand, a negative or no association between disclosure and future performance may imply that firms disclose information to mitigate the pressure emanating from environmentalists, members of the society or regulatory bodies. The authors find that disclosure of environmental capital expenditure information is not associated with future improvement in firm's environmental performance; concluding that firms disclose this information to legitimize their current operation rather than to signal a change in their views towards the environment.

Reliability and Value Relevance

The study by Cho et al. (2012) suggests a bias in disclosing environmental capital expenditures information as they find a discrepancy between the disclosure decisions of firms with high and low environmental performance. The study shows that the decision to disclose is associated with lower environmental performance. Along with their findings that disclosure is not associated with an improvement in future performance, the authors conclude that the disclosure of environmental capital expenditure is meant to legitimize firm's environmental operations and to project an image that the low-performing firms are complying with environmental regulations.

Another study by Patten (2005) examines the reliability of environmental capital expenditure projections. He compares the projected and actual environmental capital expenditures disclosed by firms in 10-K reports. He finds that the actual expenditures are - on average - lower than the projected figures by 16.4%. Furthermore, the author finds that this lack of precision in estimating future environmental capital expenditures does not match the accuracy in projecting firms' overall capital expenditures. After further examination, Patten (2005) could not conclude that this lack of forecast precision is due to a reduction in environmental capital expenditures resulting from a decline in the firm's financial performance. Patten (2005) suggests that these overly optimistic forecasts are a tool of legitimization to portray the firm's environmental operations in a positive light.

Regarding the relevance of environmental capital expenditures, prior research confirms that past capital expenditures information is value relevant. Using an event study, (Belkaoui, 1976) shows that the market reacts favorably to disclosure of environmental capital expenditures in annual reports of an S&P 500 sample of firms - vs. a control sample - for the first two-days following the disclosure. Using the market efficiency hypothesis, the author explains that such information would favorably affect the investor's perceptions about the expected risk of the company as well as the discount factor applied.

Clarkson et al. (2004) study the valuation of environmental capital expenditures made by firms in the pulp and paper industry to improve their pollution abatement performance. Examining disclosures in 10-K reports, they find that investors view the expenditures made by low-polluting firms in a different light from those made by high-polluting firms. Expenditures in the pulp and paper industry are guided by the Best Available Technology (BAT); implying that low-polluting firms influence regulatory requirements; consequently they influence the

expenditures made by the high-polluting firms. Clarkson et al. (2004) find that investors positively value investments disclosed by low-polluting firms while they assign a value of zero to investments of high-polluting firms. In addition, investors assess a considerable liability associated with the low-environmental performance of these firms.

Using 10-K disclosures, Johnston (2005) provides a model that separates environmental capital expenditures into mandatory investments - to make firms meet regulatory requirements - and voluntary investments - to allow firms to achieve performance levels beyond the regulatory thresholds. Using future stock prices and returns, Johnston (2005) finds that mandatory investments are negatively associated with the firm's future financial performance implying that investors view these investments as liabilities rather than capital investments. In contrary to his prediction, Johnston (2005) could not establish an association between voluntary investments and future stock returns or stock prices. The findings of Johnston (2005) imply that investors value mandatory and voluntary environmental expenditures differently. While they value the mandatory investments negatively, the results imply that investors are still not able to assess the impact of voluntary environmental expenditures.

Summary

Prior research suggests that firms comply with SEC and FASB requirements regarding the disclosure of past expenditures as evidenced by the increased number of firms disclosing this information over the years (Alciatore et al., 2004). There is also evidence that investors value the information content in environmental capital expenditure disclosures and are able to differentiate between expenditures made by the high and low performing firms (Clarkson et al., 2004). However, prior research also suggests that investors are not able to value voluntary investments made to improve firms' environmental performance beyond what is required by the regulator

(Johnston, 2005). This might be explained by the lack of evidence that spending would lead to improved future environmental performance (Cho et al., 2012). In brief, it appears that the majority of capital spending is made for the purpose of compliance with existing regulations and that firms do not have precise long-term plans to improve their future environmental performance beyond what is required by the regulator. These findings are also reflected in the low-accuracy of environmental capital expenditure forecasts (Patten, 2005). A summary of main findings is presented in Figure-2.

Figure-2: Summary of Research on Environmental Expenditures Disclosures:

Measurement and reporting:

- The SEC requires firms to disclose past and future expenditures in 10-K reports.
- Some past environmental disclosure research does not differentiate between past and future disclosure as two distinct disclosure themes.
- Furthermore, a study by Johnston (2005) shows that there is a difference in value relevance between mandatory environmental capital expenditures – expenditures made to ensure compliance with environmental regulations - and voluntary capital expenditures made to improve firm's environmental capital expenditures beyond regulatory requirements.

Decision to disclose:

- Increased disclosure regulation is positively associated with increased reporting of environmental expenditures over the years. Alciatore et al. (2014) find that during a period of increased disclosure regulation between 1989 and 1998, the number of firms disclosing their past and future capital expenditures increased as well. Furthermore, they find a decline in the average amounts of capital expenditures reported, indicating that firms with less material information disclosed their expenditures in response to increased regulations.
- Using a sample of Fortune 500 firms, Cho et al. (2012) find that the amount of environmental capital expenditures are mainly immaterial and are not associated with improved future environmental performance. These findings lead Cho et al. (2012) to conclude that the disclosure of such information is derived by firms' need to legitimize their environmental operations by providing positive impressions about their environmental investments.

Reliability of disclosures:

- The study by Cho et al. (2012) also suggests a bias in reporting environmental capital expenditures as they find that firms with low-environmental performance are more inclined to disclose this type of information. The authors consider this finding as further evidence about firms' legitimization incentives.
- Patten (2005) finds a large discrepancy between forecasted environmental capital expenditures and the actual expenditures made later on. He also suggests that that firms use these forecasts as a legitimization rather than an accountability tool.

Relevance of disclosures:

- Albeit the reliability issues previously discussed, there is evidence that investors could distinguish the value of environmental investments made by firms.
- Clarkson et al. (2004) find that investors value environmental expenditures of firms with high-environmental performance but not those made by firms with low-performance.
- Johnston (2005) finds that investors negatively value mandatory investments made by firms to comply with environmental regulations. On the other hand, he could not find an association between voluntary investments and stock returns implying that investors could not assess the contributions of these investments.

Table-1: Overview of Environmental Expenditure Research

Authors	Topic	Measure of Environmental Expenditure	Findings
Belkaoui (1976)	Examines the impact of disclosure of pollution control expenditures on firms' stock market performance.	The disclosure of pollution control expenditures in annual reports.	The author finds that the market reacts positively to the disclosure of pollution control expenditures. The market reaction lasts for a short period of time following the disclosure.
Clarkson et al. (2004)	Examines the value relevance of pollution abatement capital expenditures in the pulp and paper industry.	The dollar value of environmental capital expenditure disclosed in 10-K reports.	The authors find that the market values the environmental capital expenditures of firms with high environmental performance and books a liability for firms with low environmental performance.
Alciatore et al. (2004)	Examine the change in environmental disclosure in response to increased environmental reporting regulation.	The authors examine the amount of: 1. Past environmental capital expenditure. 2. Future environmental capital expenditure. 3. Environmental operating expenditure.	The authors find an increase in the number of firms disclosing environmental capital expenditures and forecasted expenditures in response to increased regulation.
Johnston (2005)	Provides a model to decompose environmental capital expenditures in mandatory and voluntary expenditures and examines the value relevance of both types of expenditures.	The author decomposes the environmental capital expenditures disclosed in 10-K reports using a regression model over the elements of the firm's environmental performance. Mandatory environmental capital expenditures are estimated using the model while voluntary expenditures are represented using the residuals from the model.	The author finds that the market value mandatory and voluntary environmental expenditures differently. They find that expenditures are negatively associated with abnormal return but did not find any significant association between abnormal returns and voluntary expenditures.
Patten (2005)	Studies the accuracy of environmental capital expenditures projections.	The author examines the differences between the projected amounts of environmental capital expenditures and the subsequent actual amounts disclosed in 10-K reports.	The study finds that actual spending is lower than the projected spending; suggesting that environmental reporting of environmental capital expenditures is misleading.
Cho et al. (2012)	Examines the determinants of disclosure of environmental capital expenditures.	The dollar value of environmental capital expenditure disclosed in 10-K reports.	The authors find that the disclosure of environmental capital expenditure is not associated with the materiality of the amount. They also find that the disclosure is not associated with improved future performance; concluding that firms disclose information to legitimize their actions.

3.3. Litigation and liabilities

Measurement and reporting

The disclosure of environmental liabilities is regulated by both the FASB and SEC. According to Gamble et al. (1995), the recognition of environmental liabilities is guided by FASB Statement No.5 – Accounting for Contingencies – which requires firms to record a liability if it is "probable" to occur and could be "reasonably estimated". Regulatory bodies' intervention provides a strong signal of the probability of occurrence which justifies the need for reporting (see Barth and McNichols, 1994; GAO report, 2004). Notification by the Environmental Protection Agency (EPA) that the firm is nominated as potentially responsible party (PRP) is an example of such intervention. Meanwhile, the estimation test is more difficult to satisfy. SFAS 5 requires firms to disclose the "best" estimate of their liabilities. SFAS requires that, when the probability of occurrence of all estimates within a certain range is the same, the firm should disclose the lowest estimate (Barth and McNichols, 1994).

Furthermore, Gamble et al. (1995) state that the FASB Issue No. 93-5 requires firms to recognize environmental liabilities and allows them to record the liabilities on a discounted basis. It also requires firms to report environmental liabilities separately from any probably recovered amounts. The SEC's Item 103 requires the disclosure of potential administrative and legislative proceedings in 10-K reports if these proceedings are material to the business, if they exceed ten percent of current assets, or if they exceed 100,000 dollars. According to Stanny (1998), the SEC Staff Accounting Bulletin No.92 (SAB 92) provides guidelines about the conditions for the firm to discount its environmental liabilities; the firm needs to have a reliable estimate about the total amount of the liability and timing of the cash payments. It also requires that firms do not offset

the probable liability with any probable insurance recovery. The bulletin requires firms to disclose all material liabilities for site restoration as well as any necessary exit cost (Alciatore et al., 2004). Finally, SAB 92 also requires the disclosure of reserved amounts and estimation of probable losses.

According to the GAO Report (2004), stakeholders raised their concerns that these guidelines allow firms a lot of discretion over the disclosure process. Interviewed stakeholders stated that the SEC item 103 does not require the firm to disclose all costs related to the outcome of legislative proceedings; thus allowing firms to avoid disclosure if the fines are less than 100,000 dollars. Furthermore, they claim that the SEC does not require firms to aggregate environmental liabilities which allow them to avoid the materiality test. Table-2 provides a summary of the different measures of environmental liabilities used by prior research.

Decision to disclose environmental litigation and liabilities

Li et al. (1997) develop an environmental liabilities disclosure model suggesting that firms resort to partial disclosure to reach the optimum equilibrium between the benefits and costs of disclosure. Using a sample of Canadian firms on the records of the Ontario Ministry for the Environment and Energy for violating environmental regulations, Li et al. (1997) examine the factors that induce firms to disclose or withhold environmental liabilities information. They find that disclosure of environmental liabilities is positively related to the firm's pollution propensity and outsider's information level about the firm's environmental activities and negatively related to proprietary litigation costs. Their findings imply that the higher the stakeholder's perception that firms are withholding private information, the more firms would disclose to avoid negative market reactions. It also implies that the higher the litigation cost associated with firms' pollution activities, the more firms will withhold private information to mitigate the effect of litigation on

the firm's cash flow. Li et al. (1997) reckon that neither full disclosure nor non-disclosure will provide the necessary equilibrium that optimizes the firm's financial position; therefore, firms have the incentive to adopt a partial disclosure policy to maximize their market value net of any potential political cost.

Barth et al. (1997) study the impact of increased regulation and enforcement by the SEC, insider information, market forces, and threat of litigation on the disclosure of environmental liabilities information generated from their involvement in Superfund sites in annual and 10-K reports. They find that firms meeting the SEC disclosure requirements[7] are more likely to disclose their Superfund sites remediation cost estimates. They also find that the higher the firm's ability to withstand the financial implication of litigation, the higher the level of disclosure of environmental liability information. In addition, they find that the higher the involvement of the firm in a larger number of Superfund sites, in comparison to the industry average, the lower the level of disclosure. This finding suggests that firms avoid the disclosure of negative news to prevent the reaction of the financial market.

Stanny (1998) examines the impact of SEC issuance of "Staff Accounting Bulletin 92" (SAB 92) on the disclosure of environmental liability information and the recognition of reserved amounts for remediation in annual and 10-K reports. Effective of the fiscal year 1993, the SEC required firms to adopt SAB 92 which guides the disclosure and recognition of environmental liabilities and limits management discretion over that process. Stanny (1998) finds an increase in the disclosure of environmental liability information following the issuance of SAB 92. The results also show an increase in the number of firms recognizing reserves for

[7] SEC requires firms to disclose any liability that is higher than 5% of total liabilities.

environmental liabilities following the issuance of SAB 92. The study does not find a significant difference between the levels of reserved amounts recognized before and after the issuance of SAB 92 for firms that used to recognize their environmental liabilities prior to the issuance of the new regulation. However, the study finds that firms with lower levels of reserved amounts started to recognize these liabilities following the adoption of the new regulation.

Alciatore et al. (2004) find similar results in their study examining the recognition and disclosure of environmental liabilities of 34 firms from the petroleum industry between 1989 and 1998; a period including the issuance of SAB 92. They find that the number of firms disclosing their remediation liabilities increased from 4 firms in 1989 to 17 firms in 1998. The average amount of liabilities accrued during this period declined from $381 to $217 million dollars; suggesting that the introduction of SAB 92 might have induced more firms with smaller levels of remediation liabilities to disclose. Concerning the amount of dismantlement liabilities recognized, the study finds that the number of disclosing firms increased from 7 to 35 while the average amount recognized increased from $455 to $475 million dollars. The study confirms the effect of regulation on the disclosure and recognition of environmental liabilities.

Reliability and Value Relevance

Barth & McNichols (1994) examine the ability of firms to estimate environmental liabilities associated with their involvement in Superfund sites. Based on the authors' review of annual and 10-K reports, they find that the recognition and disclosure of information related to environmental liabilities associated with Superfund sites are limited. Using remediation cost estimates contained in the Record of Decision (ROD), they find that firms are able to estimate – and thus recognize – a minimum threshold of environmental liabilities based on the site hazard characteristics as described by the Environmental Protection Agency (EPA).

Using an equity valuation model, Barth & McNichols (1994) find that investors' valuation of Superfund sites' environmental liabilities is higher than the value of the liabilities recognized by the polluting firms. Barth & McNichols (1994) cast doubt about the reliability of information disclosed and the sufficiency of the environmental liabilities recognized by firms in their financial reports. First, they suggest that – despite the high level of uncertainty associated with Superfund sites environmental liabilities - firms still have the ability to estimate and recognize a minimum value of these liabilities based on available public information. Second, their findings also suggest that firms have been less conservative in recognizing and disclosing their environmental liabilities as evidenced by the fact that investors value an un-booked liability using public information of Superfund sites. Finally, the findings of Barth & McNichols (1994) also confirm that investors value environmental liabilities information.

Also examining the reliability of disclosure and recognition of reserved amounts for remediation activities, Stanny (1998) finds that high polluting firms are associated with higher levels of disclosure of environmental liability information and recognition of reserved amounts for remediation activities in annual and 10-K reports. The author finds that there is significant positive association between some measures of disclosure of environmental information and the number of polluting facilities owned by the firm. The results also show that the reserved amounts for remediation activities are positively associated with the number of Superfund sites on which the firm is listed and the number of polluting facilities operated by the firm. The study also highlights the importance of regulation in reducing the discretion of firms with relatively higher levels of environmental performance; where firms with lower amounts of environmental liabilities increased the recognition of these reserves following the issuance of SAB 92. The

findings of Stanny (1998) are in accord with those of Li et al. (1997) who find that disclosure of environmental liabilities is positively related to the firm's pollution propensity.

Regarding the value relevance of environmental liability information, Campbell et al. (2003) find that the disclosure of firm's environmental liabilities reduces the uncertainty in firm's market valuation. Using a sample of chemical-manufacturing firms designated as Potentially Responsible Party (PRP) in Superfund sites, they study whether the disclosure of environmental liabilities reduces site uncertainty and allocation uncertainty[8]. Using Barth & McNichols (1994) valuation model, Campbell et al. (2003) find that both site and allocation uncertainty are negatively associated with firm value implying that investors book a liability to firms involved in Superfund sites to account for site and allocation uncertainties. Campbell et al. (2003) find that disclosing private environmental liabilities' information reduces the allocation uncertainty and, hence, improves the firm's market valuation. They also find that financial statement disclosures detailing the firm's involvement in Superfund sites reduce the value of the liability booked by investors in relation to site uncertainty. In brief, the findings of Campbell et al. (2003) suggest that disclosure of environmental liabilities reduces estimation risk and that in the absence of information about firms' environmental accruals, investors will overvalue the firm's liability to compensate for the uncertainty in determining firm's involvement in Superfund sites.

[8] Site uncertainty is related to the level of ambiguity in determining the total clean-up cost of any PRP site while allocation uncertainty is related to difficulty of determining the portion of the site clean-up allocated to each firm involved in the pollution of these sites.

Summary

Higher levels of reported environmental liabilities would discount firm's value; therefore, there is evidence that firms carefully weigh their decision to disclose their environmental liabilities (Li et al., 2007). It is also evident that in the absence of information, investors would penalize the company by heavily discounting the firm's value to compensate for uncertainties regarding its environmental liabilities (Campbell et al., 2003). Research shows that increased regulation has forced more polluting firms to provide an assessment of their environmental liabilities (Stanny, 1998; Alciatore et al., 2004); whether these assessments are accurate enough is an issue that needs more investigation. Reporting of environmental liabilities is engulfed with uncertainties about the existence of the liability at the first place and then by the amount to be recorded. Research shows that, using their private information, firms are able to measure the minimum threshold of these liabilities but are still reluctant to recognize any liabilities beyond this threshold. Several studies reflect this matter by showing that investors' valuation of firms' environmental liabilities exceeds the amounts recognized by firms (Campbell et al., 2003; Clarkson et al., 2004). A summary of research findings is presented in Figure-3.

Figure-3: Summary of Research on Environmental Liabilities Disclosures:

Measurement and reporting:

- The SEC and FASB require firms to recognize their environmental liabilities if they are probable to occur and could be reasonably estimated. Although regulatory intervention is a strong signal about the probability of occurrence, the uncertainty about the value of their environmental obligations provide firms with the opportunity of not recognizing these liabilities.
- Furthermore, firms are not required to aggregate their environmental liabilities, which allow firms to avoid the recognition or disclosure of their liabilities if they deem the outcome of certain events to be immaterial.

Decision to disclose:

- Li et al. (1997) research the economic costs and benefits of environmental disclosures, they find that firms increase their disclosure of environmental liabilities to avoid negative market reactions in case investors perceive the firm is withholding sensitive information. On the other hand, increased litigation risk due to the firm's environmental performance will derive the firm to avoid the disclosure of such information.
- Barth et al. (2004) find that firms with environmental liabilities equal to 5% of their total liabilities – an SEC disclosure requirement – are more likely to disclose such information. Barth et al. (1997) also find that the level of disclosure is associated with the firm's ability to withstand the negative consequences of revealing such negative information to the market.
- Alciatore et al. (2004) and Stanny (1998) find that increased disclosure regulations induced firms with smaller levels of environmental liabilities to recognize these liabilities following the issuance of SAB 92.

Reliability of disclosures:

- Barth & McNichols (1994) find that firms are able to estimate a minimum threshold of their environmental obligations thorough information provided in the Record of Decision issued by the Environmental Protection Association (EPA); however, they still find that the recognition and disclosure of such information in 10-K reports is still limited. They also find that investors assessment of the firm's environmental liabilities is higher than those recognized by the firm which casts the doubt about the reliability of the information disclosed.
- Stanny (1998) find that firms with lower-environmental performance – higher number of polluting facilities – are associated with higher levels of disclosure. They find that firms with better performance only increased their disclosures following the issuance of SAB 92.

Relevance of disclosures:

- Campbell et al. (2003) finds that the disclosure of environmental liabilities reduces investors' uncertainty about firms' environmental liabilities; hence, disclosure of such information improves the firm's market valuation.

Table-2: Overview of Environmental Liabilities Research

Authors	Topic	Measure of Environmental Liabilities	Findings
Barth and McNichols (1994)	Examines if firms' environmental liabilities related to Superfund sites could be estimated using sites characteristics: such as the hazard score assigned by the Environmental Protection Agency, the type of contamination (soil or water), and site types and required remediation technologies.	The cleanup cost estimate as measured in the Record of Decision (ROD) filed by Environmental Protection Agency. This estimate includes the initial capital incurred at the start-up of the cleanup operation and reoccurring expenditures for operation and maintenance.	The authors find that site characteristics could help predicting a lower bound of cleanup costs of Superfund sites.
Barth et al. (1997)	Studies the impact of regulation and enforcement, insider information, litigation, and capital market forces on the disclosure of environmental liabilities information in annual and 10-K reports.	The authors use a 13-item disclosure index that measures different types of information related to the firm's environmental liabilities.	The authors find that increased regulatory influence, litigation threat, and capital market demand for information explain the disclosure of environmental liabilities in annual and 10-K reports.
Li et al. (1997)	The authors provide a disclosure model predicting that partial disclosure of environmental liabilities maximizes the firm's market value net of litigation and political costs. The authors also examine the validity of the model using the disclosure of environmental incidents for a sample of Canadian firms.	A dummy variable equal 1 if the firm is disclosing environmental incidents – administrative orders to comply, prosecutions, or spills – in their annual reports, annual information forms, or management discussion and analysis, and zero otherwise.	The authors find that firms' likelihood of disclosing environmental liabilities information is positively associated with outsiders thinking that management has insider information and the firm's pollution propensity. They also find that disclosure is negatively related to the level of political cost related to regulatory intolerance to pollution.
Stanny (1998)	Examines whether increased disclosure regulations is associated with increased disclosure of environmental liabilities information.	A content index to measure firm's disclosure of information related to accounting policy compliance, reserved amounts, and additional possible losses. The author also measures the dollar value of reserved amounts for remediation activities.	The author finds that environmental disclosure increased following the issue of SAB 92 and also finds that firms increased the disclosure of reserved amounts following the issuance of the standard.
Campbell et al. (2003)	Studies the market valuation of environmental liabilities disclosure related to the firm's involvement in Superfund sites and examines whether these disclosures reduce site and allocation uncertainties.	There are two measures of environmental liabilities: the dollar value of accrued environmental liabilities reported by the firm and a disclosure index measuring site level information related to firm involvement in Superfund sites.	The authors find that the disclosure of private environmental liabilities information is positively valued by the market since it reduces the level of site and allocation uncertainty.
Alciatore et al. (2004)	Examine the change in environmental disclosure in response to increased environmental reporting regulation.	The authors examine the amount of: 1. Remediation liabilities 2. Dismantlement liabilities	The authors find an increase in the number of firms disclosing environmental remediation and dismantlement liabilities following the issuance of SAB 92.

3.4. Pollution abatement

Measurement and reporting

Disclosure of pollution abatement information is related to the description of incidents and remediation efforts made by firms that may result in environmental liabilities. According to Gamble et al. (1995), the SEC Item 303 requires firms to disclose any events or uncertainties that affect the firm's future financial condition. Therefore, in such cases where firms could not recognize environmental liabilities related to certain events, Item 303 requires them to provide information about incidents that could affect the firm's future financial position. Alciatore et al. (2004) also state that the SEC issued FRR No 36 in 1989 mandating firms to disclose the effects of PRP status and its impact on future financial results in MD&A.

Prior research examines firms' disclosure of remediation activities related to polluted sites; they mostly research firms' disclosures about their involvement in Superfund sites as defined by CERCLA[9]. Barth and McNichols (1994) find that firms' private information about sites' hazard and other qualitative information about their involvement in Superfund sites could help determine the lower boundary of their environmental liabilities; which highlights the importance of disclosing this type information. Pollution abatement activities involve a wide range of events that include major spills (such as the Exxon Valdez oil spill in Alaska), polluted sites, or minor spills; however, the majority of research studies focus on disclosures related to firms' involvement in Superfund sites. Table-3 provides a summary of all measures used in prior research to define firms' pollution abatement activities.

[9] The Comprehensive Environmental Response, Compensation, and Liability Act

Decision to disclose pollution abatement information

Using economic theory, Freedman & Stagliano (2002) examine the disclosure of pollution abatement information for firms involved in first-time initial public offerings (IPO). On the one hand, Freedman & Stagliano (2002) suggest that IPO firms may not disclose pollution abatement information due to the negative news included in the disclosure which gives the impression that the firm is more risky. However, they argue that withholding such important information may be costly to the firm from an economic and social perspective; therefore, they envisage that the level pollution abatement disclosures would be higher for IPO firms in comparison to non-IPO firms. Using a five-theme content index, Freedman and Stagliano (2002) compare the disclosures of 26 IPO firms, named as potentially responsible parties (PRP) in Superfund sites, to those made by a control sample of PRP firms that were not involved in IPO. They find that, in general, the level of disclosure of pollution abatement information is very low despite the fact that the disclosure of such information is regulated by the SEC. Furthermore, they could not find a significant difference between the disclosures made by IPO and non-IPO firms. The findings of Freedman and Stagliano (2002) suggest that pollution abatement disclosures are not driven by investors' need for information.

On the contrary, Ely & Stanny (1999) suggest that the presence of sophisticated investors – able to analyze and draw conclusions – would increase the demand for pollution abatement information. They study the disclosure determinants of firms named as Potentially Responsible Party (PRP) in Superfund sites and find that firms with higher level of user sophistication – proxied by analyst following and percentage of holding by institutional investors – are more likely to disclose information that the firm was named as a PRP. They also find that user sophistication is also related to the specificity of the disclosure; meaning that firms heavily

followed by analysts or held by institutional investors disclose greater details – in the form of more quantitative information - about their PRP sites. Ely & Stanny (1999) argue that sophisticated users - who are engaged in data gathering - are informed that the firm is named as a PRP from outside sources such as the Environmental Protection Agency fillings. Therefore, firms with higher levels of sophisticated users are more likely to provide more information to clarify their involvement in Superfund sites and alleviate any potentially detrimental views provided by external sources.

There is also evidence that institutional factors heavily influence the disclosure of pollution abatement information. In their study of the relation between financial performance, environmental performance, and environmental disclosure, Al-Tuwaijiri et al. (2004) examine the disclosure of pollution abatement information in 10-K reports[10]. They find that institutional factors that proxy for the firm's concerns about the environment[11] are positively associated with environmental disclosure of pollution abatement information. Their findings suggest that firms establishing structures to manage their environmental operations are more likely to disclose pollution abatement information.

Alciatore et al. (2004) find that the disclosure of firms' involvement in PRP sites increased following the issuance of FRR 36 in 1989 and SAB 92 in 1993. Comparing the

---

[10] The disclosure index by Al-Tuwaijiri et el. (2004) measures (1) the amount of toxic waste generated by the firm (2) oil or chemical spills (3) the firm is designated as a Potential Responsible Party (PRP) and (4) the financial fines and penalties resulting from violating federal laws.

[11] Firm's environmental concern is measured using a factor analysis of (1) the presence of an environmental committee (2) the issuance of a sustainability report and (3) the number of voluntary EPA programs in which the firm is participating.

disclosure of 34 firms in the oil industry, they find that the number of disclosing firms increased from 4 firms in 1989 to 12 firms in 1998. They also find that the average number of PRP sites increased from 9 to 85 during the same period. The results imply that more firms with higher level of involvement in PRP sites started to disclose their information following the issuance of the regulation.

Reliability and Value Relevance

Early research by Rockness et al. (1986) suggests that firms in the chemical industry with higher levels of involvement in Superfund sites are less likely to disclose information about their nomination as Potentially Responsible Party. However, recent study by Ely & Stanny (1999) finds that firms with more PRP sites – according to EPA fillings - are more likely to disclose information about their involvement in these Superfund sites. Furthermore, these high-polluting firms are also more likely to disclose more specific information – quantitative information - about their Superfund sites. That shift in behavior might be explained by the issuance of FRR 36 in 1989 and SAB 92 in 1993 which oblige firms involved in Superfund sites to disclose all relevant information about their involvement.

The study by Al-Tuwaijiri et al. (2004) also provides evidence that there is a discrepancy in disclosing pollution abatement information. In contrast to Ely & Stanny (1999), they find that firms with higher environmental performance – measured by the percentage of recycled waste – are associated with higher levels of pollution abatement disclosures. The authors refer to Verrecchia's (1983) voluntary disclosure theory to predict that the proprietary cost of disclosing pollution abatement information is lower for the sample of high performing firms.

Testing the relevance of pollution abatement information, Al-Tuwaijiri et al. (2004) find a negative but insignificant relation between firms' stock returns and environmental disclosures

of pollution abatement information over a period of three years. The results suggest that investors do not integrate pollution abatement information into their assessment of the firm's future financial performance. The results hint that investors may also view these disclosures in a negative light which might explain why firms with low-environmental performance are less keen on disclosing this type of information.

Using Barth and McNichols (1994) valuation model, Ely & Stanny (1999) find that the number of PRP sites is negatively associated with firms' market value. However, they also find that disclosing information about firms' involvement in Superfund sites mitigates this negative relation. These findings imply that due to the high level of uncertainty about firms' involvement in Superfund sites, investors will heavily discount firms' value. However, higher levels of Superfund disclosures help investors make a more informed investment decision which reflects in a better risk assessment and hence a higher market valuation of PRP firms. The findings of Hughes (2000) also confirm the negative association between the firm's market value of equity and the number of Superfund sites for which the firm is designated as Potentially Responsible Party.

Mobus (2005) studies the relevance of mandatory disclosure of legal enforcement action using the legitimacy theory framework. She examines the association between the disclosure of legal enforcement actions and future environmental performance. The author hypothesizes that mandatory disclosure of negative information – in this study the number of legal enforcements by environmental agencies in 10-K reports - will induce firms to change their subsequent performance to comply with society's expectations regarding firms environmental performance. The author finds a negative association between the disclosure measure and subsequent environmental performance; implying that firms with higher numbers of legal enforcements

experience an improvement in their environmental performance. These findings suggest that mandating environmental disclosures plays a positive role in changing firms' environmental performance.

Summary

In the absence of precise estimates of firms' environmental liabilities, pollution abatement disclosures provide investors with information that could help them mitigate their investment risk (Ely & Stanny, 1999). Early studies show that firms have been offered high discretion over the disclosure of pollution abatement information which resulted in low levels of disclosure (Rockness et al., 2006; Freedman & Stagliano, 2002). Increased regulation by the SEC forced more firms to reveal their private information (Alciatore et al., 2004). However, there are concerns whether investors could interpret the information content of pollution abatement disclosures effectively. Evidence suggests that there is a lack of demand for this type of information by regular investors (Freedman and Stagliano, 2002); which may be due to their inability to translate the information into more robust financial implications. This matter is confirmed by the increased disclosure for firms with more sophisticated investors – i.e. institutional investors – (Ely & Stanny, 1999). More research is required on how investors integrate pollution abatement decision in their investment decision. A summary of pollution abatement research is presented in Firgure-4.

Figure-4: Summary of Research on Pollution Abatement Disclosures:

Measurement and reporting:

- SEC require firms to disclose and describe any events that may raise uncertainties about future cash flow. FRR No 36 requires firms to disclose information about firms' PRP status in specific.
- Barth & McNichols (1994) find that such qualitative information could help investors assess the lower boundary of firm's environmental liabilities.

Decision to disclose:

- The findings of Freedman & Stagliano (2002) suggest that the disclosure of pollution abatement information is not derived the financial market' economic demand for such information. Using a sample of IPO firms, they could not find a significant difference between the levels of disclosure of IPO firms and those of non-IPO firms.
- Ely & Stanny (1999) suggest that the presence of sophisticated investors – such as institutional investors – increases the demand and hence the supply for such information. They interpretation is that sophisticated investors are more able to analyze pollution abatement information.
- Al-Tuwaijiri et al. (2004) find that institutional factors related to managing the firm's environmental risk are associated with higher level of pollution abatement information. They find that firms with established environmental governance and management structures disclose more information.
- Finally, Alciatore et al. (2004) find that increased regulation – issuance of FRR No 36 by the SEC – is associated with higher levels of pollution abatement disclosures.

Reliability of disclosures:

- Rockness et al. (1986) find that disclosure of information about the firm being named as potentially responsible party is associated with firms with lower number of Superfund sites. Their finding suggests a reporting bias of pollution abatement information exists.
- However, a more recent study by Stanny (1998) find opposite results. They suggest that increased regulation – issuance of FRR No 36 and SAB 92 – may have led firms with lower-environmental performance to disclose such information.

Relevance of disclosures:

- Al-Tuwaijiri et al. (2004) could not find a significant association between pollution abatement information disclosed in 10-K reports and firm's stock returns; implying that investors could integrate such information in their investment decision.
- On the contrary, Ely & Stanny (1999) find that the number of PRP sites is associated with lower market values. They also finds that firms disclosing more information about their PRP status help investors mitigate their risk which reflect positively in their market valuation.
- Hughes et al. (2000) also find a negative association between the number of Superfund sites and firm's market value.
- Mobus (2005) finds that disclosure of pollution abatement information is associated with further improvement in the firm's environmental performance. The author suggests that the disclosure of such information will induce firms to change their behavior to comply with society's norms and expectations.

Table-3: Overview of Pollution Abatement Research

Authors	Topic	Measure of Pollution Abatement	Findings
Rockness et al. (1986)	Examine the disclosures of firms in the chemical industry about their management of hazardous waste in Superfund sites. The study also tests if there is an association between firms' waste management and their financial performance.	1. Corporate Communication Section Environmental information disclosure a. Monetary information. b. General Hazardous waste disposal information. c. Tonnage disposal measures. d. Superfund involvement. e. Regulatory compliance. 2. Audited Financial Statements Contingent liability footnote a. Environmental information. b. Superfund information.	The authors find that the high polluting firms involved in Superfund sites avoid the disclosure of hazardous waste information in their annual reports. They also find that firms waste generation is associated with lower financial performance and lower levels of solvency.
Ely and Stanny (1999)	Studies the association between user sophistication – high analyst following and high institutional holding – and the level of details about firms' nomination as Potentially Responsible Party (PRP) in annual and 10-K disclosures.	Statements about the number of PRP sites.	The authors find that high analyst following results in firms disclosing more specific information about their nomination as Potentially Responsible Party.
Freedman and Stagliano (2002)	Examines environmental disclosure of IPO firms nominated as PRP in annual and 10-K reports.	1. Disclosure that the company was nominated a PRP. 2. Disclosure of the number of sites for which the company was named a PRP. 3. Names of specific sites, with a description of the progress and problems of cleaning the site. 4. Mention of whether the costs are, or are expected to be, material in their impact on the company's financial statements.	The authors could conclude that the there is a relation between firms' involvement in IPO and disclosure of PRP information.

		5. The dollar amount of Superfund liability exposure.	
Alciatore et al. (2004)	Examine the change in environmental disclosure in response to increased environmental reporting regulation.	The authors examine number of PRP sites disclosed.	The authors find an increase in the number of firms disclosing the number of PRP sites following the issuance of FRR No 36 and SAB 92.
Al-Tuwaijiri et al. (2004)	The authors examine the association between environmental disclosure in 10-K reports, environmental performance, and financial performance.	The authors use a disclosure index to measure the disclosure of: 1. PRP designation. 2. Toxic waste. 3. Oil or chemical spill. 4. Environmental fines and penalties.	The authors find that high environmental performance is positively associated with firms' financial performance and with more specific disclosures about firms' polluting activities.
Mobus (2005)	Using the legitimacy framework, the study examines the association between firms' mandatory environmental disclosures and future environmental performance.	The author measures mandatory disclosures using the number of legal enforcements by environmental agencies disclosed in 10-K reports.	The author finds a negative association between disclosure of legal enforcements and subsequent environmental performance.

3.5. Environmental performance indicators

Measurement and reporting

Since there is no regulation to determine which kind of environmental performance indicators should be reported to outside stakeholders, firms' efforts to measure and disclose these indicators could be considered voluntary to a large extent. In general, firms adopt various reporting guidelines to communicate this type of information to their stakeholders; most notably the Global Reporting Initiative (GRI) or the ISO 14031 guidelines (Morhardt et al., 2002). The fourth generation of the GRI guideline requires firms to report on 34 environmental issues under different categories such as product sustainability, recycling, energy consumption, water consumption, emissions, effluents and waste, biodiversity and natural habitat, transportation, supply chain assessment and compliance with environmental regulations.

A study by Rodrigue et al., (2013b) examines the determinants of firms' selection of environmental performance indicators (EPI). Using series of interviews with key personnel in a firm with a proactive environmental strategy, the authors find that the firm's environmental strategy, shareholders' pressure, and outside stakeholders' pressure all influence the choice of internal EPIs used by the firm. Most importantly, the study shows that some firms – such as the case firm - may actively seek to measure EPIs beyond what is required by the regulator with the aim of becoming environmental leaders. Another important finding of this study is that although the measurement and reporting of EPIs is voluntary, there is a relevant audience showing interest in this type of information (such as investors, governments, stock indices, industry associations, and local communities) which may increase the level of scrutiny over the information disclosed.

Azzone et al. (1996) present a general framework for environmental reporting including the reporting of environmental performance indicators for products and processes. They suggest that firms should report the amount of emissions, waste produced, energy consumed and transportation (details are provided in Table-4). An important issue they discuss in their study is whether these indicators should be aggregated (disclosure of firm-level environmental performance) or disaggregated (disclosure of site-level performance). While aggregated indicators are useful in comparing performance over time, the authors argue that aggregated measures may be used to hide sites where firms' environmental performance is below acceptable levels.

Several studies provide evidence that the level of reporting Environmental performance indicators is still very low. Henri & Journeault (2007) survey 1500 Canadian manufacturing firms over the use of environmental performance indicators. Although the sample firms responded that the use of EPIs is important to ensure compliance with environmental regulations and decision making, external reporting of these indicators was considered the least important use of EPIs. Other studies by Clarkson et al. (2008) and Morhardt et al. (2002) code firms' environmental reports according to the GRI or ISO 14031 guidelines and provide empirical evidence that the level of information reported is lower than what is expected by these guidelines. Using a disclosure index based on the GRI guidelines, Clarkson et al. (2008) find that a sample of 122 firms reports an average score of 8.09 items out of a 60-item total score. Morhardt et al. (2002) find that firms report 36 items (out of 115 according to a GRI coding system) and 44 items (out of 132 according to an ISO 14031 coding system). A list of the different measures of environmental performance indicators is presented in Table-4.

Decision to disclose environmental performance indicators

Prado-Lorenzo et al. (2009) examine the determinants of disclosing greenhouse gas emissions (GHG) information on their website for a sample of 50 firms from several countries[12]. They examine whether disclosure is related to the firm's financial condition, supervision by debt-holders, and the level of governmental involvement represented by the ratification of the Kyoto Protocol. The authors measure GHG disclosures using an index composed of quantitative measures of firms' greenhouse emissions[13] and general information related to the firm's strategy and management of their greenhouse gas emissions. They find that the disclosure of GHG information is positively related to firms located in countries that ratified the Kyoto Protocol, firm size, and industry membership. The authors suggest that firms located within countries that ratified the Kyoto Protocol are required to make higher levels of capital expenditures which explain the importance of GHG disclosures. However, the study of the disclosure decision of quantitative information – measured according to the GRI guidelines – shows that there is no significant association between the disclosures made and the firm's leverage, financial condition, or the ratification of the Kyoto Protocol.

Rankin et al. (2011) explore the link between internal and external institutional factors and environmental disclosure. They examine the association between Australian firms' disclosures of greenhouse gas emissions (GHG) and organizational factors, and regulations. The

---

[12] The sample includes 50 Fortune 500 firms from the USA, Australia, Canada, and the European Union.

[13] The authors use GRI (G3) guidelines EN16 to EN20 to measure disclosures related to firms' environmental performance indicators.

authors suggest that the establishment of internal structures to proactively manage the firm's environmental operations will have a positive impact on the disclosure of credible GHG information. They reckon that these structures not only serve as management tools that translate the firm's commitment to enhance their environmental operations into actions, but also act as learning and communication tools. They also suggest that firms participating in voluntary governmental programs are more likely to disclose more credible information. They find that the decision to disclose GHG[14] information is associated with the firm's adoption of an environmental management system (EMS), the firm's ISO 14001 certification of their EMS, the quality of the firm's governance[15], and the firm's voluntary adherence to the Carbon Disclosure Project (CDP)[16]. Examining the amount and credibility of GHG disclosures using a disclosure index for a subsample of 80 firms that disclosed GHG information, Rankin et al. (2011) find that the level of GHG disclosure is associated with the existence of a certified EMS, the adoption of the GRI, and the voluntary reporting to the CDP. The authors could not find a relation between the decision to disclose and the presence of an environmental committee or trading in the EU ETS.

Freedman & Jaggi (2005) compare the disclosures of greenhouse gas emission information between firms located in Kyoto Protocol-ratifying countries and those in non-

---

[14] The decision to disclose is measured using a binary variable equal 1 if the firm discloses GHG information and 0 otherwise.

[15] Firm's governance is scored according to the Horwath (2008) report.

[16] The authors found that firms with CDP reports publicly available are significantly associated with the decision to disclose GHG information.

ratifying countries[17]. They find that Kyoto firms are associated with higher levels of disclosure of greenhouse information in comparison to the non-Kyoto firms. The authors also find that firms with higher levels of CO2 emissions - and located in Kyoto ratifying countries - are associated with higher levels of disclosure. However, they could not find a significant association between the firm's financial condition (measured by return on assets) or the level of supervision by debt-holders (measured by the level of debt to equity) and the level of greenhouse gas disclosures. Freedman & Jaggi (2005) suggest that the stakeholder theory predicts that firms disclose greenhouse gas information to satisfy the information needs of the different stakeholders including investors. However, the authors state that the stakeholders' theory fails to explain the difference in disclosure between firms. Using legitimacy theory, they reckon that Kyoto-firms disclose more information about their greenhouse gas emissions to alleviate the public and political pressures emanating from ratifying the protocol.

Reliability and Value Relevance

Cormier and Magnan (1997) find that pollution indicators are reflected in firms' market valuation. Using a sample of Canadian firms in environmental sensitive industries, the authors find a negative association between firms' market value of equity and their indicators of water pollution. The authors use a proxy of water pollution that measures the level of firm's pollution in the flow-through of discharged water relative to the amount allowed by the regulator. This finding implies that the market uses these performance indicators to assess an un-booked liability

[17] The authors measure greenhouse gas disclosure using a five-item index measuring a mix of qualitative and quantitative information. The index measures the disclosure of (1) firm's emissions (2) costs associated with greenhouse gas emissions and (3) firms' plans to deal with global warming.

to these firms. Another study by Cormier et al. (1993), using a similar valuation model, finds comparable results. Cormier et al. (1993) also find that investors assess a market premium (discount) to firms with high (low) environmental performance – using firms' water pollution indicators.

Hughes (2000) finds that nonfinancial pollution measures are reflected in the firm's market valuation. The author examines the value relevance of SO_2 information following the enactment of the 1990 Clean Air Act Amendment (CAAA). The phase one of the 1990 CAAA required a list of high-polluting firms in the electric-utility sector to reduce their SO_2 emissions while obligations of the low-polluting firms were delayed for phase two. The author finds that - following the enactment of the act - the market value of equity is negatively associated with the amount of SO_2 emissions for the sample of high-polluting firms; implying that investors are able to assess the amount of liabilities generated from the emissions of SO_2 to the atmosphere. The study could not establish a similar association for the control sample of low-polluting firms; indicating that the market did not book any liabilities for these firms. In 1992, the cost of compliance with the 1990 CAAA was revised downward due to technological advancements. The author does not find any association between the market value of equity and the amount of SO_2 emissions following the revision of compliance costs.

Johnston et al. (2008) study the value relevance of SO_2 emission allowances traded by US electric utilities. They argue that these allowances have an asset value since they allow firms to maintain their operation under the existing environmental conditions – or they could alternatively be sold – and they also have a real option value since they allow firms to defer capital spending in scrubbers to reduce their SO_2 emissions. Using Ohlson (1995) valuation model, they find a positive relation between the market value of equity and the number of SO_2

emission allowances held by firms; which indicates that investors value these allowances as assets of the firm. Furthermore, they examine the market reaction on the date of auction of SO_2 emission allowances and find positive abnormal returns for the purchasing firms. The authors suggest that investors value the purchase of SO_2 emission allowances as real options since they help the firm to defer major capital expenditures.

Finally, a study by Clarkson at al. (2011)a examine whether it pays to be green by studying whether there is an association between improvement of firms' environmental performance and the change in the firm's financial performance. The authors hypothesize that improving environmental performance is a signal of a proactive strategy that leads to improved financial performance by reducing environmental compliance cost or increased revenues from sales of green products. Clarkson at al. (2011)a find that a reduction in the level of Toxic Release Inventory (TRI) is associated with a subsequent improvement in the firm's return on assets, firm value and cash flow. Similarly, using firms' Toxic Release Inventory (TRI), King & Lenox (2001) find a negative association between firm's pollution level and firm's value using Tobin's q. On the other hand, King & Lenox (2002) find that firm's efforts for pollution prevention – estimated using firm's TRI - are associated with higher firm's value (Tobin'q) and higher levels of profitability (return on assets).

Figure-5: Summary of Environmental Performance Indicators Research

Measurement and reporting:

- Disclosure of Environmental Performance indicators (EPI) is unregulated. Global Reporting Initiative (GRI) and ISO 14031 guidelines provide suggestions on how to report this information.
- Azzone et al. (1996) discuss whether such information should be reported at firm or plant level. While aggregate EPI disclosures are useful in comparing performance over time, it could still serve to hide below-average performance at some plants.
- Henri & Journeault (2007) find that firms collect EPI information for internal use but are reluctant to disclose the information to outside stakeholders. Clarkson et al. (2008) and Morhardt et al. (2002) confirm that the level of reported EPI information is very low in comparison to what is required by voluntary reporting guidelines (i.e. GRI and ISO 14031).

Decision to disclose:

- Prado-Lorenzo et al. (2009) find that disclosure of greenhouse gas emissions (GHG) information is related to the location of the firm in a Kyoto Protocol ratifying country, firm size, and industry membership. They could not find an association between the disclosures and the firm's financial condition. Freedman & Jaggi (2005) also find similar results.
- Rankin et al. (2011) find that the disclosure of GHG information is associated with the firm's established structures to manage their environmental operations. They find that firms with who adopt an environmental management system, have an ISO 14001 certification, have a higher quality governance structure, and voluntarily participate in the Carbon Disclosure Project are more likely to disclose GHG information.
- Through interviews of key personnel in a firm with an active environmental strategy, Rodrigue et al. (2013)b find that the presence of an active environmental strategy, and pressure by shareholders and outside stakeholders influence the choice of EPI to be measured and reported by the firm.

Relevance of disclosures:

- There is empirical evidence that investors integrate EPI information in their investment decisions.
- Cormier & Magnan (1997) find a negative association between firm's measures of water-pollution and a sample of Canadian firms' market value of equity.
- Hughes (2000) finds a negative association between the amount of SO2 emissions and firms' market value of equity for a sample of high-polluting firms following the enactment of 1990 Clean Air Act Amendment. The author could not find any association between the pollution measure and firm value for the sample of low-polluting firms.
- Using Ohlson (1995) valuation model, Johnston et al. (2008) find that SO2 emission allowances have a real asset value. They also find positive abnormal returns around the purchase date of these allowances.
- Clarkson et al. (2011)a find that the reduction of Toxic release inventory is associated with an improved financial performance.

Table-4: Overview of Environmental Performance Indicators Research

Authors	Topic	Measure of Environmental Performance Indicators	Findings
Cormier and Magnan (1993)	Examine the association between firm's market valuation and its level of water pollution. The aim of the study is to understand whether water pollution indicators provide investors with information about the firm's expected environmental liabilities.	The actual level of suspend solids, average concentration of sulfuric anhydride, biochemical oxygen demand (BOD), and other substances in the plant water discharges; relative to the amounts allowed by the Pollution Standard set by the Environment Ministries in Canada.	The authors find a negative and significant association between the firm's market valuation and its water pollution performance. It indicates that investors integrate non-financial pollution performance information in their assessment of the firm's liabilities.
Azzone et al. (1996)	Presents a framework for presenting corporate environmental indicators.	The authors measure firms' environmental performance indicators as: 1. Emissions: Quantity of Sox, NOx, VOCs, CO, NH3, and CO2 released, and quantity of CFCs and halons consumed. 2. Waste: a. Amount of non-hazardous waste generated and disposed (Total, by category and by destination type). b. Amount of hazardous waste generated and disposed (Total, by category, transported, treated and by destination type). c. Recycling recovery rates. 3. Energy: a. Amount of energy consumed by type (solid fuel, petroleum, gas, electricity, and heat). b. Total amount of energy consumed. 4. Transportation: a. Number of cars and/or distances. b. Number of passenger transport vehicles and/or distances. c. Number of goods vehicles and/or distances. d. Number of aircraft and/or distances.	
Cormier and Magnan (1997)	Study how investors evaluate the water pollution performance of Canadian firms.	Same measure as Cormier et Magnan (1993)	The authors find that the market valuation of firms is negatively associated with the firm's pollution performance. Additionally, they find that this assessment differs by the firm's industry

			membership. Firms in the pulp and paper, chemical and oil industries were more negatively evaluated in comparison to firms in the steel, metal and mining industries. The authors suggest that political scrutiny over the firm's environmental performance could explain the difference in the market valuation of their environmental performance.
Hughes (2000)	Study the association between pollution indicators and firm's market value of equity using a sample of utility firms affected by Phase One of the 1990 Clean Air Act. The author attempts to find whether non-financial pollution measures are good indicators of environmental liabilities.	Percentage of SO_2 emissions relative to the firm's total emissions of SO_2, NO_x, and CO_2.	The author finds that a negative association between market value of equity and firms' level of SO_2 emissions for firms affected by Phase One of the Clean Air Act after the inaction of the act. The author could not find a similar association for the control sample of firms that were not affected by the act.
Freedman and Jaggi (2005)	Study the impact of ratifying the Kyoto Protocol and firms' disclosure of greenhouse gas (GHG) emission information.	The authors use a 5-item index to measure disclosure of GHG information: 1. Mention of global warming or of the Kyoto Protocol. 2. Firm's plans to deal with global warming and the objective to control global warming. 3. Potential costs to achieve the global warming objectives. 4. Current costs to reduce the greenhouse gas emissions. 5. Information on the extent of greenhouse-gas emissions.	The authors find that firms located in countries that ratified the Kyoto Protocol are more likely to disclose GHG information in comparison to firms located in non-ratifying countries.
Johnston et al. (2008)	Examine the value relevance of sulfur dioxide (SO_2) emissions allowances.	The number of SO_2 emission allowances held by the firm at the end of the year.	The market positively value the firm's holding of SO_2 emission allowances in accordance with the authors' hypothesis that these allowances have an asset value.
Prado-Lorenzo et al. (2009)	Study the determinants of Greenhouse Gas Emissions disclosures.	The authors use the GRI indicators to create a GHG disclosure index: 1. Total direct and indirect gas emissions by weight. 2. Other relevant indirect greenhouse gas emissions by weight. 3. Initiatives to reduce greenhouse gas emissions and reductions achieved. 4. Emissions of ozone-depleting substances by weight.	The authors find that GHG disclosures are associated with firm size, industry membership, and the location of the company's head-quarter in a country that ratifies the Kyoto protocol. They also found that the disclosure of environmental performance indicators – as defined by the GRI indicators - are mainly associated with firms' industry membership

		5. NO, SO and other significant air emissions by type and weight.	
Rankin et al. (2011)	Examine the disclosure of greenhouse gas (GHG) emission disclosures.	The authors use two measures to proxy for GHG disclosures: 1. A dichotomous measure equal 1if firms disclose GHG information and 0 otherwise. 2. A 20-item disclosure index based on the ISO 14064-1 requirements.	The authors find that firms with an Environmental Management System (EMS) certified by ISO 14001, using the GRI for reporting environmental information, and providing information to the Carbon Disclosure Project are more likely to disclose GHG information.

3.6. Governance structure and management system

Measurement and reporting

Similar to the reporting of environmental performance indicators, disclosures related to the governance and management of the firm's environmental operations is completely voluntary. There is an ambiguity in defining what is the most effective governance structure to oversee firms' environmental operations and what are the elements of an environmental management system that would lead to improved levels of environmental performance. Firms voluntarily adopting the GRI guidelines are required to provide some information about issues related to the governance and management of firm's sustainability such as the firm's strategy, involvement in external initiatives, stakeholder engagement, reporting assurances, governance structure and composition, remuneration and incentives, and management approach. Meanwhile, studies by Clarkson et al. (2008) and Morhardt et al. (2002) code firms' environmental reports according to the GRI guidelines and conclude that the reporting of environmental governance and management information is substantially lower than what is demanded by the GRI.

A study by Pondeville et al. (2013), examines the development of corporate environmental management system. Pondeville et al. (2013) propose three main elements defining an environmental management system. The first element is the formal management control system composed of rules and procedures to manage the firm's environmental operations. The second element is the informal management control system made by employees and managers' involvement in solving the firm's environmental problems. The third element is the management information system that stores information about the firm's environmental operations that could be further used for decision making and control.

Another study by Rodrigue et al. (2013a) examines the association between the firm's environmental governance and its environmental performance. The authors define three mechanisms of environmental governance: (1) the existence of an environmental committee (2) the percentage of directors knowledgeable about their industries' environmental issues (3) the existence of environmental performance incentives in executive compensation. The results of Rodrigue et al. (2013a) show that the sample firms[18] reported in their proxy statements and their 10-K reports that 51% of boards have an environmental committee, 10% of directors have prior environmental experience, and 33% of firms include environmental related incentives in their executive compensation.

Perez et al. (2007) provide a tentative framework of what could constitute a successful environmental management system, by conducting field interviews with environmental managers in a sample of Spanish firms. They examine the link between the firm's environmental strategy and its environmental management system to understand its impact on the firm's environmental performance. They define four pillars for the firm's environmental management system: training and awareness building, continuous improvement, integrating stakeholders' interests, and organizational learning. They argue that the presence of such a management system would lead firms to develop intangible assets that improve their environmental performance.

Perez et al. (2007) define the first pillar – training and awareness – as the environmental training programs provided to employees at different sites. They find that these programs improve employee's awareness, knowledge, skills, and expertise vis-à-vis carrying their

[18] Rodrigue et al. (2013)a examine 219 firm-year observations between 2003 and 2008 for firms between SIC codes 10XX and 39XX.

environmental duties. They reckon that forming environmental committees and participation programs is effective catalyst of awareness-building among employees.

As for the second pillar, continuous improvement of the firm's environmental performance relies on the organization's willingness to acquire latest technologies. The authors find that some organizations are ready to improve their environmental performance beyond what is legally required. They argue that spending for continuous improvement will help them avoid large capital expenditures if future regulations become more stringent. Therefore, the authors find that continuous improvement goals should be imbedded in the firm's capital planning.

Perez et al. (2007) also suggest that there are many tools to integrate stakeholder's interests into organizational strategy. Sponsoring environmental activities is a tool to reduce the tension between firms and their local communities. Though these initiatives help firms improving their reputations, the authors express their concern that they might be tools for stakeholders' management rather than measures of accountability. Other tools of integration include participation in voluntary environmental initiatives such as industry related working groups.

Furthermore, the authors highlight the importance of considering customers' environmental demands as well as environmental performance of their suppliers. For example, some firms require their suppliers to obtain certain environmental certifications to assure that their products are manufactured in compliance with regulatory requirements. The authors also require the integration of employee feedback by forming internal committees that help assessing and controlling the firm's environmental management system.

Finally, Perez et al. (2007) define organization learning as "the process of improving actions through better knowledge and understating, implying changes to internal values, routines

and rules" (page 415). They emphasize the role of employee training, forming of cross-functional environmental committees, use of information systems, and integration of environmental issues into accounting systems and budgets as important tools of developing organization learning.

Reliability and value relevance

Prior research provides evidence that the financial market values superior environmental governance and management systems. Using a survey of 297 firms traded on the London Stock Exchange, Thomas (2001) finds that the adoption of an environmental policy is associated with positive excess returns. Thomas (2001) also finds that positive returns persist for adopting firms that are members of polluting industries which are normally associated with negative excess returns. Meanwhile, the study could not find an association between firms that adopt training for staff in environmental protocols and excess stock returns. In general, the findings of Thomas (2001) suggest that the stock market considers the adoption of an environmental policy as a long-term investment rather than a short-term expense.

Klassen & McLaughlin (1996) study whether a strong environmental management is reflected in a positive financial performance. The authors use third party environmental awards as an output measure that aggregates the different dimensions of the firm's environmental management. Using a sample of firms listed on NYSE/AMEX, they find positive abnormal returns around the dates when the awards are announced signaling that the market reacts positively to the recognition of firms' environmental management. By measuring firms' Tobin's q, Hibiki et al. (2003) find that firms with ISO14001 certification are associated with higher levels of market valuation. Tobin's q of firms with ISO14001 certification is 11% to 14% higher than that of firms without the certification.

Rodrigue et al. (2013a) examine if environmental governance mechanisms are associated with higher levels of environmental performance. They study the relation between three governance mechanisms – the existence of an environmental committee, the level of environmental awareness among board directors, and the existence of environmental incentives in executive compensation – and different measures of the firm's environmental performance. Rodrigue et al. (2013a) could not find significant association between the three environmental governance mechanisms and the level of environmental regulatory performance or the level of environmental capital expenditures. The study only finds a positive association between the level of environmental incentives in executive compensation and the level of environmental performance related to pollution prevention activities. Rodrigue et al. (2013)a conclude that the existing governance mechanisms do not have a substantial impact on the firm's environmental performance. They argue that firms embrace these mechanisms to portray an image of responsible environmental management.

Figure-6: Summary of Research on Environmental Governance Structure and Management System Disclosures:

Measurement and reporting:

- Reporting of information about environmental management systems and government structures is not mandated by regulatory bodies. Most recently the GRI has been providing guidelines on how to report this type of information. Research by Clarkson et al. (2008) and Morhardt et al. (2002) show that the level of information reported is still below what is required by the GRI guideline.
- Pondeville et al. (2013) suggest that the environmental management system is composed of three main elements (1) formal system (made of rules, procedures, etc…) (2) informal system (formed by the interaction between employees) (3) the information system that supports the decision making process.
- Rodrigue et al. (2013) suggest that an effective environmental governance system is made of (1) the existence of a separate environmental committee (2) the percentage of directors with knowledge about environmental issues (3) the existence of an incentive system that is tied to the firm's environmental performance.

Measurement and reporting:

- Perez et al. (2007) define four pillars for the firm's environmental management system: (1) training and awareness building, (2) continuous improvement, (3) integrating stakeholders' interests, and (4) organizational learning. They suggest that these pillars could be considered as intangible assets that lead to improving the firm's environmental performance.

Relevance of disclosures:

- Klassen and McLaughlin (1996) find that a superior environmental management is positively reflected in firm's valuation. They find that firm's environmental awards – an output measure of the excellence in environmental management – are associated with positive stock returns around the announcement dates of the awards.
- Rodrigue et al. (2013) study the association between an effective environmental management system and firm environmental performance. They only find a positive association between the existence of environmental incentives in executive compensation and a measure of voluntary performance related to the firm's pollution prevention activities. They conclude that established governance structures are inefficient and that firms use these structures to portray an image of environmental responsibility.

Table-5: Overview of Research on Environmental Governance Structure and Management system Disclosures:

Authors	Topic	Measure of Governance Structure and Management system	Findings
Klassen and McLaughlin (1996)	Study the value relevance of external environmental awards – a output proxy for firms' environmental management.	The authors use external environmental awards as a measure of the firm's management system.	The authors find positive returns around the announcement dates of the awards.
Perez et al. (2007)	Using field research, the authors study the interaction between strategy and environmental management system and their impact on the firm's environmental performance.	The authors define the firm's environmental management system based on four pillars: (1) Training and awareness building. (2) Continuous improvement. (3) Integrating stakeholders' interests. (4) Organizational learning.	The authors provide a structure for firms' environmental management system and link it to the different levels of environmental performance.
Pondeville et al. (2013)	Study the contextual and strategic factors that contribute to the formation of the firm's environmental management system.	The authors identify three elements that define the firm's environmental management system: (1) Formal management system: rules, procedures, etc… (2) Informal management system: formed by employees' interaction to solve environmental issues. (3) Information system to support decision making.	The authors could not find a significant association between ecological risk and the development of an environmental management system. On the other hand, they find that the development of an active environmental strategy and a management system are associated with pressures from market, community, and organizational stakeholders.
Rodrigue et al. (2013)	Examine whether established governance structures are associated with improved environmental performance.	The authors use three measure to proxy for the firm's environmental governance structure: 1. The existence of an environmental committee. 2. The percentage of directors with environmental management experience. 3. The presence of environmental incentives in executive compensation.	They only find an association between the presence of environmental incentives in executive compensation and the firm's voluntary efforts for pollution prevention.

4. The dimensions of environmental disclosure

Total environmental disclosure is a construct that has many dimensions that researchers need to consider (Ingram & Frazier, 1980; Walden & Stagliano, 2004)[19]. Environmental reports should not be assessed based only on the amount of information disclosed but also on the comprehensiveness and the quality of the information. Therefore, based on previous research, I suggest that environmental reporting should satisfy or provide a balance along four dimensions that I discuss in this section: past vs. forward-looking, positive vs. negative, qualitative vs. quantitative, and voluntary vs. mandatory disclosures. By attentively designing environmental reports along these dimensions, firms could provide their stakeholders with a set of comprehensive and relevant disclosures.

4.1. The time dimension of disclosure: Past vs. future disclosures

Measurement and reporting

In their definition of disclosure, Gamble et al. (1995) set the time-frame dimension to have a significant importance. According to (Gamble et al., 1995), stakeholders need past, and forward looking information:

> *"The objective of environmental disclosure is to provide stakeholders with information that will allow them to evaluate the long and short-term environmental concerns of an entity in terms of risk, current and perspective cash flow requirements, and consistency with societal environmental concerns."*

[19] (Ingram & Frazier, 1980) present four dimensions of environmental disclosure: the theme, the specificity, the time, and the evidence of disclosure.

The GAO report (2004) also highlights that forward-looking information is mandated by the SEC.

> *"In addition, under item 303 companies are "encouraged" to include in their filings forward-looking information, which SEC guidance defines as anticipating a future trend or event, or anticipating a less predictable impact of a known event, trend, or uncertainty"(p.10).*

Some scholars attempt to include this time dimension in their research of environmental disclosure. In their content index, Ingram & Frazier (1980) use the time dimension to differentiate between past and future oriented statements; however, they fail to find any correlation between this dimension and environmental performance. According to Ingram & Frazier (1980), the decomposition of the disclosure into its different constituents may land more significant results for different research questions. However, their failure to find any significant results could be attributed to the fact that there is no clear guideline on how to classify information as past or future oriented since the literature does not fully exploit this dimension of disclosure.

Marshall & Brown (2003) classify environmental reporting in terms of leading or lagging disclosures. They use the definitions provided by the European Environment Agency (EEA) and the International Organization for Standardization (ISO) for this purpose. According to the EEA, firms' disclosures falls under three categories: (1) descriptive indicators explaining what is happening to the environment, (2) efficiency indicators explaining how resources are utilized to produce consumer goods, and (3) performance indicators showing firm's commitment to a certain targeted objectives. Similarly, ISO standards define three indicators: (1) environmental indicators describing the state of the environment, (2) operational indicators showing how firms'

operations have impacted the environment and (3) management indicators providing information on management efforts to meet their environmental goals. Marshall & Brown (2003) consider performance indicators (under EAA classification) and management indicators (under ISO standards) to be leading indicators providing more relevant and valuable information to stakeholders about the firms' commitment to improving their future environmental performance. Meanwhile, they consider the other types of disclosures as less relevant since they only indicate firms' prior performance.

Marshall & Brown (2003) examine the disclosures of 150 listed firms listed, they find that the majority of firms' environmental reporting is composed of lagging indicators (82.3% could be classified as EEA Descriptive indicators or 86.2% could be classified as ISO Operational indicators) in comparison to the amount of leading disclosures (13.3% EEA Performance indicators or 11.7% ISO Management indicator). They also find that only 32.9% of firms reported at least one metric related to EEA Performance indicators and only 50.6% of firms reported at least one ISO Management indicators. The authors argue that this low level of forward looking information might provide a negative signal about firms' commitment and efforts to improve their future environmental performance.

Decision to disclose forward-looking information

Marshall and Brown (2003) examine the factors that may influence firms' disclosure of leading information. They find that ISO compliant firms, large firms, and manufacturing firms tend to disclose more forward- looking information in comparison to non-ISO compliant firms, small firms, and natural resources or service firms. They argue that ISO compliant firms are obliged to establish an environmental management system (EMS); hence, they become more committed to enhancing their environmental performance. Furthermore, large firms are more

visible to external stakeholders and possess the necessary resources to invest in pollution abatement and prevention technologies; therefore, they are keen to adopt a behavior that portrays them as environmental leaders. Finally, they argue that firms belonging to some manufacturing industries (for example, the chemical industry) have a history that could be best described by high levels of pollution; meaning that these firms would attempt to improve their environmental performance to signal a change in their behavior and enhance their negative public image.

4.2. The objectivity of environmental disclosures: Positive vs. Negative Disclosures

Measurement and reporting

Classifying environmental disclosure as negative news is ambiguous since there is a lack of event studies to inform us how the market reacts to the different disclosure themes. Patten & Crampton (2004) rely on the definition of Deegan & Rankin (1997) who describe negative disclosures as "disclosures that present the company as operating to the detriment of the natural environment". Table-6 provides a list of themes classified as negative disclosures in different research studies.

Reliability of disclosing negative information

Research on environmental disclosure motivation examines the avoidance of negative disclosures or counterbalancing negative information using positive or neutral disclosures (see Deegan & Gordon, 1996; Deegan & Rankin, 1996; Hughes et al., 2000; Patten & Crampton, 2004; Rockness et al., 1986). Although conservatism is a major attribute of financial reporting (Ball, et al., 2000; Basu, 1997), research findings suggest that environmental reporting is more biased towards the disclosure of good news. Proponents of the legitimacy theory are concerned that firms are using environmental disclosure as a self-laudatory tool.

Patten & Crampton (2004) explore the motivation of firms to disclose environmental information using a content index that examines the amount of negative and positive disclosures in annual reports and corporate websites. They find that there is a positive association between the amount of positive and negative environmental disclosures in both media meaning that firms try to offset the impact of negative disclosures by providing more positive information. These findings contribute to the argument that firms try to legitimize their operations using environmental disclosures.

Deegan & Gordon (1996) show that Australian firms are biased towards reporting good news. They examine the objectivity of annual report disclosures made by 197 firms during the period ranging from 1980 to 1991. They first find that only 71 firms make any kind of environmental disclosure. Most importantly, they find that the amount of positive disclosures outweigh the negative ones in the annual reports. By examining the trend, they conclude that firms increase the amount of negative disclosures in their 1991 reports compared to their 1988 disclosures. However, they observe that the amount of positive disclosures have exponentially increased over the same period. Deegan & Gordon (1996) find that the increase in environmental disclosure during the period from 1988 to 1991 coincides with increased membership in environmental groups. Therefore, it appears that firms increase the amount of negative news in their annual reports following scrutiny from environmental groups; meanwhile, they also increase the amount of positive disclosures in order to counterbalance the effect of negative disclosures.

Deegan & Rankin (1996) examine the objectivity of Australian reporting for a list of twenty firms that are prosecuted for violating environmental laws. Their findings show that firms that have negative news to disclose are still biased towards the disclosure of positive

information. Only six firms reported negative information in their annual reports and the mean number of words related to positive information outweighs that of negative information disclosed. Deegan & Rankin (1996) suggest that firms attempt to counter the negative environmental disclosures with more positive ones.

Hughes et al. (2000) examine the 1992 annual report disclosures of firms classified by Fortune magazine as environmental leaders and laggards. They find that both types of firms provide negative information like litigation or fines in the mandatory sections of the annual report such as the footnotes or the MD&A; meanwhile, they use the voluntary disclosure sections of the report, narrative section and president letter, to provide positive disclosures about the firm's environmental policies and efforts. These findings imply that firms disclose negative news because they are compelled to do so; however, they attempt to counterbalance the negative disclosures by portraying an environmentally friendly image of the company in less- regulated sections.

Rockness et al. (1986) suggest that firms avoid the disclosure of negative environmental information. They examine the disclosures of 21 chemical companies involved in Superfund sites during the period from 1980 to 1983. Rockness et al. (1986) find that the sample firms avoid mentioning their involvement in Superfund sites in their annual reports. From a sample of 21 firms, only 13 firms disclosed any environmental information in their 1980 annual reports and 11 firms did so in their 1983 reports. Among the firms who chose to disclose environmental information, only three firms with the least number of sites stated their involvement in Superfund sites. A firm like DuPont who is involved in 21 Superfund sites did not mention this fact in its annual report. Surprisingly, in their footnote about contingent liabilities, which is a mandatory form of disclosure, no firm reported a contingent liability related to Superfund sites. On the other

hand, most of the firms emphasized their environmental efforts by disclosing their environmental capital expenditures. Finally, Meng et al. (2014) finds that Chinese firms with poor environmental performance refrain from disclosing negative information such as their exposure to environmental penalties, violating environmental standards, or the existence of environmental risks.

Summary

Increasing disclosure per se is not the sole purpose of reporting as long as the information disclosed is biased. Therefore, based on the findings of prior research, the balance between negative and positive disclosure is a dimension to consider in future research since it provides an indication about firm's incentives to disclose. Previous research suggests that firms disclose negative information only when they are mandated to do so and that they use positive disclosures to offset the effect of negative information.

Table 6 – List of Themes Classified as Negative Disclosures

Authors	Themes	
(Deegan & Gordon, 1996)	• Company in conflict with the government view on its environmental activities. • Admission of causing environmental, including health-related, problems for residents through the company's environmental activities. • Explicit admission of excessive polluting emissions. • Company encountering waste disposal problems.	• Government investigation into, and court action concerning, the company's environmental activities. • Acknowledgment of detrimental effects of activities on the land. • Admission of environmentally based community or media sensitivity to the industry or firm. • Non-compliance with regulations. • Admission of past problems with the company's environmental activities.
(Deegan & Rankin, 1996)	• The buildup of a restricted chemical compound • Inability to rehabilitate mine sites following closure.	• Admittance that environmental performance is less than acceptable. • Adverse publicity relating to plant malfunctions or human errors which have potentially harmed the environment.

(Hughes et al., 2000)	*Economic factors* • Past and current expenditure for environmental equipment, facilities, and remediation and operating costs. • Future estimates of expenditures environmental equipment, facilities, and remediation and operating costs. • Accrued liabilities for future environmental expenditures. • Mentioned with other items.	*Litigation* • Pending litigation. • Litigation settlement. • PRP status cited. • Number of sites. • Number of other PRPs. • Estimated costs.
(Patten & Crampton, 2004)	• Discussion of exposures due to past or present remediation problems. • Specific disclosure that the company has been named as a potentially responsible party.	• Disclosure of monetary accruals and/or expenses incurred for remediation. • Discussion of exposures due to other, non-remediation-related environmental problems

4.3. The specificity of environmental disclosures: Quantitative vs. qualitative disclosures.

Ingram & Frazier (1980) classify environmental disclosures according to the specificity of the information disclosed. Furthermore, many researchers put more weight on numeric information (whether quantitative or economic information) since this type of information is easier to integrate into investment decisions; which makes it more relevant to investors (Wiseman, 1982; Cho & Patten, 2007; Aerts & Cormier, 2009). Prior research mainly focuses on comparing the disclosure of economic information to that of non-economic information. Aerts & Cormier (2009) examine the determinants of annual report environmental disclosures for a sample of US and Canadian firms. The authors distinguish between two categories of disclosures: economic and social based information. They find that industry membership is positively associated with disclosure where firms in environmentally sensitive industries disclose more economic and social information than those in non-environmentally sensitive industries.

They also find that firms' news exposure – measured by the number of articles about the firm's environmental performance - is positively associated with both types of disclosure. They find that Canadian firms disclose less economic information in comparison to US firms. This finding suggests that the difference between the regulatory environment in Canada and the US contribute to the disclosure practices in both countries.

Relevance and reliability of quantitative and qualitative disclosures

Using a sample of US and Canadian firms, Aerts & Cormier (2009) find that firms with low-environmental performance disclose more social information but not economic information. In contrast, Cho & Patten (2007) examine the disclosure of monetary vs. non-monetary information in 10-K reports. The authors suggest that the disclosure of monetary information is associated with higher levels of proprietary costs in comparison to non-monetary information; therefore, firms will only disclose monetary information if the benefits of doing so outweigh the costs. They find that – for the sample of firms in environmentally sensitive industries – the average disclosure of monetary information of the low-performers is higher than that of the high performers. They return their findings to the benefits of disclosing sensitive information in legitimizing the firm's operations. They claim that the incentive is higher for the low-performers in comparison to the high-performers. However, the authors could not find a difference between the samples of low and high performers when examining their disclosure of non-monetary information. They claim that the proprietary cost of disclosure for this type of information is low inducing the low and high performers to disclose.

Moneva & Cuellar (2009) examine the value relevance of financial and non-financial environmental information for a sample of listed Spanish companies. Using Ohlson (1995) market valuation model, they find that the market integrates the disclosures of financial

information in their assessment of the firm's market value of equity. Meanwhile, they also conclude that there is no association between the disclosure of non-financial information – such as the disclosure of information about the firm's environmental policy or environmental management system - and the firm's market valuation. Moneva & Cuellar (2009) also find that tightening of regulation – following the introduction of the 2002 standards for disclosure of environmental information increased the value relevance of financial disclosures.

Aerts & Cormier (2009) examine whether the disclosure of economic and social information has an impact on the firm's media legitimacy. Environmental media legitimacy measures whether firms are perceived positively or negatively by the media; therefore, it could be considered as a measure of acceptance of the firm's environmental performance or – alternatively – a measure of the threat to the firm's legitimacy. The authors posit that enhanced environmental disclosure is an antecedent to higher media legitimacy. The authors find that the disclosure of economic information positively impacts the firm's media legitimacy but could not find a similar association between social disclosures and media legitimacy. These findings are aligned with the findings of Cho and Patten (2007) suggesting that firms disclose more sensitive information to restore their legitimacy.

Using the economic and legitimacy frameworks, Cormier & Magnan (2013) examine the impact of firms' environmental disclosures on analyst forecasts and firms' media legitimacy. They regroup firms' disclosures into two categories: economic related disclosures and sustainable development and environmental management disclosures. They find that both economic and sustainability disclosures improve analysts' forecast and reduce their uncertainty. They also find that both types of disclosures reduce analyst consensus for firms with low environmental performance and firms operating in environmentally sensitive industries. Their

latest findings imply that the financial market perceives disclosures made by firms with high levels of performance or firms operating in environmentally less-sensitive industries as more indicative of their environmental performance. Furthermore, Cormier & Magnan (2013) also find that both economic and sustainability disclosures improve firms' media legitimacy – measured by the Janis-Fadner coefficient – which subsequently increases analyst consensus and reduces forecast uncertainty. The findings of Cormier & Magnan (2013) suggest that firms' environmental legitimacy has an impact on firm value and provides reconciliation between two views – economic and legitimacy theories – explaining firms' disclosure decision.

4.4. Mandatory vs. voluntary disclosures

Berthelot et al. (2003) provide a thorough review of mandatory and voluntary environmental disclosures. Their study suggests that both types of disclosures were relevant to the financial markets but the authors cast their concern over the reliability of the information disclosed. The different measures of mandatory and voluntary disclosures are presented in previous section and will be discussed further here.

This study provides a review of the main measures of mandatory and voluntary disclosures. The study shows the extent to which the disclosure of environmental expenditures, liabilities and litigations, and pollution abatement information is regulated by the SEC and FASB. As mentioned earlier, there are concerns that firms have a lot of discretion over the reporting of mandatory information by applying their judgment of whether the information is deemed relevant enough to be reported or not (GAO report, 2004). On the other hand, the study reviews two measures of voluntary disclosures – environmental performance indicators and governance and environmental management information – which are primarily disclosed in

standalone reports. With the issuance of reporting guidelines –such as the GRI- the question is whether firms complied with the requirements of these guidelines or not.

The study shows that – with the evolution of disclosure regulations – firms have continuously attempted to comply. For example, recent studies (Cho et al., 2012; Alciatore et al., 2004) report cases where firms over-complied with regulations and disclosed immaterial information. On the other hand, there is evidence that the voluntary disclosure of environmental information in standalone reports is still very low in comparison to the requirements under the reporting guidelines such as the GRI (Clarkson et al., 2008; Mordhart et al., 2002).

Berthelot et al. (2003) conclude that both mandatory and voluntary disclosures are not reliable enough based on the association between disclosure and firm environmental performance. The Berthelot et al. (2003) review did not include the impact of reporting guidelines such as the GRI guideline issued in 2002. Following the issuance of the GRI guideline many firms adopted the guideline to design their environmental reports. Clarkson et al. (2008) examine the reliability of environmental information disclosed in standalone sustainability reports and finds that firms with high levels of environmental performance disclose more information than the low-performing firms. The results suggest the low-performing firms may not want to reveal their true environmental performance beyond what is required by regulatory requirements.

On the contrary, using a sample of Australian firms, Clarkson et al. (2011b) find a negative association between firms' environmental disclosures in GRI reports and firms' environmental disclosures. They suggest that these findings are consistent with socio-political theories that predict that firms with low-environmental performance will use their environmental disclosures to legitimize their operations. They also find that the amount of hard disclosures

(verifiable information) included in low-performers' reports are higher than those disclosed by the sample of high-performing firms. The results of Clarkson et al. (2011b) fuel the debate between proponents of economic theory and those of legitimacy theory about firms' incentives to disclose environmental information. It also provides opportunities for research on the differences in voluntary disclosure practices at country level.

Finally, Berthelot et al. (2003) provide evidence that both mandatory and voluntary disclosures are value relevant. Recent research by Cormier & Magnan (2013) finds that both mandatory and voluntary disclosures are valued by the financial market as they increase analysts' consensus and reduces forecast's uncertainty. However, they also find that both measures of voluntary and mandatory disclosures reduce analysts' consensus for firms with low-environmental performance or firms located in environmentally sensitive industries implying these disclosures are not representative of firms' environmental performance.

In this review, I also extend the relevance of environmental disclosures to matters beyond financial relevance. Prior research shows that environmental disclosure is associated with subsequent environmental performance. For example, Mobus (2005) finds that the disclosure of mandatory information – mostly negative information in nature - is associated with improved future environmental performance. Using the legitimacy framework, Mobus (2005) explains that the fact that firms are obliged to disclosure induces these firms to improve their performance to comply with societal expectations. These findings suggest that mandatory environmental information is also relevant to different stakeholders who are mainly concerned about the levels of pollution and not the firm's financial performance.

5. Discussion

This review contributes to our knowledge of the different types of environmental information disclosed, as well as the regulation and the guidelines that shaped these disclosures. It also provides researchers with a list of the different measures of environmental disclosure used in prior studies. The study provides a review of five environmental themes: environmental capital expenditures, environmental liabilities, pollution abatement, environmental performance indicators, and governance and management systems. It also provides a review of four dimensions that could be utilized to assess the comprehensiveness of disclosure. There are other themes of environmental disclosure – not included in this study - that provide opportunities for future research. For example, there is still a need for more research on how to measure and report compliance with environmental regulation and whether the information disclosed is value relevant. For example, a study by Bhat (1998) finds that compliance with environmental regulations – measured by the amount of environmental penalties - is associated with higher levels of profits, negating suggestions that stringent environmental regulations would lead to a decline in firms' profitability. Similarly, there is also a need for more research on many types of environmental information such as firms' vision and strategy (Clarkson et al., 2008) and firms' environmental profile including an assessment of industry's environmental performance (Clarkson et al., 2008; Marshall & Brown, 2003). Although, these themes were included in different content indexes, there is no research to inform us about what information needs to be disclosed, how the stakeholders value these disclosures, and whether firms report this information objectively.

The main theoretical contribution of this review study is that it reconciles the tension between two theories – legitimacy and economic theories – that explain the disclosure decision

of environmental information and shows that disclosure of environmental information could not be attributed to one single theory. Over the years, environmental regulation (Alciatore et al., 2004; Stanny, 1998; Freedman and Jaggi, 2005; Prado-Lorenzo et., 2009), internal institutional factors such as the adoption of an environmental management system (Rankin et al., 2011), economic demand for environmental information (Li et al., 1997) and firms' need to legitimize their environmental operations (Cho et al., 2012) have all played roles in firms' disclosure decision and influenced the amount and type of information disclosed. The study shows that any assessment of corporate environmental disclosures should not be performed in a comprehensive manner; otherwise, it may lead to doubtful conclusions on why firms release their proprietary information.

In fact, different types of environmental information could be disclosed to achieve different goals. For example, a review of research on the disclosure of environmental liabilities shows that economic factors are main determinants of firms' disclosure decision. As found by Li et al. (1997), the importance of the information – based on the firm's propensity to pollute – and the perceptions of shareholders about the amount of information withheld by the firm lead firms to disclose more information. The firm's exposure to higher litigation cost lowers the disclosure threshold which explains why firms avoid full disclosure. However, it seems that partial disclosure is not an effective legitimization tool since investors are actively engaged in searching this type of information and that they usually overvalue the firm's environmental liabilities than that disclosed by the firm (Barth & McNichols, 1994; Campbell et al., 2003). There is evidence that partial disclosure of firms' environmental liabilities is still an effective tool to reduce investment risk (Campbell et al., 2003).

In comparison, prior research does not provide an economic model to explains why firms disclose environmental expenditure information albeit the fact that this information is valued by the financial market (Clarkson et al., 2004; Johnston, 2005). However, the low reliability of forecasted capital expenditures - high spread between forecasted and actual amounts - (Patten, 2005) and the lack of significant association between actual environmental expenditures and future environmental performance (Cho et al., 2012) suggest that the disclosure of environmental capital expenditures is used as a legitimization tool to provide the impression that firms are allocating funds to improve their environmental performance. Nevertheless, there is a lack of research on the effect of disclosing environmental expenditures on firms' legitimacy and whether this type of disclosure is an effective legitimization tool.

Meanwhile, there is no model to examine the determinants of environmental governance and management system disclosures. There is little or no evidence that the existence of these structures has improved environmental performance or that investors are able to integrate this type of information in their investment decisions. On the contrary, the few studies about this type of disclosure suggest that firms disclose environmental governance and management information to portray an image that the firm is concerned with corporate social and environmental responsibilities (Rodrigue et al., 2013). There is still a need for more research on this type of disclosure to confirm whether it is used by firms as an impression management tool or whether the information disclosed has real economic value.

In brief, legitimacy and economic theories both play a role in explaining the disclosure of different types of environmental information. The extent to which each theory explains the corporate disclosure of environmental information depends on the type of information disclosed. On one hand, research shows that market demand for environmental liabilities motivates the

disclosure of such information and that this type of disclosure could not be used as an effective impression management tool since, in the absence of disclosure, investors will engage in active search for information. On the other hand, there is little evidence to suggest that the disclosure of firm's governance and management system information has an economic value which may suggest that the disclosure of such information is mainly influenced by legitimacy factors.

I would also like to highlight that regulation has played a major role in shaping the disclosure of environmental information (see Stanny, 1998; Alciatore et al., 2004; Moneva & Cuellar, 2009). The SEC and FASB have continuously issued new regulations to enhance the reporting of financial implications resulting from firms' environmental performances such as the disclosure of environmental liabilities, fines and litigation, environmental capital expenditure, and descriptive information related to the firm's environmental risk. Research shows that regulations increase the value relevance of environmental disclosures since it provides a signal that these disclosures contain information about the firm's future cash flow. Moreover, firms have a lot of discretion over the assessment of whether the information is deemed relevant enough to be reported or not. Previous studies show that new regulations resulted in reducing this discretion. For example, Alciatore et al. (2004) find that firms with lower levels of environmental liabilities and capital expenditures started to disclose their private information following the issuance of SAB 92 and FRR 36.

Furthermore, many studies suggest that regulation of firms' environmental performance has also increased the value relevance of voluntarily disclosure. For example, Prado-Lorenzo et al. (2009) and Freedman and Jaggi (2005) find that the disclosure of GHG information was higher in countries that ratified the Kyoto Protocol in comparison to non-ratifying countries;

implying that firms realize that the information is more relevant when they become subject to higher threat of litigation.

The study shows that there are still concerns over the measurement and reporting of quantitative disclosures like firms' discretion vis-à-vis the aggregation or disaggregation of these measures; an issue that firms have been using to manipulate the information reported and present the firm's environmental performance in a positive light. For example, firms may choose to disaggregate their environmental liabilities in order to avoid the thresholds at which reporting becomes mandatory (GAO report, 2004). Meanwhile, firms may choose to aggregate their environmental performance indicators at the firm-level rather than the site-level to avoid reporting incidents where performance is not meeting expectations. Therefore, there is a need for more guidelines or regulations about the required level of aggregation/disaggregation to prevent firms from manipulating the information disclosed.

Another issue that could be of interest to academics is the difference in value relevance between the different disclosure themes and how it impacts environmental disclosure research that use content indexes. For example, Clarkson et al. (2004) show that the market positively values the disclosure of environmental capital expenditures for low-polluting firms while environmental liabilities are found to be negatively associated with firm value (Campbell et al., 2003). These findings cast doubt about the usefulness of content indexes in valuation studies and how to interpret their findings knowing that the index is composed of themes that may be valued differently by the market.

There are many issues to be addressed in future research to improve our understanding of environmental disclosures. In general, environmental disclosures could either be classified as output measures of the firm's environmental performance - such as financial and non-financial

indicators - or input measures to this performance - such as the firm's governance and management systems in place. This review of environmental disclosure studies shows that there is a shift from early research of financial indicators (environmental liabilities, expenditures, etc.), followed by research of non-financial indicators, to research of how firms internally manage their environmental operations. This development suggests that, over time, stakeholders have been demanding more information - beyond financial and non-financial disclosures – about firms' management. The study indicates that there is an ambiguity in defining firms' environmental governance and management structures and the link between these structures and firms' environmental performance. There is also a need to understand how stakeholders process information about firms' environmental management and how it impacts their assessment of firms' environmental performance.

Finally, there is a need for more research of the time dimension of environmental disclosures. First, researchers need to be able to classify disclosures according to their time orientation and whether the disclosure is a reflection of past performance or an indication of future performance. Second, research studies need to examine the reliability of future-oriented environmental disclosures and whether these disclosures are reflected in an improved performance or not. Third, valuation studies need to separate past and future oriented disclosures and to examine the value relevance of each component separately since the risks associated with those two types are different.

Chapter 3 – Reexamining the Association between Environmental Disclosure and Environmental Performance

1. Introduction

Whether firms' environmental disclosures are informative and reliable or elusive and opportunistic is an unresolved question in accounting research. Researchers attempt to answer that question by investigating the association between a firm's environmental disclosure and environmental performance and by assessing the motivations of firms to disclose such information. Finding an association between environmental disclosure and environmental performance casts doubt on the reliability of environmental reporting (Berthelot et al, 2003) and provides support for increased regulation and higher level of reporting standards' enforcement.

Previous studies find contrasting results about the incentives of firms to disclose environmental information and whether the information disclosed is representative of this performance. Some studies suggest that firms with high environmental performance disclose more environmental information due to the economic benefits emanating from the positive news integrated in their disclosures (Al-Tuwaijiri et al., 2004; Clarkson et al., 2008). Other studies find that firms with low-environmental performance disclose more information to mitigate the scrutiny from outside stakeholders and maintain the legitimacy of their operations[20]. These findings suggest that we cannot determine firm's environmental performance based on the disclosure magnitude. Alternatively, research finds that firms' size and industry membership

[20] See Cho & Patten (2007), Fekrat et al. (1996), Guthrie & Parker (1989), Hughes et al. (2000), Hughes et al. (2001), Patten (2002), Rockness et al. (1986), Rockness (1985).

explain firms' environmental disclosure; whereas large firms and firms operating in environmentally sensitive industries disclose more information (Patten, 2002; Cho et al., 2012). I reckon that prior research involves some theoretical and methodological issues that lead to the controversy. Therefore, I reexamine the association between environmental disclosure and environmental performance[21] to determine if firms' environmental disclosures are biased and understand the reasons behind partial reporting.

1.1. Motivation for examining the association between environmental disclosure and environmental performance

In this essay, I suggest that the contrasting findings of prior research are due to two main reasons:

1. There is a lack of understanding about the motivations of the high and low-performers to disclose environmental information; which is fundamental to assess the credibility of the information disclosed.
2. Prior research, examining environmental disclosure in different media such as annual, 10-K, or sustainability reports, disregards the disclosure requirements and the level of enforcement associated with these media; thus, rendering the findings of prior research incomparable.

From a theoretical point of view, previous studies present two polarizing views of firms' incentives to disclose environmental information. Using a legitimacy theory framework, some studies suggest that low-performers disclose more environmental information to legitimize their

[21] For the purpose of this study, I used the KLD ratings as a measure of environmental performance. KLD ratings provide a general assessment of the firm's environmental operations, recycling activities, energy consumption, emissions, products, environmental strategy and management, and others.

actions in response to public pressures (Fekrat et al., 1996; Hughes et al., 2000; Hughes et al., 2001; Neu et al., 1998; Patten, 2002; Walden & Stagliano, 2004). On the other hand, Al-Tuwaijri et al. (2004) and Clarkson et al. (2008) find that economic benefits of disclosure drive high performing firms to disclose more information. For now, research is still inconclusive on what are the main drivers of environmental disclosure. None of these studies provide empirical evidence about the determinants of environmental disclosure for the high and low performing firms; they use the association between environmental disclosure and environmental performance to infer firms' motivation to disclose.

These polarized views contradict the findings of other studies showing that both economic and legitimacy incentives explain the environmental disclosures of firms (see Aerts & Cormier, 2009; Aerts, Cormier, & Magnan, 2008; Cormier et al., 2005; Cormier & Magnan, 1999; Cormier & Magnan, 2003; Neu et al., 1998). In this study, I attempt to fill this gap in the literature about the association between disclosure and performance by studying the motivation of firms with low and high environmental performance to disclose their proprietary environmental information. This study also extends the work by (Aerts & Cormier, 2009; Cormier et al., 2005; Cormier & Magnan, 1999; Cormier & Magnan, 2003; Neu et al., 1998) by testing their environmental disclosure models using samples of firms with different levels of environmental performance.

Second, the contradicting findings of previous studies may be due to measuring environmental disclosure in different media (Cho et al., 2012). There is little consensus between researchers about the importance of each media in disclosing environmental information. While some scholars focus on annual reports as the primary source of environmental information (see Neu et al., 1998); others consider disclosures made in 10-K reports or sustainability reports (Al-

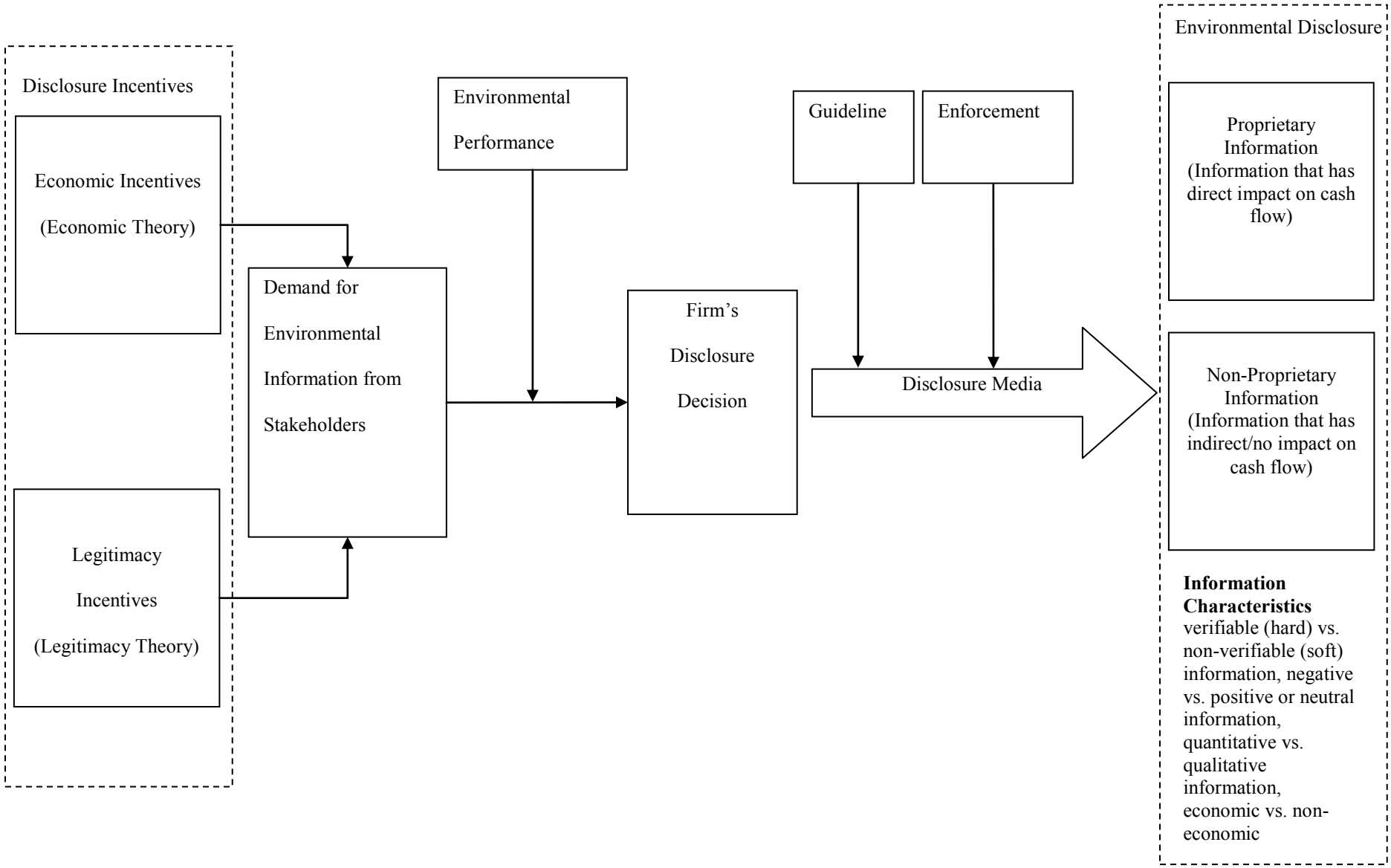
Tuwaijri et al., 2004; Clarkson et al., 2008). There are differences between the disclosure requirements and the level of enforcement associated with these media – as shown in Appendix A. Hope (2003) emphasizes the importance of enforcing accounting standards and states that enforcement is equally important to the standards themselves. He finds that enforcement leads to firms respecting accounting rules. Previous studies on the association between disclosure and performance measure environmental disclosures in either annual, 10-K, or sustainability reports; thus; rendering their results difficult to compare In this study, I investigate the association between disclosure and performance in each disclosure media to understand how the different disclosure requirements and different levels of standards' enforcement influence the firm's disclosure decision and hence reflect on the relation between disclosure and performance. By comparing disclosures in different media, I believe that this study contributes to the ongoing debate about whether more regulatory requirements and higher levels of enforcement are required or not.

In an attempt to explain the association between disclosure incentives, environmental performance, disclosure channels, and environmental disclosure, Figure-1 presents a proposed disclosure model. Firms' environmental disclosures are motivated by the economic and legitimacy incentives of disclosure (Aerts & Cormier, 2009; Cormier et al., 2005; Cormier & Magnan, 1999; Cormier & Magnan, 2003; Neu et al., 1998). Verrecchia (1983) suggests that economic incentives – or costs-and-benefits of disclosure - are derived by demand for environmental disclosure from the firm's financial stakeholders such as investors, creditors, or other stakeholders who require information on how the firm's environmental performance impacts its cash flow. In other words, low demand for environmental information implies that the costs of disclosure would outweigh its benefits and the firm may decide to refrain from the

disclosure of its private information. I suggest that both the economic and legitimacy incentives are moderated by the firm's environmental performance. In other words, the level of performance would determine the sensitivity of the information and hence the benefit and cost of disclosure. Furthermore, the level of environmental performance would determine firms' need to defend the legitimacy of their operations if it becomes questioned by non-financial stakeholders (stakeholders interested in understanding the harm caused by firms' operations to the environment such as environmentalist groups, the general public, or regulators). Hence, based on its economic and legitimacy incentives, firms make a careful decision whether to disclose or not (the amount of disclosure) and what to disclose (the amount of proprietary information disclosed).

To communicate its environmental information to the financial and non-financial stakeholders, firms use the available communication media (annual reports, 10-K reports, sustainability reports, websites, or others). Some of these media are guided by disclosure requirements (for example annual reports, 10-K reports, or GRI guided sustainability reports) and different levels of enforcement of shareholders' protection laws. The disclosure guidelines and enforcement levels provide further moderation to the disclosure decision and determine the outcome environmental disclosure (Hope, 2003; Kothari, 2000). In this case, the outcome disclosure could be measured by the amount of disclosure and the level of disclosure of proprietary information. Therefore, the association between environmental disclosure and environmental performance captures the level of bias in the low and high performing firms' disclosures due to the effects of economic and legitimacy factors.

Figure-1: Environmental Disclosure Model



1.2. Objective of this study

In this study, I examine the motivation of firms with low and high environmental performance to disclose – or retain - their proprietary environmental information. I also reexamine the association between disclosure and performance to assess the credibility of environmental disclosures and whether they are representative of the firm's environmental performance. To achieve this objective I conduct three levels of analysis.

First, I study the information disclosed in annual reports, 10-K reports, and sustainability reports over the period from 1997 to 2010. The objective of this analysis is to understand the type of information disclosed in each medium and to determine if it is necessary to consider the disclosures made in the three media when studying the association between disclosure and performance – the results of this analysis are presented in Appendix E.

Second, I reexamine the association between environmental disclosure and environmental performance in a setting that addresses previous methodological shortcomings in measuring environmental disclosure. For a better definition of environmental disclosure, I use a multi-dimensional disclosure index that combines the different disclosure themes in prominent studies by Aerts et al. (2008), Clarkson et al. (2008), Patten & Crampton (2004), Walden & Stagliano (2004) and Wiseman (1982). This disclosure index measures the amount of disclosure by the number of environmental topics disclosed (defined as total disclosure). Since total disclosure is an aggregate measure, I use additional measures to proxy for the level of proprietary and non-proprietary information in total disclosure. These measures include the disclosure of verifiable versus non-verifiable information (hard vs. soft information), the disclosure of negative versus positive information, and the disclosure of quantitative versus qualitative information. In

addition, I consider the disclosure of economic information; a type of disclosure that should be relevant to the firm's investors. The study considers environmental disclosures made by a sample of 78 firms during the period from 1997 to 2010 to capture the continuous variation in disclosure. I conduct this analysis on the information disclosed in annual, 10-K, and sustainability reports separately and on the information disclosed in the three reports combined.

Third, I examine whether firms' incentives to disclose environmental information differ between groups of firms with low and high environmental performance. In other words, prior research shows that economic costs and benefits and legitimacy incentives influence the disclosure decision of firms. However, the question remains whether these factors have the same influence on the disclosure decision of both low and high environmental performers. To answer this question, I extend previous analysis and study how economic and legitimacy factors influence environmental disclosures of low and high performing firms using a disclosure model based on the findings of previous research (Aerts & Cormier, 2009; Aerts et al., 2008; Cormier & Magnan, 1999; Cormier & Magnan, 2003; Neu et al., 1998).

1.3. The importance of this research question

Environmental information is valued by investors since low-environmental performance entails large costs for firms to comply with regulations (Belkaoui, 1976; Ingram, 1978; Jaggi & Freedman, 1982; Jaggi & Freedman, 1992; Clarkson et al., 2004; Johnston, 2005; Spicer, 1978). Therefore, environmental disclosures should be indicative of the firm's environmental performance making the association between disclosure and performance indispensable for financial markets to remain efficient.

More specifically, mapping between environmental disclosure and performance is fundamental for the growth and survival of the relatively new socially responsible investment (SRI) market with many investors mulling over channeling their funds into sustainable firms (Lewis, 2001). Listed firms in that market need to show commitment to sustainability issues to avoid higher financing costs (Heinkel, Kraus, & Zechner, 2001). The SRI market is still at an early growth stage and there are difficulties understanding the basis of inclusion of firms into these stock indices. Ziegler & Schröder (2010) suggest that the Dow Jones sustainability indices rely on financial indicators in order to qualify firms for inclusion. If true, it may cast doubt about the performance of social indices and whether listed firms exhibit the desired social and environmental performance. Environmental disclosure may provide an assurance to investors that these firms are more committed to sustainability issues. Understanding the association between a firm's environmental disclosure and its environmental performance – as well as understanding firms' disclosure incentives - provides assurance to shareholders that investments are efficiently channeled; such investment efficiency is important to sustain the growth of that market and help firms avoid under-pricing (Akerlof, 1970).

1.4. Contributions

This study contributes to the environmental disclosure literature in many ways. First, it fills a gap in the literature by extending previous economic-based disclosure models (e.g. Cormier & Magnan, 1999; Cormier & Magnan, 2003) to understand whether they explain the incentives of the low and high performing firms to disclose environmental information. There has been a continuous debate between proponents of economic theory who suggest that corporate environmental disclosure is fuelled by shareholders' demand for information and advocates of legitimacy theory who believe that it is an opportunistic practice adopted by firms that aim for

maintaining their legitimacy by providing a colorful picture of their environmental operations (Cormier & Magnan, 2011). To contribute to the debate, this research examines the incentives of firms with high and low environmental performance to disclose their proprietary environmental information. The findings of this research do not support the cynical view that environmental reporting is an opportunistic practice that is solely meant to portray firms' environmental activities in a positive light. In contrast, it provides assurances over the integrity of the disclosure process and suggests that – at least – mandatory disclosures are free of bias.

In brief, the results of this study provides investors and regulators with empirical evidence that environmental disclosures of low-performing firms comply with regulatory disclosure requirements; however, they have less propensity to voluntarily disclose information about their environmental operations. The findings of this study also show that the presence of environmental guidelines encourages firms with high-environmental performance to voluntarily reveal proprietary information; thus, regulators should increase the adoption of these guidelines to eliminate discrepancies between the disclosures of high and low-performing firms.

Second, the study provides a thorough analysis of environmental disclosures over a period of fourteen years - from 1997 to 2010. During this period, the environmental disclosure process witnessed many changes including an increase in the publication of stand-alone environmental reports and the adoption of voluntary reporting guidelines (e.g. Global Reporting Initiative – GRI). Furthermore, this is the first study to examine and compare disclosures in annual reports, 10-K reports and sustainability reports. The findings of this research show that annual reports are not the primary media of disclosure environmental information; thus, future research should embody disclosures in 10-K reports and sustainability reports. It also raises

questions for future research about the role of annual reports and whether it is still an important source of environmental information.

Furthermore, the results of this study highlight the importance of regulatory enforcement of disclosure guidelines in reducing firms' discretion over the reporting process. For example, the lack of significant difference between the 10-K reports' disclosures of firms with high and low environmental performance suggesting that increased SEC scrutiny may lead to a reduction in firms' discretion over information reported.

Finally, Hausman & Taylor (1981) emphasize the importance of controlling for unobservable effects such as firm or time specific effects; which is a shortcoming of cross-sectional and longitudinal analysis. By controlling for some of a firm's specific effect such as industry membership, Patten (2002) was able to achieve different results from those presented by early research on the association between environmental disclosure and environmental performance. However, I argue that Patten (2002) neither provides full control of all firms' unobservable effects – due to a lack of required degrees of freedom to control for each firm - nor does he control for time specific effects which is also a shortcoming of cross sectional studies. The results of the panel data analysis – employed by this study – shows that there are significant firm and time specific effects. By controlling for these effects, this study provides more credible results about the association between environmental disclosure and environmental performance.

1.5. Structure of the study

Section 2 is a literature review of prior studies that examine the association between environmental disclosure and environmental performance. In this review, I present the conflict between the results of the different studies and analyze the shortcomings that led to this

controversy. In this section, I also provide the hypothesis development. In section 3, I present the disclosure model used to examine the association between disclosure and performance and the methodology employed. In section 4, I show the results of this study. I present a descriptive study of the information disclosed in annual reports, 10-K reports, and sustainability reports as well as the development of environmental disclosures during the fourteen years between 1997 and 2010 (details are presented in Appendix E). I also present the results of studying the association between environmental disclosure – in all three reports – and environmental performance. Finally, I present the results of studying the incentives of the two groups of firms to disclose their information to understand whether the drivers of disclosure differ between the low and high performers. Section 5 discusses the results and provides recommendations.

2. Literature Review and Hypothesis Development

2.1. Disclosure of environmental information

According to previous research on the determinants of environmental disclosure, firms' decision to disclose their proprietary environmental information is better explained by economic and legitimacy theories. Firms need to simultaneously satisfy the information needs of their financial shareholders – who demand to know how the firms' environmental performances affect future cash flows - while maintaining the legitimacy of their operations in the eyes of the non-financial stakeholders who are primarily interested in understanding the impact of firms' operations on the environment (Cormier & Magnan, 2013).

Economic theory suggests that the demand for environmental information originates from the firm's current and potential investors and from its outside stakeholders. Investors demand the disclosure of all relevant information that affects their investment decision. To determine

their disclosure policy, firms evaluate the costs and benefits of that disclosure. Diamond (1985) suggests that in the absence of information, traders will get involved in private information gathering which increases the cost of trading. Therefore, by releasing its private information, firms benefit from reducing the cost of information gathering for all traders, increase their marginal utility and improve the trading process. Similarly, Botosan (1997) finds that higher levels of voluntary disclosure are associated with lower levels of cost of capital. She suggests that voluntary disclosure reduces the transaction cost related to private information gathering which increases the demand for the security; thus, increasing the price of the security and reducing its cost of capital.

On the other hand, Verrecchia (1983) associates the disclosure of proprietary information with the cost of disclosing proprietary information that is potentially threatening to the firm's competitive position. In that case, the market may react less-negatively to the withholding of the proprietary information which will induce the firm to adopt a non-disclosure policy. For example, Scott (1994) finds that disclosure of pension plan information is negatively associated with costs associated with increased scrutiny from labor unions.

Most importantly, Verracchia (1983) suggests that the firm's disclosure policy – decided by the costs and benefits of disclosure - is determined simultaneously with the investor's demand for information. For example, Botosan (1997) finds that there is no association between disclosure and cost of capital for firms with higher analyst following. This finding may imply that higher analyst following provides a substitute for the firm's disclosure; thus, reducing the demand for the disclosure of private information. In the case of environmental disclosure, it is difficult to determine the level of demand for each type of information disclosed. However, it could be assumed that firms with low-environmental performance possess more proprietary

information than the high-performing firms since the disclosure of this information could entail negative reaction from regulatory bodies; which could affect the firm's competing position and cash-flow.

From a different perspective, environmental performance of firms from environmentally sensitive industries may draw the attention of non-financial stakeholders; which include members of the society concerned about firms' environmental performances, environmentalists, or regulatory bodies (Neu, 1998). Pressures-to-conform from non-financial stakeholders may represent a threat to the legitimacy of the firm's operation. Proponents of the stakeholder theory assert that, depending on the level of pressure from the non-financial stakeholders, firms adopt a disclosure policy to mitigate the effect of that threat (Gray et al., 1995). Lindblom (1994) suggests that firms adopt one of three disclosure strategies to legitimize their actions. Firms may attempt (1) to inform the public, (2) to change its perceptions, or (3) to divert stakeholders' attention from its corporate actions. In the context of environmental disclosures and using the legitimacy framework, O'Donovan (2002) finds that firms may resort to four different disclosure tactics in response to strong threats to their legitimacy. They may avoid the disclosure of sensitive information, alter the perceptions of the public, alter the social values, or conform to social values and reveal their private information. In brief, legitimacy theory predicts that firms may revert to different sets of disclosure decisions to maintain the legitimacy of their operations. These different disclosure strategies were demonstrated by Falconbridge – a Canadian company working in the mining and smelting of nickel – in response to tightening of government regulations for the emissions of sulfur dioxide during the period from 1964 to 1991 (Buhr,1998).

2.2. Previous literature on the association between environmental disclosure and environmental performance

Empirical research on the association between environmental disclosure and environmental performance provide contrasting results. Proponents of legitimacy theory predict that firms disclose environmental information to maintain the legitimacy of their social contract which mandates them to provide valuable services and to operate according to accepted social norms (Deegan, 2002; Deegan, Rankin, & Tobin, 2002; Gray, Kouhy, & Lavers, 1995a; Gray, Javad, Power, & Sinclair, 2001). This group of studies finds that social and political pressures are associated with the level of environmental information disclosed (Neu et al., 1998). The second school of thoughts relies on economic theories to explain firms' incentives to disclose environmental information. They find that environmental disclosures are motivated by market forces meaning that the disclosure process is subject to economic cost and benefit analysis (Cormier & Magnan, 1999; Cormier & Gordon, 2001; Cormier & Magnan, 2003).

By examining the amount of information disclosed, previous studies try to infer whether the incentives to disclose environmental information differ between groups of low-performers and high-performers. Early studies (e.g. Fekrat et al., 1996; Freedman & Wasley, 1990; Ingram & Frazier, 1980; Rockness et al., 1986; Wiseman, 1982) do not provide conclusive results since they find very weak or almost no association between the level of environmental performance and environmental disclosures of firms by examining annual report disclosures. Patten (2002) points out some shortcomings in these studies which fail to control for firm size and industry effects.

Results of environmental disclosure research fall into three distinct categories. The first set of results suggests that disclosures of low-performing firms are elusive and aim at portraying

them the way they would like to be seen rather than what they are. Firms adopt different disclosure strategies to gain or maintain legitimacy. According to Lindblom (1994), changing perceptions of the relevant public without changing a firm's performance is among these strategies. Hughes et al. (2001) label this process as "legitimization" in contrast to "legitimacy". The latter describes a situation where the firm discloses information that reflects its true performance. For instance, Rockness et al. (1986) examine the disclosures of chemical firms involved in Superfund sites. They find that these firms refrain from disclosing information about their low-environmental performance. Only 13 firms out of 21 make annual report disclosures about the environmental waste disposal and no firms disclose their involvement in Superfund Sites. Only three firms with better environmental performance (involved in 1 or 2 Superfund sites) disclose general information about the amount of waste disposed. These findings echo those of Deegan & Gordon (1996) and Deegan & Rankin (1996) who, using a sample of Australian firms prosecuted by the environmental protection authorities, find that these firms are biased towards the disclosure of positive information about their environmental performance while concealing negative ones. Following an examination of annual report disclosures, Hughes et al. (2000) find that firms with low-environmental performance to voluntarily disclose more positive information to offset the effect of negative disclosures made in mandatory sections. Finally, Rockness (1985) finds that participants in a field experiment are not able to rank firms according to their environmental disclosures in annual reports meaning that low-performing firms were successful in altering the participants' perceptions about their performance.

The second literature relies on the notion that social pressures and the firm's need to maintain its legitimacy encourage low-performing firms to disclose more proprietary information. Patten (2002) examines the annual reports of 131 companies. Using the Toxic

Release Inventory (TRI) as a surrogate for environmental performance, Patten (2002) finds that annual report disclosure for 131 firms - using the Wiseman (1982) index and a line count - is negatively related to the level of environmental performance meaning that the low-performers tend to disclose more information about their environmental activities. Using a single disclosure score, Patten (2002) does not provide enough evidence about the level of proprietary information disclosed. Cho & Patten (2007) observe managerial actions and the decision to disclose monetary information. They find that in the sample of non-environmentally sensitive firms, i.e. those subject to less scrutiny, the low-performers tend to disclose more non-monetary information than their matched sample of high performers. Meanwhile low-performers in sensitive industries would disclose more monetary information than do the high-performers to deter public attention since monetary information is valued by the market.

The third group of studies supports the proposition that environmental disclosures are motivated by economic cost and benefit analysis. Proponents of economic theories suggest that high-performing firms gain economic benefits from disclosing information about their environmental performance that offsets the costs associated with the disclosure of such proprietary information; assuming that the cost of disclosure is lower in the case of high-performing firms (Scott, 1994; Verrecchia, 1983). Hence, Al-Tuwaijri et al. (2004) find that firms with high-environmental performance disclose more negative information about their waste disposal and Potentially Responsible Party designation (PRP) in their 10-K reports. Similarly, Clarkson et al. (2008) find that a sample of high-performing firms discloses more verifiable information –described as hard disclosures – in their sustainability reports and on their websites. Proponents of economic theory ignore the non-disclosure cost associated with the low-performers. Non-disclosure of relevant environmental information may expose the low-

performing firms to high financial costs due to the creation of information asymmetry gap between management and the market and the cost of information gathering on the part of the investor (Cormier & Magnan, 1999; Cormier & Magnan, 2003; Diamond, 1985).

In brief, one string of research suggests that firms' disclosures are motivated by their incentives to legitimize their actions and casts the doubts about the reliability of the information disclosed in terms of portraying an accurate image of the firm's environmental operations. The findings of this literature suggest that low-performing firms will only disclose more positive and less-proprietary information (Deegan & Gordon, 1996; Deegan & Rankin, 1996; Hughes et al., 2000). The second string of research agrees that legitimacy incentives are the main drivers of environmental disclosures for low-performing firms; however, this literature is still inconclusive how these incentives impact the level of proprietary information disclosed. The findings of Cho & Patten (2007) suggest that the need to legitimize their actions may in fact derive the low-performing firms to disclose more proprietary information – monetary information in that case. The third literature adopts a view that economic costs and benefits are the main determinants environmental disclosures. They argue that the benefits of disclosure are higher and the costs are lower for high-performing firms. They find that the high-performing firms are willing to disclose more negative information (Al-Tuwaijri et al., 2004) and more verifiable information (Clarkson et al., 2008).

These findings raise two important issues about firms' environmental disclosures. First, Prior research does not provide empirical evidence about the determinants of environmental disclosures of low and high environmental performers. Therefore, there is a need to understand the disclosure motivation of each group. Second, research on the association between environmental disclosure and environmental performance is based on the amount of information

disclosed. The interpretation that low-environmental performers disclose more information to legitimize their actions does not fully conform to the broad legitimacy theory framework. According to this framework, O'Donovan (2002) shows that firms adopt different disclosure strategies including disclosure avoidance, disclosure of self-serving information that shapes social values and perceptions, and disclosure of information that shows compliance with public values. As a result, legitimacy theory does not necessarily predict more disclosure but sometimes less disclosure of sensitive or negative information that could threaten the firm's legitimacy (see also de Villiers & van Staden, 2006). Therefore, there is a need to assess environmental disclosure beyond the current metrics that focus on the amount of information disclosed.

3. Hypothesis Development

The association between environmental disclosure and environmental performance

Although the association between firms' environmental disclosure and environmental performance has been previously examined, the results of previous studies find conflicting results to whether the low or the high-environmental performers provide more disclosures; hence, creating a debate about the incentives of each group of firms to disclose their proprietary information (see Patten, 2002; Cho & Patten, 2007; Al-Tuwaijiri et al., 2004; Clakson et al., 2008). As previously discussed, there are two main theories that explain the disclosure motivation of firms. Economic theory predicts whether firms would disclose or withhold proprietary information based on the cost-and-benefit of disclosure (Diamond, 1985; Verrecchia, 1983; Botosan, 1997). The legitimacy theory also predicts that firms would adopt a disclosure strategy to defend any threats to the legitimacy of its operations (Lindblom, 1994). Prior empirical research confirms that both economic and legitimacy incentives influence the

disclosure strategy of firms (see Neu et. Al, 1998; Cormier & Magnan, 1999; Cormier & Magnan, 2003; Aerts et al., 2008; Aerts & Cormier, 2009). How these incentives affect the disclosures of the low and high performers is still debatable. Empirical research on the association between disclosure and performance land contrasting results. Al-Tuwaijiri et al. (2004) finds that firms with high environmental performance disclose more information in their 10-K reports about their remediation efforts. They suggest that the high-performers receive economic benefits from disclosing their proprietary information which bears good news to the market. Clarkson et al. (2008) find similar results in their examination of firms' sustainability reports.

A second string of research finds that low-performers disclose more information maintain the legitimacy of their operations (Patten, 2002). Cho & Patten (2007) suggest that - under pressures to legitimize their actions – firms disclose more proprietary information about their environmental performance. The third line of research suggests that disclosures of low-performers are elusive and attempt to portray a positive image of the firms' environmental performance. Some studies suggest that low-performers withhold negative information about their environmental activities (Deegan & Gordon, 1996; Deegan & Rankin, 1996) and other studies suggest that low-performers would only disclose information that portrays a favorable image of the firm's environmental profile and enhances their reputation (Rockness, 1986; Cho et al., 2012). In summary, research provides confounding results about the amount and quality (level of proprietary information) of disclosure of low and high performers.

Firms' disclosure motivations are affected by economic and legitimacy incentives. Environmental performance moderates the effect of these incentives. Based on the information content determined by the firm's performance and the level of demand for information, firms

would assess the costs-and-benefits of disclosure and adopt a disclosure policy that would maximize its economic gains (Li et al., 1997). On the other hand, the level of performance determines the level of threat to the firm's legitimacy which in return would define the firm's disclosure policy. I suggest that the association between disclosure and performance represents the level of bias resulting from the firm's disclosure policy that is mutually determined by the interaction of the economic and legitimacy incentives. Therefore, I hypothesize that there is an association between disclosure and performance; though, it is difficult to determine the outcome of the disclosure policy of the low and high performers.

H1: there is an association between the level of environmental disclosure and the level of environmental performance.

Enforcement and the association between environmental disclosure and environmental performance

Firms release their private environmental information through three disclosure channels: annual, 10-K, or sustainability reports. There are differences between these disclosure channels in terms of disclosure requirements and the level of enforcement associated with each disclosure channel. Kothari (2000, p. 95) explains the role of enforcement of shareholders protection laws and threat of litigation on the quality of disclosure. He emphasizes that enforcement is equally important to the quality of the accounting standards. Although there is little empirical research on the impact of enforcement of shareholders rights on disclosure, Hope (2003) finds that higher levels of enforcement of shareholder protection laws are associated with higher quality reporting which is translated into higher forecast accuracy. In terms of environmental disclosures, there is a general agreement that there is lax enforcement of environmental disclosure requirements; providing firms with discretion over the disclosure decision (Government Accounting Office

(GAO), 2004). Gamble et al. (1995) suggest that there is little guidance and no evidence of enforcement from the FASB towards the disclosure of environmental information in annual reports. In comparison, they suggest that the SEC mandate more detailed disclosures in 10-K reports. The 2004 GAO report shows that the SEC conducts a random review of annual 10-K filings (SEC reviews 8% to 18% of all filings). In case of non-compliance with disclosure requirements, the SEC opens communication channels with the firm that could lead to the Division of Enforcement if the firm fails to comply (Government Accounting Office (GAO), 2004; pages 24-25). In comparison to annual or sustainability reports, the level of enforcing the disclosure requirements is higher in 10-K reports. Therefore, I suggest that due to threat of legal actions, the low and high performing firms will comply with disclosure requirements in 10-K reports. Hence, there will be less significant differences between the disclosures of low and high environmental performers in 10-K reports.

H2: there is less significant association between firms' environmental disclosures in 10-K reports and environmental performance.

The incentives to disclose environmental information of high and low environmental performers

Research on the association between environmental disclosure and environmental performance is subject to a polarizing theoretical debate about firms' incentives to disclose environmental information. However, there is no empirical evidence that the factors that motivate firms to disclose environmental information differ between groups of firms with low and high environmental performance. Prior research suggests that firms' environmental disclosures are motivated by both economic and legitimacy incentives. Research on the economic cost-and-benefit of disclosure shows that firms benefit from disclosing environmental information by reducing the cost of information gathering for all traders; thus, improve the

trading process (Diamond, 1985; Botosan, 1997). Verrecchia (1983) argues that the higher the level of proprietary information, the higher the cost of disclosure. Scott (1994) finds that firms subject to scrutiny from labor unions disclose less pension plan information due to the cost associated with the disclosure with that information. Low environmental performance entails more regulatory costs in the form of penalties, liabilities or more capital expenditures to remedy that performance. Therefore, it could be argued that the market is more interested in environmental information of low-performers than the high-performers. In other words, the low-performers possess more proprietary information than the high-performance which makes both the costs and benefits of disclosure of the low-performers higher than those of the high performers. Therefore, based on the balance between disclosure costs and benefits and the demand for information, I suggest there are differences between the economic incentives of disclosures of the low and high performers; which leads to different disclosure outcomes.

H3: The association between environmental disclosure and the economic incentives to disclose is different between the groups of low and high-performers.

Neu et al. (1998) find that political and social pressures are determinants of firms' environmental disclosures in annual reports. Examining disclosures made by European firms, Cormier & Magnan (2003) find that media visibility increases pressures upon firms to disclose more information. These findings suggest that firms use their disclosure strategy to mitigate legitimacy threats generated from the scrutiny of environmentalists, society, or the regulatory bodies. Lindblom (1994) suggests that firms adopt different strategies to legitimize their actions: inform the public, change its perceptions, or divert its attention. To legitimize their actions, O'Donovan (2002) finds that firms adopt four different disclosure tactics: avoid the disclosure, alter the perceptions, alter the social values, or comply with social norms. Based on their

environmental performance, I suggest that the level of threat to the low-performers' legitimacy is higher than that of the high-performers. Hence, I suggest that the high and low performers may adopt different disclosure strategies in response to the different incentives to disclose.

H4: The association between environmental disclosure and the legitimacy incentives to disclose is different between the groups of low and high-performers.

In this study, I suggest that both economic and legitimacy incentives influence environmental disclosures of the two groups of firms – firms with high and low environmental performance - differently. Therefore, I explore the extent to which economic and legitimacy theories would explain the disclosures of firms with high and low environmental performance.

4. Methodology

There are some methodological issues that affect the statistical association between disclosure and performance and the interpretation of previous research findings. First, prior research employs cross-sectional analyses of environmental disclosures, a methodology that ignores the continuous development and growth in that field (see Cormier & Magnan, 2003; Deegan et al., 2002; Gray, Kouhy, & Lavers, 1995a; Gray, Kouhy, & Lavers, 1995b). During the last two decades, the role of sustainability reports as an important media to disclose environmental information continue to grow. These reports are subject to continuous evolvement; such as increased disclosure regulation and the development of guidelines for voluntary disclosure. Cross-sectional studies provide a snapshot of environmental disclosures during a phase where firms are still learning how to measure, present, and disclose such information.

Another problem associated with cross-sectional studies is the lack of control for firm specific unobservable variables that may be associated with other dependent variables (Hausman & Taylor, 1981). Patten (2002) attempts to measure these unobservable variables by controlling for industry fixed-effects; which proxies for similarities among firms within the same industries. Though he finds a significant association between industry controls and environmental disclosure; I suggest that these industry controls do not fully reflect the unobserved heterogeneity in these firms. Therefore, in this study I perform a panel data analysis of firms' environmental disclosures to control for the continuous change in environmental reporting over-time and the unobserved heterogeneity in the cross-sections. The results of this study confirm the existence of a cross-section and period effects.

Thirdly, understanding the association between environmental disclosure and environmental performance is undermined by the definition of environmental disclosure in prior research. Several studies (see Fekrat et al., 1996; Hughes et al., 2000; Hughes et al., 2001; Patten, 2002; and Wiseman, 1982) rely on the amount of information to proxy for environmental disclosure and to explain firms' incentives to disclose environmental information[22]. Consequently, these studies report that low-performing firms disclose more environmental information as they need to legitimize their actions (refer to Patten, 2002; Hughes et al., 2000;

[22] The Wiseman (1982) index relies on a single score to evaluate environmental disclosure. The reliance on single score does not indicate the level of proprietary information disclosed within that index. Aerts & Cormier (2009), Walden & Stagliano (2004), and Clarkson et al. (2008) use disclosure metrics that proxy for different aspects of disclosure that differentiate between the proprietary and less-proprietary information. For example, Aerts & Cormier (2009) differentiate between economic disclosures and social related disclosures. Clarkson et al. (2008) define two metrics – hard and soft disclosures - to assess the level of proprietary information in environmental disclosures.

Hughes et al., 2001). This assessment is not completely in accordance with the legitimacy theory framework which predicts that firms would adopt different disclosure strategies in response to the different threats to their legitimacy. For example, de Villiers & van Staden, (2006) and O'Donovan (2002) show that withholding sensitive information – or reduction in disclosure – has also a legitimizing effect. Therefore, in this study I develop parameters to measure the level of proprietary information disclosed - rather than the amount of information disclosed - to assess the firm's incentives to disclose[23].

To shed more light on the association between environmental disclosure and environmental performance, I conduct three different analyses. First, I study firms' environmental disclosures in three disclosure media to assess whether or not to consider the information in 10-K and sustainability reports next to the one in annual reports. Second, I research the association between environmental disclosure and environmental performance using measures of disclosure that separate between the amount of information disclosed and some properties of this information. Third, I examine the incentives of low and high performers to disclose environmental information to understand differences in motivation to disclose between the two groups of firms.

4.1. Examination of annual reports, 10-K reports and sustainability reports' environmental disclosure

Annual reports, 10-K reports and sustainability reports are three different media that firms use to communicate environmental information to the public. To the best of my

[23] Scott (2006) defines proprietary information as the information that directly affects the firm's cash-flow, while non-proprietary information is information that has indirect impact on the cash-flow (page 384).

knowledge, the relative importance of each of these media and the information included in each of them has not been studied yet. I examine environmental information included in each media – during the period from 1997 to 2010 - using a comprehensive disclosure index that combines previous work by (Aerts et al., 2008; Clarkson et al., 2008; Patten & Crampton, 2004; Walden & Stagliano, 2004; Wiseman, 1982).

The disclosure index is an extension of Clarkson et al. (2008) index; which is inspired by GRI guidelines. However, the Clarkson et al. (2008) index is not comprehensive since it emphasizes specific elements of voluntary disclosure. Therefore, I complement it with themes from other indexes. For example, I include themes about the firm's contamination and remediation efforts from Aerts et al. (2008) and Patten & Crampton (2004), and expand the measurement of the firm's pollution abatement efforts to include descriptions of equipment installed and processes developed according to Wiseman (1982). The disclosure of economic indicators is one of the weaknesses of the Clarkson et al. (2008) index since it does not differentiate between the disclosure of past and future capital and operational expenditures. Therefore, I borrow these themes from the Wiseman (1982) index. Furthermore, I include themes about environmental litigation and liabilities from the Aerts et al. (2008) and Wiseman (1982) indexes. Finally, I add themes related to the discussion of current and potential environmental laws that are necessary to assess the firm's environmental risk using themes from the Aerts et al. (2008) and Wiseman (1982) indexes.

In brief, the index includes 63 environmental disclosure themes under 10 different categories: governance and management systems, credibility, contamination and remediation efforts, pollution abatement and environmental performance indicators, economic factors, litigation and liabilities, vision and strategy claims, laws and regulations conformity,

environmental profile, and environmental initiatives. There are 18 themes from Aerts et al. (2008) and Wiseman (1982) indexes and 45 themes from the Clarkson et al. (2008) index. A score of 1 is assigned if the theme exists in one of these reports and 0 otherwise.

Furthermore, I examine the different properties of these disclosures. In accordance with Clarkson et al. (2008), I examine the disclosure of hard versus soft information. I define hard disclosures as verifiable disclosures indicative of the firm's environmental performance. Soft disclosures are environmental information not related to the firm performance or non-verifiable statements about the firm's progress in that domain. I also study the disclosure of negative versus positive or neutral information since research by Deegan & Gordon (1996) and Deegan & Rankin (1996) points out at firms' reluctance to disclose negative information. I rely on Patten & Crampton (2004) definition of negative disclosure to classify the different environmental themes. Finally, I examine another aspect of environmental information that is the specificity of the information disclosed. Specifically, I examine whether firms disclose specific information about their operations or just general statements. I use three levels of specificity according to Wiseman (1982): quantitative information, firm specific qualitative information, and general information. According to Ingram & Frazier (1980), the first two items could be grouped into one category since they refer to the firm specific activities. Meanwhile, the third item represent a different category since it refers to general statements that are not significantly related to the company's environmental efforts. Additionally, I examine the disclosure of economic information; a type of relevant information for the stock market. The disclosure index is presented in details in Appendix C and an example of how firms' disclosures are classified is presented in Appendix D.

4.2. The association between environmental disclosure and environmental performance

To study the association between environmental disclosure and environmental performance, I conduct a panel data analysis of environmental disclosure over a 10 year period from 1997 to 2010. Cormier & Magnan (1999) present a disclosure model to explain how the economic costs and benefits of disclosure affect the amount of environmental information disclosed. I extend this model to include legitimacy factors that also influence environmental disclosure of firms as suggested by Neu et al. (1998). The proposed model is the following:

$$Disclosure = \alpha_0 + \alpha_1 * performance + \alpha_2 * beta + \alpha_3 * Trading\ Volume + \alpha_4 * Debt\ to\ Equity\ Change + \alpha_5 * Common\ Stock\ Change + \alpha_6 * Block\_Insider + \alpha_7 * Block\_Highest + \alpha_8 * ROA + \alpha_9 * Debt\ to\ Assets + \alpha_{10} * Return + \alpha_{11} * Negative\ News + \alpha_{12} * Total\ News + \alpha_{13} * Media\ Legitimacy + \alpha_{14} * Size$$

Where:

Definition of variables:

1. Environmental disclosure (*Disclosure*):

The definition of environmental disclosure is fundamental for this study. Environmental disclosure is a multi-construct variable (Ingram & Frazier, 1980); therefore, it is important to have a content index that captures all the major dimensions of that variable: I measure the total number of disclosure themes made by the firm (*Total Disclosure*), the disclosure of hard versus soft information (*Hard Disclosure*, *Soft Disclosure*) (Aerts & Cormier, 2009; Clarkson et al., 2008), the good news versus bad news disclosure (*Positive Disclosure*, *Negative Disclosure*) (Deegan & Rankin, 1996), the general versus specific information disclosure (*Quantitative*

Disclosure, *Firm Specific Qualitative Disclosure*, *Qualitative Disclosure*) (Cho & Patten, 2007; Wiseman, 1982), and finally I also use a proxy for economic disclosures.

2. Independent variables:

    a. Environmental performance (*performance*):

There are two types of proxies for environmental performance. Cho & Patten, (2007), Fekrat et al. (1996), Ingram & Frazier (1980) and Wiseman (1982) use general surrogates of performance that proxy for many of the firm's environmental activities. Meanwhile, Al-Tuwaijri et al. (2004), Clarkson et al. (2008) and Patten (2002) use specific measures of pollution control such as the level of TRI or the ratio of recycled toxic waste to total waste to proxy for the firm's performance. These specific measures – although more objective – do not provide a complete picture of the firm's overall performance (Berthelot et al., 2003). More general measures – such as the CEP and KLD ratings – provide a comprehensive picture of the firm's environmental performance that maps the items in the different content indices. Patten (2002) criticizes CEP rankings because the performance evaluation criteria differ from one industry to the other. I reckon that KLD ratings are a good surrogate for environmental performance and have been used in prior studies by Cho, et al., (2006), Cho & Patten (2007), and Dhaliwal et al. (2011). Further, Ziegler & Schröder (2010) underline the use of KLD ratings as a basis of firms' inclusion in the Domini 400 Social Index. Therefore, I use KLD ratings to proxy for firms' environmental performance[24].

---

[24] Using KLD ratings, I develop a proxy for environmental disclosure that includes 5 environmental strengths and 6 environmental concerns *(performance = number of strengths + (6 – number of concerns)).* The environmental strengths included are (1) Beneficial Products and Services (2) Pollution Prevention (3) Recycling (4) Clean Energy,

b. Measures of information cost gathering:

The following measures proxy for the need for information and the asymmetry gap between the insiders and the outside shareholders (Cormier & Magnan, 1999):

i. Risk (*beta*): measured using the firm beta. Firms' beta is calculated using the five year monthly returns.

ii. Trading volume (*Trading Volume*): using the firm trading volumes divided by the outstanding number of shares. Trading volumes are provided by the Center for Research in Security Prices (CRSP).

iii. Reliance on the capital market (*Debt to Equity Change*; *Common Stock Change*): using the change in the firm's debt to equity and the change in the firm's common stock. Data is provided by Compustat database.

iv. Insider holdings (*Block_Insider*): measured by the percentage of shares held by the firm's officers and directors. Information is gathered from firms' proxy statements.

v. Outsider holdings (*Block_Highest*): measured by the percentage of shares held by the highest shareholder. Information is gathered from firms' proxy statements.

According to Cormier & Magnan (1999), firm's beta, trading volume, reliance on the capital market are proxies for the demand for information from investors. Hence, these measures are positively associated with environmental disclosure since disclosure would reduce the cost of information gathering for the outside shareholders. Meanwhile, significant holdings by insider

---

and (6) Other Strengths. The environmental concerns included are (1) Hazardous Waste (2) Regulatory Problems (3) Ozone Depleting Chemicals (4) Substantial Emissions (5) Agricultural Chemicals, and (6) Other Concern.

and outsider owners attenuate the cost of information gathering and hence are associated with lower levels of disclosure.

c. Measures of financial condition:

i. Accounting performance measured by the firm's return on assets (*ROA*).

ii. Market performance measured by the firm's return (*Return*).

iii. Leverage measured using the firm's debt to assets (*Debt to Assets*).

Cormier & Magnan (1999) suggest that strong financial condition would enable firms to withstand the cost of disclosing proprietary information. Hence, higher return on assets and market return are associated with higher levels of disclosure, while higher levels of debt to assets would be associated with lower levels of disclosure.

d. Measures of firm's legitimacy

i. Media legitimacy (*Media Legitimacy*): is a measure of the media's perception of the firm's environmental performance. According to Aerts & Cormier (2009) media legitimacy is measured using the Janis-Fadner Coefficient.

ii. Environnementalistes' pressure (*Negative News*) : Neu et al. (1998) account for environmentalists' concerns by measuring the number of negative articles containing negative criticism of the firm's environmental performance. They find that firms subject to negative criticism reduce their environmental disclosure.

iii. Society awareness (*Total News*): news exposure has been used in prior research as a proxy for society awareness and concern about the firm environmental performance (Aerts & Cormier, 2009; Neu et al., 1998)

e. Control Variables:

i. Size (*Size*): larger firms are more visible to the public and more followed by analysts (Aerts & Cormier, 2009). Therefore, I assume that the level of environmental performance will depend on the firm's size which proxies for the visibility of the firm within its society.

4.3. The incentives to disclose environmental information in samples of firms with low and high performance

In order to test the difference between the incentives of low and high performers to disclose environmental information, I use the following disclosure model based on prior research by Cormier & Magnan (1999), Cormier & Magnan (2003), and Neu et al. (1998). This disclosure model combines factors that represent economic costs and benefits with factors that affect firms' legitimacy:

$$Disclosure = \alpha_0 + \alpha_2 * beta + \alpha_3 * beta * Low + \alpha_4 * Trading\ Volume + \alpha_5 * Trading\ Volume * Low + \alpha_6 * Debt\ to\ Equity\ Change + \alpha_7 * Debt\ to\ Equity\ Change * Low + \alpha_8 * Common\ Stock\ Change + \alpha_9 * Common\ Stock\ Change * Low + \alpha_{10} * Block\_Insider + \alpha_{11} * Block\_Insider * Low + \alpha_{12} * Block\_Highest + \alpha_{13} * Block\_Highest * Low + \alpha_{13} * ROA + \alpha_{14} * ROA * Low + \alpha_{14} * Debt\ to\ Assets + \alpha_{15} * Debt\ to\ Assets * Low + \alpha_{16} * Return + \alpha_{17} * Return * Low + \alpha_{18} * Negative\ News + \alpha_{19} * Negative\ News * Low + \alpha_{20} * Total\ News + \alpha_{21} * Total\ News * Low + \alpha_{22} * Media\ Legitimacy + \alpha_{23} * Media\ Legitimacy * Low + \alpha_{24} * Size$$

Where:

Low: is a dummy variable equal 1 if the firm is classified as a low performer and 0 if the firm is classified as a higher performer. A firm is classified as low performer if its average performance over the period from 1997 to 2010 is below the median of the average performance of all firms.

Therefore, there are 39 firms classified as low performers and 39 firms classified as high performers.

To test whether or not there are differences between the disclosure incentives of the high and low performers, I examine the significance of the interaction terms between the different dependent variables and the dummy variable (*Low*).

4.4. Sample selection

KLD ratings for environmental performance are available for firms between the years 1997 and 2010. The following criteria are used to select the firms:

1. The firm should be available on Compustat.
2. The firm should have a ten year KLD rating between 1997 and 2010.
3. The firm belongs to an environmentally-sensitive industry.

The selection criteria lead to the identification of 78 firms distributed as following: 2 firms in SIC 10xx (metal mining), 7 firms in SIC 13xx (oil exploration), 13 firms in SIC 20xx (food manufacturing), 8 firms in SIC 26xx (paper), 18 firms in SIC 28xx (chemical and allied products), 2 firms in SIC 29xx (petroleum refining), 5 firms in SIC 30xx (rubber and plastic manufacturing) 3 firms in SIC 33xx (metals), and 22 firms in SIC 49xx (electric and gas services). With 14 years of KLD ratings, the final sample comprises 1092 firm-years. The list of firms is presented in Appendix B.

5. Results

5.1. Analysis of information disclosed in annual reports, 10-K reports, and sustainability reports

In this section, I discuss the results of descriptive analysis of 78 firms' environmental disclosure over the period of fourteen years (from 1997 to 2010) in annual reports, 10-K reports, and sustainability reports. The detailed results are provided in tables 1 to 16 and the detailed analysis is provided in Appendix E. The objective of this analysis is to (1) assess and understand the type of information disclosed in each of these media, and (2) understand the importance of each media in conveying environmental information. The analysis comprises of two different steps:

1. Analyze the information disclosed in annual report, 10-K report, and sustainability reports.
2. A pair-wise comparison between the information disclosed in each report and an analysis of information that is disclosed in one media but not the other ones.

The analysis of environmental disclosures in annual, 10-K, and sustainability reports provides some insights about firms' disclosure activities. First, environmental disclosures have continuously increased during the period from 1997 to 2010. This increase is mainly due to the widespread adoption of standalone sustainability reports as disclosures in 10-K reports remained constant and disclosures in annual reports declined during the same period. Second, annual reports are not the main source of environmental information since the level of disclosure in these reports is lower than that in 10-K or in sustainability reports. In general, firms use annual reports to provide a general overview about their environmental performances with little details about the different categories describing that performance. Furthermore, there is little

incremental information in annual reports over those made in 10-K reports. Third, in comparison to annual or sustainability reports, 10-K reports include more details about the firm's economic factors and litigation & liabilities. Therefore, analysis relying on annual report disclosures may result in misleading findings about the firm's propensity to disclose negative information or quantitative financial information. Fourth, the analysis shows that sustainability reports are annexes to annual and 10-K reports. In other words, they include a large amount of information that is not disclosed in both media such as pollution abatement, governance and management, credibility, and vision & strategy information. Sustainability reports are not the main medium to disclose negative information about the firm's litigation & liabilities or financial information. Therefore, research studies that examine sustainability reports are not conclusive on firms' environmental disclosures since they exclude important information disclosed in the other media. Fifth, the adoption of reporting guidelines (mostly the GRI guideline) improves disclosure in sustainability reports by increasing the level of information disclosed and reducing the dispersion in disclosures made by the different firms. Finally, the aggregated disclosure in the three reports is higher than the disclosure in each report separately. These findings implies that combining information from the different reports provides a more comprehensive understanding of the firm's environmental operations than considering each report individually.

5.2. The association between environmental disclosures and environmental performance: an analysis of aggregate information disclosed in annual reports, 10-K reports, and sustainability reports

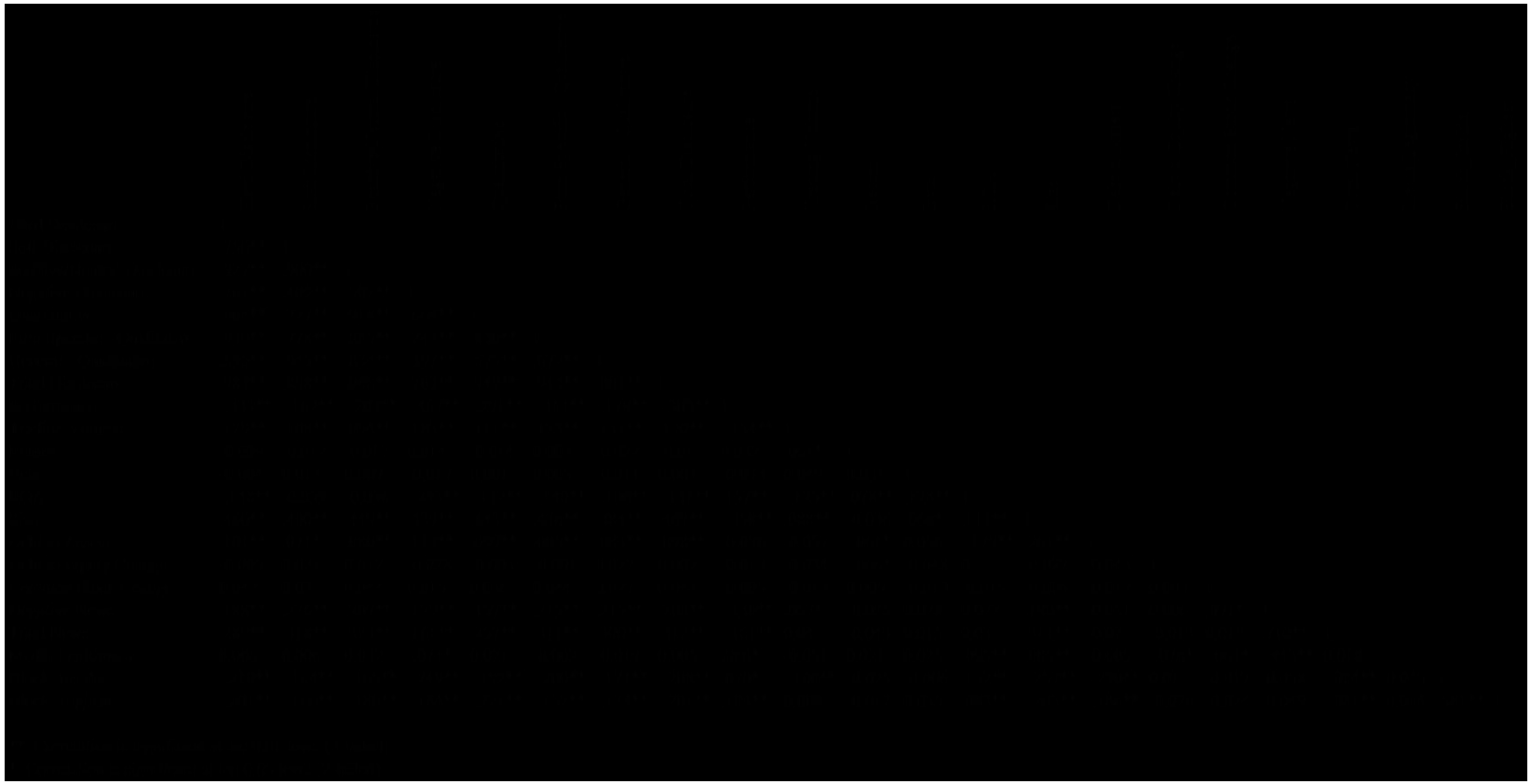
In order to better assess firms' environmental disclosures; I consider all public disclosures made by a firm in the three types of media – annual reports, 10-K reports, and

sustainability reports. The objective of this section is to determine if there is an association between firms' environmental disclosures and firm's environmental performance.

Correlation between environmental disclosure measures, environmental performance, and the other independent variables.

Table-1 shows the correlation between the different disclosure variables, environmental performance and the other independent variables. There is a significant negative association between the different disclosure measures and the firm's environmental performance. High levels of trading volume, debt-to-assets, total news, and negative news are positively associated with measures of environmental disclosure. Higher levels of return on assets, debt to assets, percentage holding by insiders, and percentage holding by the largest shareholder are negatively associated the different measures of disclosure.

Table-1: Pearson Correlation



Multivariate analysis of the association between aggregate disclosure – in annual, 10-K, and sustainability reports – and environmental performance

In this section, I examine the association between aggregate disclosure – those made in annual, 10K, and sustainability reports – and the firm's environmental performance. The panel data analysis presented in Table-2 shows that there is a positive association between 7 measures of environmental disclosure (total, hard, soft, positive, quantitative, firm-specific, and qualitative information) and firms environmental performance (*support for H1*); suggesting evidence for a reporting bias between firms according to their environmental performance. There is no association between negative or economic disclosures and firm's environmental performance. The association between disclosure measures and performance presented in Table-2 are the opposite of the correlation between these variables presented in Table-1. In fact, the correlation analysis does not control for all factors affecting firms' environmental disclosure including firm and time specific unobservable effects. Table-2 shows that both the firm (cross-section) and time (period) effects are significant which may explain the contradiction between the results of the correlation and the multivariate analysis which provides more evidence about the importance of the panel data analysis when examining the association between disclosure and performance.

Contrary to predictions, high trading volumes are associated with lower levels of disclosure except for the disclosure of negative or qualitative information; two measures that are not associated with the firm's trading volume. Reliance on the capital market (change in debt to equity or change in common stock) is positively related to the different measures of disclosure except for the disclosure of negative and economic information. Higher levels of holding by insiders are also associated with higher levels of disclosure (except for measures of economic and negative disclosures). The level of holdings by the highest shareholder is associated with

lower levels of quantitative disclosures. Society awareness about the firm's environmental activities (Total News) is positively associated with measures of total, hard, positive, negative, quantitative, firm specific qualitative and economic disclosures. Environmentalists pressures (Negative News) is associated with lower levels of negative disclosures suggesting that firms attempt to hide negative information about their environmental performance when they face real threat to legitimacy. Further, higher levels of media legitimacy are associated with lower levels of negative disclosures; it may also imply that firms with higher levels of media legitimacy attempt to preserve their positive image.

Table-2: The Association between Environmental Disclosure and Environmental Performance in All Reports (to be continued)

	Total Disclosure		Hard Disclosure		Soft Disclosure		Positive/Neutral		Negative Disclosure	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	-6.0393	0.101	-6.0494 **	0.040	0.0101	0.992	-4.0251	0.205	-2.0237 ***	0.008
Performance	0.7474 ***	0.001	0.5110 ***	0.002	0.2364 ***	0.003	0.8340 ***	0.000	-0.0837	0.124
Beta	-0.9204	0.124	-0.7388	0.107	-0.1816	0.392	-0.7036	0.189	-0.2073	0.160
Trading Volume	-0.0300 ***	0.002	-0.0227 ***	0.001	-0.0074 *	0.064	-0.0335 ***	0.000	0.0037	0.324
Debt to Equity Change	0.0007 ***	0.006	0.0004 **	0.044	0.0003 ***	0.008	0.0008 ***	0.001	-0.0001	0.131
Common Stock Change	0.0014 ***	0.000	0.0012 ***	0.000	0.0003 ***	0.010	0.0015 ***	0.000	-0.0001	0.281
Block_Insider	0.1670 ***	0.005	0.0925 **	0.045	0.0745 ***	0.000	0.1669 ***	0.002	0.0003	0.982
Block_Highest	-0.0362	0.293	-0.0245	0.349	-0.0117	0.299	-0.0480	0.148	0.0119	0.242
ROA	0.8872	0.840	0.9916	0.790	-0.1044	0.934	0.2188	0.950	0.6599	0.636
Debt to Assets	-4.0409 **	0.039	-2.2943	0.125	-1.7466 ***	0.010	-4.0755 **	0.019	0.0200	0.970
Return	-0.5742	0.323	-0.4194	0.328	-0.1548	0.453	-0.6006	0.260	0.0346	0.815
Negative News	-0.2168	0.558	-0.3099	0.275	0.0930	0.483	-0.0591	0.866	-0.1572 *	0.059
Total News	0.4321 **	0.028	0.4106 ***	0.007	0.0215	0.742	0.3624 **	0.037	0.0691 *	0.065
Media Legitimacy	-0.0084	0.988	-0.0897	0.829	0.0813	0.683	0.2091	0.694	-0.2243 *	0.061
Size	4.3177 ***	0.000	3.5743 ***	0.000	0.7434 ***	0.003	2.7389 ***	0.001	1.5765 ***	0.000
Cross-section fixed (dummy variables)										
Period fixed (dummy variables)										
Adjusted R-squared		0.672		0.700		0.505		0.597		0.775
F-statistic		22.488		25.501		11.785		16.526		37.173
Prob(F-statistic)		0.000		0.000		0.000		0.000		0.000
Mean dependent var		11.986		8.863		3.124		8.290		3.692
S.D. dependent var		9.363		7.267		2.584		7.691		2.720
Durbin-Watson stat		1.423		1.372		1.519		1.471		1.037
Redundant Fixed Effects Tests										
Test cross-section and period fixed effects										
Effects Test		Prob.		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000		0.000
Period F		0.000		0.000		0.000		0.000		0.013
Period Chi-square		0.000		0.000		0.000		0.000		0.006
Cross-Section/Period F		0.000		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000		0.000

Periods included: 14
Cross-sections included: 78
Total panel (balanced) observations: 1092

Table-2: The Association between Environmental Disclosure and Environmental Performance in All Reports (continue)

	Quantitative		Firm Specific		Qualitative		Economic	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	-2.3712	0.221	-4.0748 ***	0.007	0.3972	0.517	-0.4525	0.687
Performance	0.2355 **	0.016	0.3774 ***	0.000	0.1375 **	0.015	-0.0185	0.604
Beta	-0.2085	0.440	-0.5813 **	0.047	-0.1212	0.429	-0.0503	0.618
Trading Volume	-0.0155 ***	0.000	-0.0116 ***	0.009	-0.0027	0.367	-0.0038 *	0.069
Debt to Equity Change	0.0004 ***	0.000	0.0000	0.704	0.0002 **	0.012	0.0000	0.701
Common Stock Change	0.0007 ***	0.000	0.0005 ***	0.000	0.0002 ***	0.003	0.0000	0.589
Block_Insider	0.0541 *	0.059	0.0611 **	0.013	0.0520 ***	0.000	-0.0009	0.929
Block_Highest	-0.0282 *	0.092	0.0019	0.894	-0.0099	0.228	0.0019	0.798
ROA	1.7349	0.442	0.2409	0.899	-1.0970	0.223	1.2322	0.197
Debt to Assets	-0.7973	0.370	-1.3275	0.137	-1.9308 ***	0.000	0.3868	0.317
Return	-0.2673	0.302	-0.1773	0.501	-0.1214	0.428	0.0730	0.510
Negative News	-0.1691	0.330	-0.1155	0.480	0.0684	0.425	-0.1010	0.127
Total News	0.2163 **	0.022	0.2220 ***	0.010	-0.0067	0.877	0.0616 *	0.100
Media Legitimacy	0.0197	0.937	-0.0428	0.866	0.0079	0.955	-0.1011	0.248
Size	1.6633 ***	0.001	1.9937 ***	0.000	0.6584 ***	0.000	0.7706 ***	0.004
Cross-section fixed (dummy variables)								
Period fixed (dummy variables)								
Adjusted R-squared		0.675		0.639		0.529		0.813
F-statistic		22.785		19.576		12.783		46.692
Prob(F-statistic)		0.000		0.000		0.000		0.000
Mean dependent var		4.643		4.907		2.433		2.658
S.D. dependent var		4.249		3.998		1.941		2.168
Durbin-Watson stat		1.423		1.420		1.512		1.012
Redundant Fixed Effects Tests								
Test cross-section and period fixed effects								
Effects Test		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000
Period F		0.000		0.000		0.000		0.000
Period Chi-square		0.000		0.000		0.000		0.000
Cross-Section/Period F		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000
Periods included: 14								
Cross-sections included: 78								
Total panel (balanced) observations: 1092								

Furthermore, I examine reaction of the low and high performers to the different disclosure incentives – results are presented in Table-3- using the interaction between these incentives and the firm's environmental performance (*Low* = 1 if the firm is classified as a low

performer and 0 otherwise). High performers with high trading volume disclose less environmental information (see the association with total, hard, soft, positive, and firm specific qualitative disclosures). The same association exists for the sample of low-performers but the relation is less than that with the sample of high-performers. In the sample of low-performers, the higher the level of insider-holding, the higher the level of disclosure (see the association with total, hard, negative, quantitative, and firm specific qualitative disclosures). This may be due to the fact that insiders may be held legally responsible for withholding relevant information and more so in the sample of low-performers. For the sample of high-performers, higher levels of debt-to-assets are associated with lower levels of disclosures. Meanwhile, higher levels of debt-to-assets are associated with higher levels of disclosures for the sample of low-performers. The results imply that the supervisory role of debt--holders is stronger in the case of low-performing firms making these firms disclose more information. In contrast, the high-performers with high levels of debt find the cost of disclosure very high in the absence of demand for information from debt-holders. In general, the results provide support for *H3* stating that the economic incentives to disclose environmental information differ between the firms with low and high environmental performance.

Higher levels of environmentalist pressures (negative news) are associated with lower levels of disclosure (especially economic disclosures) in the sample of high-performing firms; meanwhile, the negative association is lower in the case of the low performers. Similar results are found when examining the association between media legitimacy and both negative and economic disclosures. These results suggest that firms with high levels of media legitimacy tend to preserve their positive image by disclosing less negative information and less proprietary information. The high performing firms are more successful in doing so in comparison to the

low-performing firms. This may be due to the high level of regulation associated with the disclosure of negative information.

It is to be noticed that increased pressures from environmentalist groups (Negative News) is associated with an increase in soft and qualitative disclosures for the sample of high-performers. For the sample of low-performers, the results show almost no association between the disclosure of soft and qualitative disclosures and the amount of negative news. These findings are in contrast to the assumptions made by other research studies that suggest that low-performing firms will respond to legitimacy threats by increasing their soft disclosures that serve to portray a positive image about the firm's environmental performance. In general, the results support *H4* stating that legitimacy incentives to disclose environmental information differ between groups of firms with low and high environmental performance.

It is also to be noticed that the analysis provided in Table-3 uses a dummy variable to proxy for firm's environmental performance (1 for firms with low performance over 14 years and 0 for firms with high performance). The reason there is no main effect (dummy variable) for environmental performance is that any invariable characteristic will create a perfect correlation with the firm control employed by the panel data analysis. In theory, the firm control proxies for these characteristics that do not vary with time (industry membership, definition of the firm as low performer, etc...).

Table-3: The Association between Environmental Disclosure and Environmental Performance in All Reports – Low vs. high Performers (*to be continued*)

	Total Disclosure		Hard Disclosure		Soft Disclosure		Positive/Neutral		Negative Disclosure	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	3.0747	0.346	0.2368	0.927	2.8379 ***	0.002	5.1880 *	0.072	-2.0972 ***	0.003
Beta	-0.3231	0.678	-0.3083	0.595	-0.0149	0.952	-0.1433	0.831	-0.1704	0.360
*Beta*Low*	-0.6201	0.518	-0.5352	0.458	-0.0849	0.802	-0.5184	0.544	-0.1010	0.671
Trading Volume	-0.1036 ***	0.003	-0.0763 ***	0.003	-0.0273 **	0.015	-0.1075 ***	0.000	0.0039	0.680
*Trading Volume*Low*	0.0801 **	0.019	0.0587 **	0.020	0.0214 *	0.055	0.0792 ***	0.009	0.0011	0.907
Debt to Equity Change	0.0014	0.610	0.0004	0.833	0.0010	0.334	0.0010	0.708	0.0004	0.487
*Debt to Equity Change*Low*	-0.0006	0.813	0.0000	0.994	-0.0007	0.518	-0.0001	0.968	-0.0005	0.358
Common Stock Change	0.0010 ***	0.000	0.0009 ***	0.000	0.0001	0.348	0.0011 ***	0.000	0.0000	0.410
*Common Stock Change*Low*	0.0031	0.782	0.0039	0.627	-0.0008	0.818	0.0017	0.860	0.0015	0.535
Block_Insider	0.0091	0.918	-0.0530	0.393	0.0621 **	0.048	0.0591	0.482	-0.0500 ***	0.006
*Block_Insider*Low*	0.2407 *	0.058	0.2359 **	0.015	0.0048	0.905	0.1612	0.164	0.0803 ***	0.004
Block_Highest	-0.0881 *	0.083	-0.0343	0.381	-0.0538 ***	0.001	-0.1122 **	0.016	0.0242 **	0.039
*Block_Highest*Low*	0.0483	0.484	-0.0151	0.779	0.0634 ***	0.005	0.0731	0.261	-0.0246	0.169
ROA	1.3003	0.829	2.4537	0.607	-1.1534	0.530	-2.2939	0.671	3.5750 **	0.021
*ROA*Low*	3.5415	0.674	0.5152	0.940	3.0262	0.214	7.5323	0.289	-3.9819 *	0.098
Debt to Assets	-9.6721 ***	0.000	-5.8953 ***	0.000	-3.7768 ***	0.000	-8.7732 ***	0.000	-0.8962	0.131
*Debt to Assets*Low*	14.6886 ***	0.001	9.2934 ***	0.007	5.3951 ***	0.000	13.0573 ***	0.001	1.5910	0.175
Return	-0.5492	0.487	-0.4034	0.492	-0.1457	0.577	-0.6218	0.373	0.0743	0.708
*Return*Low*	0.1560	0.876	0.0925	0.900	0.0635	0.853	0.2629	0.772	-0.0964	0.711
Negative News	0.6924	0.271	0.0862	0.860	0.6062 ***	0.008	0.9772	0.106	-0.2840 ***	0.009
*Negative News*Low*	-1.0374	0.180	-0.4373	0.466	-0.6001 **	0.023	-1.2006 *	0.099	0.1629	0.263
Total News	0.3601	0.216	0.3790	0.144	-0.0189	0.824	0.2758	0.316	0.0839 *	0.055
*Total News*Low*	0.0424	0.913	0.0220	0.944	0.0204	0.865	0.0489	0.890	-0.0069	0.918
Media Legitimacy	-0.6119	0.502	-0.6864	0.285	0.0745	0.828	-0.1255	0.888	-0.4848 ***	0.002
*Media Legitimacy*Low*	0.9549	0.410	0.8908	0.286	0.0641	0.877	0.5753	0.603	0.3667 *	0.095
Size	2.8819 ***	0.002	2.5873 ***	0.001	0.2946	0.276	1.4092 *	0.083	1.4686 ***	0.000
Cross-section fixed (dummy variables)										
Period fixed (dummy variables)										
Adjusted R-squared		0.674		0.701		0.511		0.597		0.776
F-statistic		-3318.934		23.281		10.932		15.064		33.901
Prob(F-statistic)		20.604		0.000		0.000		0.000		0.000
Mean dependent var		11.986		8.863		3.124		8.290		3.692
S.D. dependent var		9.363		7.267		2.584		7.691		2.720
Durbin-Watson stat		1.423		1.372		1.541		1.461		1.056
Redundant Fixed Effects Tests										
Test cross-section and period fixed effects										
Effects Test		Prob.		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000		0.000
Period F		0.000		0.000		0.000		0.000		0.013
Period Chi-square		0.000		0.000		0.000		0.000		0.005
Cross-Section/Period F		0.000		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000		0.000
Periods included: 14										
Cross-sections included: 78										
Total panel (balanced) observations: 1092										

Table-3: The Association between Environmental Disclosure and Environmental Performance in All Reports – Low vs. high Performers (continue)

	Quantitative		Firm Specific		Qualitative		Economic	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	0.3140	0.857	0.7894	0.534	1.9875 ***	0.001	-0.3986	0.686
Beta	-0.0663	0.825	-0.2032	0.621	-0.0441	0.802	-0.1223	0.282
*Beta*Low*	-0.1803	0.657	-0.4485	0.360	0.0094	0.969	0.1324	0.408
Trading Volume	-0.0351 **	0.015	-0.0568 ***	0.001	-0.0117	0.162	0.0034	0.579
*Trading Volume*Low*	0.0216	0.129	0.0495 ***	0.002	0.0092	0.273	-0.0071	0.240
Debt to Equity Change	0.0001	0.917	0.0003	0.810	0.0009	0.200	0.0001	0.920
*Debt to Equity Change*Low*	0.0003	0.774	-0.0002	0.854	-0.0007	0.330	0.0000	0.987
Common Stock Change	0.0006 ***	0.000	0.0003 **	0.031	0.0001	0.291	0.0000	0.659
*Common Stock Change*Low*	0.0008	0.863	0.0010	0.823	0.0014	0.645	0.0003	0.882
Block_Insider	-0.0098	0.797	-0.0407	0.284	0.0596 ***	0.005	-0.0119	0.303
*Block_Insider*Low*	0.1015 *	0.085	0.1627 ***	0.003	-0.0227	0.412	0.0158	0.403
Block_Highest	-0.0189	0.421	-0.0245	0.275	-0.0446 ***	0.000	0.0053	0.663
*Block_Highest*Low*	-0.0309	0.366	0.0247	0.402	0.0547 ***	0.001	-0.0049	0.755
ROA	3.3491	0.192	0.2088	0.943	-2.2768	0.156	2.1333	0.106
*ROA*Low*	-1.0369	0.794	2.0335	0.588	2.5538	0.193	-1.1715	0.513
Debt to Assets	-2.4711 **	0.010	-4.1158 ***	0.000	-3.0824 ***	0.000	-0.1870	0.674
*Debt to Assets*Low*	4.4870 **	0.026	7.0233 ***	0.001	3.1381 ***	0.005	1.0366	0.241
Return	-0.3478	0.283	-0.1218	0.747	-0.0778	0.710	0.0219	0.871
*Return*Low*	0.1857	0.663	0.0224	0.961	-0.0416	0.875	0.0514	0.779
Negative News	0.0012	0.997	0.2596	0.450	0.4325 ***	0.000	-0.2556 **	0.012
*Negative News*Low*	-0.2006	0.570	-0.3942	0.318	-0.4429 ***	0.004	0.2119 *	0.091
Total News	0.1852	0.216	0.2353 *	0.083	-0.0608	0.278	0.1460 ***	0.007
*Total News*Low*	0.0433	0.819	-0.0622	0.721	0.0609	0.448	-0.1178 *	0.088
Media Legitimacy	-0.1230	0.748	-0.5072	0.229	0.0199	0.936	-0.3174 ***	0.006
*Media Legitimacy*Low*	0.2281	0.648	0.7103	0.179	0.0036	0.990	0.3089 *	0.056
Size	1.2301 **	0.010	1.2388 ***	0.001	0.4090 **	0.037	0.7174 ***	0.004
Cross-section fixed (dummy variables)								
Period fixed (dummy variables)								
Adjusted R-squared		0.674		0.646		0.534		0.813
F-statistic		20.574		18.281		11.854		42.220
Prob(F-statistic)		0.000		0.000		0.000		0.000
Mean dependent var		4.643		4.907		2.433		2.658
S.D. dependent var		4.249		3.998		1.941		2.168
Durbin-Watson stat		1.417		1.439		1.538		1.028
Redundant Fixed Effects Tests								
Test cross-section and period fixed effects								
Effects Test		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000
Period F		0.000		0.000		0.000		0.001
Period Chi-square		0.000		0.000		0.000		0.000
Cross-Section/Period F		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000
Periods included: 14								
Cross-sections included: 78								
Total panel (balanced) observations: 1092								

5.3. The association between environmental disclosures and environmental performance in annual reports, 10-K reports, and sustainability reports.

The association between environmental disclosures and environmental performance in annual reports

Table-4 shows the association between environmental disclosure and environmental performance in annual reports. In general, the low-performers disclose more information in annual reports as shown by the negative and significant coefficient of total disclosure. The results suggest that disclosures of the low-performers are of higher quality since the low-performers make more hard, negative, quantitative, and economic disclosures. Though the low-performers disclose more soft-information; there is no difference between the high and low-performers in terms of disclosing qualitative information in annual reports.

Table-4 also shows that there is a negative and significant relation between trading volumes and the different measures of disclosure which suggests that highly traded firms find it less beneficial to disclose environmental information in annual reports. However, the issuance of new shares is associated with higher levels of disclosures (there is a positive and significant association between common stock change and measures of total, hard, positive, negative, quantitative, and firm specific qualitative disclosures). As expected, a higher level of holding by the highest block-holder is associated with less disclosure. The findings suggest that firms with a higher level of inside or outside holdings attempt to reduce the amount of negative information released. Higher levels of debt to assets are associated with higher level of quantitative and economic disclosures (economic disclosure is only significant at 11%). Total news following of the firm's environmental activities is associated with higher levels of hard, quantitative and

economic disclosures. Further, the amount of negative news about the firm's environmental activities is associated with lower levels of economic disclosures.

Table-4: The Association between Environmental Disclosure and Environmental Performance in Annual Reports (to be continued)

	Total Disclosure		Hard Disclosure		Soft Disclosure		Positive/Neutral		Negative Disclosure	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	1.5733	0.331	0.5316	0.717	1.0416 **	0.023	1.2500	0.209	0.3126	0.698
Performance	-0.2905 ***	0.009	-0.2299 **	0.013	-0.0606	0.127	-0.1203	0.113	-0.1665 ***	0.003
Beta	-0.2376	0.434	-0.1475	0.569	-0.0902	0.415	-0.2589	0.210	0.0302	0.852
Trading Volume	-0.0420 ***	0.000	-0.0343 ***	0.000	-0.0078 ***	0.002	-0.0263 ***	0.000	-0.0156 ***	0.000
Debt to Equity Change	0.0001	0.618	0.0000	0.858	0.0000	0.312	0.0001	0.354	0.0000	0.852
Common Stock Change	0.0012 ***	0.000	0.0011 ***	0.000	0.0001	0.121	0.0007 ***	0.000	0.0005 ***	0.000
Block_Insider	-0.0534	0.227	-0.0656	0.102	0.0122	0.222	-0.0096	0.717	-0.0435 **	0.034
Block_Highest	-0.0418 **	0.016	-0.0336 **	0.028	-0.0081	0.174	-0.0182	0.105	-0.0235 ***	0.009
ROA	-1.3437	0.487	0.2639	0.879	-1.6076 ***	0.006	-0.5611	0.698	-0.7998	0.379
Debt to Assets	1.0577	0.266	1.2660	0.124	-0.2083	0.523	0.3580	0.587	0.6924	0.139
Return	0.0091	0.979	0.0218	0.939	-0.0127	0.908	0.0288	0.893	-0.0119	0.946
Negative News	-0.0891	0.590	-0.1022	0.405	0.0131	0.879	0.0371	0.776	-0.1253	0.128
Total News	0.1536	0.110	0.1467 **	0.037	0.0069	0.892	0.0873	0.267	0.0651	0.137
Media Legitimacy	0.1893	0.504	0.1408	0.530	0.0485	0.669	0.0873	0.670	0.0942	0.463
Size	1.1493 ***	0.003	0.9743 ***	0.007	0.1750	0.101	0.5618 **	0.021	0.5840 ***	0.004
Cross-section fixed (dummy variables)										
Period fixed (dummy variables)										
Adjusted R-squared		0.547		0.527		0.433		0.548		0.515
F-statistic		13.661		12.707		9.022		13.740		12.157
Prob(F-statistic)		0.000		0.000		0.000		0.000		0.000
Mean dependent var		3.682		2.698		0.984		2.322		1.357
S.D. dependent var		4.144		3.369		1.253		2.804		2.027
Durbin-Watson stat		1.081		0.979		1.551		1.299		0.839
Redundant Fixed Effects Tests										
Test cross-section and period fixed effects										
Effects Test		Prob.		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000		0.000
Period F		0.000		0.000		0.048		0.101		0.000
Period Chi-square		0.000		0.000		0.025		0.059		0.000
Cross-Section/Period F		0.000		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000		0.000

Periods included: 14
Cross-sections included: 78
Total panel (balanced) observations: 1092

Table-4: The Association between Environmental Disclosure and Environmental Performance in Annual Reports (continue)

	Quantitative		Firm Specific		Qualitative		Economic	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	0.1777	0.815	0.6043	0.449	0.7806 **	0.044	0.4154	0.547
Performance	-0.1081 **	0.038	-0.1401 **	0.011	-0.0386	0.237	-0.1002 **	0.021
Beta	-0.0810	0.582	-0.0696	0.644	-0.0781	0.422	-0.0350	0.786
Trading Volume	-0.0178 ***	0.000	-0.0186 ***	0.000	-0.0055 ***	0.008	-0.0144 ***	0.000
Debt to Equity Change	0.0000	0.641	0.0000	0.829	0.0000	0.610	0.0000	0.996
Common Stock Change	0.0003 ***	0.000	0.0008 ***	0.000	0.0000	0.428	0.0001	0.137
Block_Insider	-0.0343	0.121	-0.0237	0.225	0.0049	0.540	-0.0306	0.106
Block_Highest	-0.0133	0.112	-0.0208 **	0.019	-0.0077	0.122	-0.0138 *	0.060
ROA	0.3481	0.738	-0.1169	0.894	-1.5920 ***	0.002	0.5929	0.511
Debt to Assets	1.2550 ***	0.008	0.2581	0.574	-0.4627 *	0.086	0.6720	0.110
Return	0.1272	0.418	-0.1024	0.523	-0.0080	0.934	0.0555	0.700
Negative News	-0.1044	0.130	0.0540	0.526	-0.0377	0.590	-0.1281 **	0.046
Total News	0.1051 ***	0.005	0.0390	0.397	0.0083	0.853	0.0899 ***	0.004
Media Legitimacy	0.0320	0.799	0.1753	0.185	-0.0257	0.779	0.0624	0.569
Size	0.3530 *	0.064	0.5923 ***	0.003	0.2004 **	0.029	0.3119 *	0.079
Cross-section fixed (dummy variables)								
Period fixed (dummy variables)								
Adjusted R-squared		0.493		0.543		0.425		0.538
F-statistic		11.185		13.461		8.762		13.231
Prob(F-statistic)		0.000		0.000		0.000		0.000
Mean dependent var		1.238		1.664		0.777		1.046
S.D. dependent var		1.817		1.973		1.067		1.649
Durbin-Watson stat		1.052		1.160		1.422		0.850
Redundant Fixed Effects Tests								
Test cross-section and period fixed effects								
Effects Test		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000
Period F		0.007		0.000		0.038		0.000
Period Chi-square		0.003		0.000		0.019		0.000
Cross-Section/Period F		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000
Periods included: 14								
Cross-sections included: 78								
Total panel (balanced) observations: 1092								

The association between environmental disclosures and environmental performance in 10-K reports

Table-5 shows that there is no association between disclosures and firms' environmental performance except for the disclosure of less proprietary information where the higher levels of performance are associated with the disclosure of soft, positive or qualitative information (support for *H2*). Unlike annual reports, higher trading volumes are associated with higher levels of disclosure including the disclosure of more proprietary information such as hard, negative, and economic information. Further, highest level of holdings by the largest outside block-holder is associated with higher levels of disclosures. Similar to annual reports, higher levels of debt to assets are associated with higher levels of quantitative and economic disclosure. Finally, firms that are subject to higher levels of negative news following are associated with lower levels of proprietary disclosures such as hard, negative, and economic disclosure. Meanwhile, the higher levels of negative news following are associated with higher levels of disclosure of less proprietary information such as soft and qualitative disclosures. The high level of total news following is associated with high levels of negative disclosures while high levels of media legitimacy is associated with lower level of negative disclosures.

Table-5: The Association between Environmental Disclosure and Environmental Performance in 10-K Reports (to be continued)

	Total Disclosure		Hard Disclosure		Soft Disclosure		Positive/Neutral		Negative Disclosure	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	-2.2872 *	0.091	-2.7777 **	0.035	0.4905	0.191	0.2302	0.800	-2.6312 ***	0.000
Performance	0.0215	0.791	-0.0462	0.507	0.0677 **	0.029	0.0900 *	0.071	-0.0809	0.147
Beta	0.0681	0.758	-0.0078	0.968	0.0758	0.394	0.2361	0.104	-0.1450	0.351
Trading Volume	0.0241 ***	0.008	0.0180 **	0.027	0.0061 ***	0.002	0.0075	0.153	0.0165 ***	0.003
Debt to Equity Change	0.0000	0.883	0.0000	0.835	0.0000	0.882	0.0000	0.551	-0.0001	0.449
Common Stock Change	0.0000	0.726	-0.0001	0.513	0.0000	0.763	0.0000	0.922	0.0000	0.423
Block_Insider	0.0389 *	0.056	0.0234	0.220	0.0155 *	0.065	0.0327 **	0.029	0.0058	0.670
Block_Highest	0.0532 ***	0.000	0.0465 ***	0.001	0.0068	0.225	0.0346 ***	0.001	0.0204 *	0.070
ROA	0.8039	0.614	-0.1646	0.919	0.9686 *	0.079	1.3068	0.122	-0.6182	0.637
Debt to Assets	0.4027	0.577	0.9451	0.144	-0.5424 *	0.065	-0.0140	0.977	0.4472	0.393
Return	0.1057	0.676	0.2260	0.291	-0.1203	0.217	-0.0809	0.616	0.2069	0.190
Negative News	-0.0252	0.807	-0.1586 *	0.074	0.1334 ***	0.002	0.1877 **	0.016	-0.2148 ***	0.004
Total News	0.0677	0.261	0.1028 **	0.045	-0.0351	0.140	-0.0362	0.341	0.1050 ***	0.010
Media Legitimacy	-0.0165	0.931	-0.1520	0.350	0.1355 *	0.052	0.1748	0.148	-0.2350 *	0.062
Size	1.8332 ***	0.000	1.7106 ***	0.000	0.1226	0.196	0.3988 *	0.069	1.4765 ***	0.000
Cross-section fixed (dummy variables)										
Period fixed (dummy variables)										
Adjusted R-squared		0.761		0.783		0.501		0.687		0.732
F-statistic		34.447		38.831		11.520		23.974		29.605
Prob(F-statistic)		0.000		0.000		0.000		0.000		0.000
Mean dependent var		6.197		4.919		1.277		2.924		3.277
S.D. dependent var		4.257		3.827		1.089		2.328		2.653
Durbin-Watson stat		1.023		1.001		1.276		1.164		0.969
Redundant Fixed Effects Tests										
Test cross-section and period fixed effects										
Effects Test		Prob.		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000		0.000
Period F		0.559		0.770		0.303		0.934		0.266
Period Chi-square		0.464		0.699		0.219		0.906		0.188
Cross-Section/Period F		0.000		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000		0.000

Periods included: 14
Cross-sections included: 78
Total panel (balanced) observations: 1092

Table-5: The Association between Environmental Disclosure and Environmental Performance in 10-K Reports (continue)

	Quantitative		Firm Specific		Qualitative		Economic	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	-0.8404	0.366	-1.9959 ***	0.001	0.4353	0.157	-0.8199	0.368
Performance	-0.0397	0.280	-0.0205	0.668	0.0692 **	0.015	-0.0420	0.207
Beta	0.0916	0.396	-0.0496	0.704	0.0491	0.525	0.0666	0.492
Trading Volume	0.0071	0.115	0.0102 **	0.016	0.0067 ***	0.000	0.0085 *	0.054
Debt to Equity Change	0.0000	0.595	-0.0001	0.241	0.0000	0.907	0.0000	0.544
Common Stock Change	0.0000	0.709	0.0000	0.333	0.0000	0.646	0.0000	0.838
Block_Insider	0.0169	0.112	0.0025	0.848	0.0191 ***	0.002	0.0104	0.296
Block_Highest	0.0130	0.101	0.0373 ***	0.000	0.0046	0.314	0.0110	0.137
ROA	0.6682	0.454	-0.7960	0.394	0.8164	0.111	0.5888	0.527
Debt to Assets	0.8791 **	0.023	0.0852	0.838	-0.5311 **	0.026	0.7270 **	0.050
Return	0.1576	0.198	0.0744	0.613	-0.1060	0.180	0.1733	0.127
Negative News	-0.0649	0.231	-0.0708	0.247	0.1086 ***	0.003	-0.0892 *	0.088
Total News	0.0340	0.247	0.0667 *	0.057	-0.0319	0.122	0.0412	0.154
Media Legitimacy	-0.0684	0.431	-0.0949	0.384	0.1030 *	0.086	-0.1106	0.163
Size	0.6555 ***	0.003	1.1188 ***	0.000	0.1009	0.195	0.6655 ***	0.002
Cross-section fixed (dummy variables)								
Period fixed (dummy variables)								
	0.781		0.693		0.547		0.802	
Adjusted R-squared	38.472		24.637		13.674		43.599	
F-statistic	0.000		0.000		0.000		0.000	
Prob(F-statistic)	2.372		2.680		1.149		2.292	
Mean dependent var	2.107		2.153		0.968		2.032	
S.D. dependent var	0.968		1.144		1.245		0.927	
Durbin-Watson stat								
Redundant Fixed Effects Tests								
Test cross-section and period fixed effects								
	Prob.		Prob.		Prob.		Prob.	
Effects Test								
	0.000		0.000		0.000		0.000	
Cross-section F	0.000		0.000		0.000		0.000	
Cross-section Chi-square	0.646		0.269		0.114		0.367	
Period F	0.557		0.190		0.069		0.276	
Period Chi-square	0.000		0.000		0.000		0.000	
Cross-Section/Period F	0.000		0.000		0.000		0.000	
Cross-Section/Period Chi-square								
Periods included: 14								
Cross-sections included: 78								
Total panel (balanced) observations: 1092								

The association between environmental disclosures and environmental performance in sustainability reports

To examine the association between sustainability reports' disclosures and environmental performance, I conduct four different analyses:

1. Examine the association between disclosure and performance for all 78 firms (the analysis includes firms that did not issue sustainability reports).
2. Examine the association between disclosure and performance in sustainability reports (the analysis includes only observations where firms issued sustainability reports).
3. Examine the association between disclosure and performance in sustainability reports issued according a reporting guideline (GRI guideline).
4. Examine the association between disclosure and performance in sustainability reports issued without adopting a reporting guideline.

The association between environmental disclosures and environmental performance in sustainability reports – all 78 firms.

Unlike the results of previous analysis of annual and 10-K reports' disclosures, Table-6 shows that there is a positive association between performance and disclosure (see measures of total, hard, soft, positive, quantitative, firm specific, qualitative, and economic disclosures)[25]. The results imply that high performing firms are more inclined to voluntarily disclose more information in sustainability reports. Firms with high risk and high trading volume disclose less information. Reliance on the capital market (higher levels of debt to equity change and common stock change) is associated with higher levels of disclosure. Increase in insider-holding is

[25] Due to software package Tobit analysis is not available for panel data.

associated with higher level of environmental disclosure while higher levels of outside-holdings are associated with lower levels of disclosures. Higher levels of debt to assets are associated with lower levels of disclosure. Finally, total news following is associated with higher level of disclosure.

Table-6: The Association between Environmental Disclosure and Environmental Performance in Sustainability Reports – All Firms (Balanced Panel) - (to be continued)

	Total Disclosure		Hard Disclosure		Soft Disclosure		Positive/Neutral		Negative	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	-6.8004 **	0.049	-5.9729 **	0.014	-0.8274	0.489	-5.7585 *	0.065	-1.0603 **	0.039
Performance	0.9588 ***	0.000	0.6843 ***	0.000	0.2745 ***	0.001	0.9039 ***	0.000	0.0583	0.124
Beta	-1.0627 *	0.100	-0.7735	0.103	-0.2891	0.178	-0.8738	0.138	-0.1850 *	0.052
Trading Volume	-0.0228 **	0.027	-0.0127	0.107	-0.0101 ***	0.004	-0.0254 ***	0.005	0.0025	0.260
Debt to Equity Change	0.0007 **	0.021	0.0004 *	0.054	0.0003 **	0.018	0.0008 ***	0.006	-0.0001	0.185
Common Stock Change	0.0012 ***	0.000	0.0009 ***	0.000	0.0003 ***	0.006	0.0013 ***	0.000	-0.0001	0.138
Block_Insider	0.1843 ***	0.007	0.1300 **	0.012	0.0543 ***	0.008	0.1745 ***	0.004	0.0095	0.433
Block_Highest	-0.0716 *	0.055	-0.0532 **	0.049	-0.0185	0.109	-0.0735 **	0.032	0.0027	0.602
ROA	1.0767	0.806	-0.1030	0.977	1.1797	0.381	1.6984	0.640	-0.5690	0.597
Debt to Assets	-4.4521 **	0.036	-2.9337 *	0.061	-1.5183 **	0.024	-3.9739 **	0.034	-0.4827	0.234
Return	-0.8053	0.198	-0.7246	0.109	-0.0806	0.698	-0.6729	0.228	-0.1354	0.267
Negative News	-0.3797	0.383	-0.3249	0.312	-0.0548	0.687	-0.2970	0.456	-0.0765	0.289
Total News	0.4981 **	0.026	0.4267 **	0.011	0.0714	0.272	0.4331 **	0.031	0.0599 *	0.095
Media Legitimacy	-0.0640	0.921	-0.0720	0.880	0.0079	0.968	0.1097	0.850	-0.1477	0.178
Size	2.5588 ***	0.004	2.0740 ***	0.001	0.4848 *	0.099	2.1641 ***	0.005	0.3947 ***	0.010
Cross-section fixed (dummy variables)										
Period fixed (dummy variables)										
Adjusted R-squared		0.500		0.505		0.429		0.492		0.445
F-statistic		11.483		11.701		8.891		11.160		9.427
Prob(F-statistic)		0.000		0.000		0.000		0.000		0.000
Mean dependent var		5.345		3.797		1.549		4.837		0.512
S.D. dependent var		8.244		6.059		2.420		7.375		1.220
Durbin-Watson stat		1.450		1.409		1.572		1.487		1.388
Cross-section fixed (dummy variables)										
Period fixed (dummy variables)										
Effects Test		Prob.		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000		0.000
Period F		0.000		0.000		0.000		0.000		0.020
Period Chi-square		0.000		0.000		0.000		0.000		0.009
Cross-Section/Period F		0.000		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000		0.000

Periods included: 14
Cross-sections included: 78
Total panel (balanced) observations: 1092

Table-6: The Association between Environmental Disclosure and Environmental Performance in Sustainability Reports – All Firms (Balanced Panel) - (continue)

	Quantitative		Firm Specific		Qualitative		Economic	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	-3.3431 **	0.029	-3.2687 **	0.020	-0.2069	0.785	-1.6835 ***	0.002
Performance	0.3248 ***	0.002	0.4927 ***	0.000	0.1447 ***	0.009	0.0893 ***	0.005
Beta	-0.3741	0.204	-0.4840 *	0.084	-0.2007	0.177	-0.1108	0.210
Trading Volume	-0.0078	0.107	-0.0080 *	0.066	-0.0070 ***	0.004	0.0009	0.596
Debt to Equity Change	0.0004 ***	0.003	0.0001	0.471	0.0002 **	0.017	0.0000	0.627
Common Stock Change	0.0006 ***	0.000	0.0003 **	0.011	0.0003 ***	0.000	0.0000	0.647
Block_Insider	0.0771 **	0.019	0.0745 ***	0.006	0.0323 **	0.016	0.0211	0.127
Block_Highest	-0.0327 *	0.051	-0.0245	0.106	-0.0136 *	0.082	0.0006	0.900
ROA	0.6634	0.761	-0.0054	0.998	0.4715	0.600	0.1037	0.878
Debt to Assets	-1.8033 **	0.050	-1.2192	0.182	-1.4340 ***	0.004	-0.4040	0.232
Return	-0.4694 *	0.092	-0.2487	0.323	-0.0901	0.549	-0.0887	0.370
Negative News	-0.1626	0.395	-0.1789	0.324	-0.0321	0.739	-0.0676	0.298
Total News	0.2272 **	0.026	0.2266 **	0.015	0.0392	0.372	0.0839 **	0.023
Media Legitimacy	0.0294	0.917	-0.0472	0.863	-0.0202	0.889	-0.0998	0.291
Size	1.3228 ***	0.001	0.8455 **	0.017	0.3905 **	0.047	0.4704 ***	0.001
Cross-section fixed (dummy variables)								
Period fixed (dummy variables)								
Adjusted R-squared		0.512		0.447		0.430		0.429
F-statistic		12.026		9.493		8.902		8.874
Prob(F-statistic)		0.000		0.000		0.000		0.000
Mean dependent var		2.330		1.936		1.083		0.482
S.D. dependent var		3.728		3.242		1.714		1.101
Durbin-Watson stat		1.431		1.448		1.597		1.167
Cross-section fixed (dummy variables)								
Period fixed (dummy variables)								
Effects Test		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000
Period F		0.000		0.000		0.000		0.001
Period Chi-square		0.000		0.000		0.000		0.000
Cross-Section/Period F		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000
Periods included: 14								
Cross-sections included: 78								
Total panel (balanced) observations: 1092								

The association between environmental disclosures and environmental performance in sustainability reports – case of firms that issued sustainability reports

Among the 1092 firm-year observation, there are 376 cases where firms issued sustainability reports. The findings of an unbalanced panel data analysis of these 376

observations are presented in Table-7. I control for firms using the GRI guidelines using a dummy variable "GRI" equal 1 if the firm reports according to the GRI guideline and 0 if otherwise. The results show that there is no significant association between the disclosures and the level of environmental performance. Adopting the GRI guideline is associated with higher levels of disclosures. High trading volumes and high levels of debt-to-assets are associated with higher levels of environmental disclosures. High returns are associated with lower levels of hard and quantitative disclosures. Society awareness (Total News) is associated with higher levels of disclosures.

Table-7: The Association between Environmental Disclosure and Environmental Performance in Sustainability Reports – Firms with Sustainability Reports (Un-Balanced Panel) – (*to be continued*)

	Total Disclosure		Hard Disclosure		Soft Disclosure		Positive/Neutral		Negative	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	18.5479 *	0.081	0.6510	0.937	17.8969 ***	0.000	21.3465 **	0.016	-2.7807	0.452
Performance	-0.1482	0.631	0.0446	0.849	-0.1928 *	0.085	-0.1915	0.467	0.0592	0.463
GRI	5.7774 ***	0.000	5.0116 ***	0.000	0.7658 ***	0.001	5.3181 ***	0.000	0.4263 **	0.014
Beta	-1.1519	0.194	-0.9147	0.206	-0.2372	0.519	-0.7726	0.311	-0.3735	0.110
Trading Volume	0.0207	0.475	0.0455 **	0.043	-0.0249 **	0.022	-0.0084	0.722	0.0288 ***	0.008
Debt to Equity Change	-0.0106 *	0.099	-0.0082	0.118	-0.0024	0.368	-0.0073	0.185	-0.0033 **	0.026
Common Stock Change	0.0001	0.576	0.0002	0.266	-0.0001	0.503	0.0003	0.217	-0.0001 *	0.063
Block_Insider	-0.2127	0.111	-0.1177	0.223	-0.0950 *	0.098	-0.1248	0.272	-0.0915 **	0.023
Block_Highest	-0.0202	0.781	-0.0227	0.677	0.0025	0.931	-0.0509	0.417	0.0334 *	0.086
ROA	-2.6282	0.679	-1.8760	0.705	-0.7523	0.744	-0.6257	0.899	-1.9078	0.318
Debt to Assets	7.9209 *	0.058	8.7656 ***	0.010	-0.8447	0.559	5.5606 *	0.098	2.3234 *	0.080
Return	-1.1279	0.224	-1.4683 **	0.033	0.3404	0.339	-0.7492	0.332	-0.3892	0.246
Negative News	-0.0756	0.817	-0.1731	0.481	0.0975	0.413	-0.0207	0.945	-0.0359	0.683
Total News	0.3540 **	0.010	0.4028 ***	0.000	-0.0488	0.352	0.2666 **	0.018	0.0743	0.132
Media Legitimacy	-0.7766	0.167	-0.6322	0.158	-0.1444	0.472	-0.5333	0.268	-0.1759	0.330
Size	-2.4251	0.316	0.3533	0.848	-2.7785 ***	0.002	-2.8716	0.141	0.4326	0.619
Cross-section fixed (dummy variables)										
Period fixed (dummy variables)										
Adjusted R-squared		0.511		0.550		0.272		0.515		0.453
F-statistic		5.257		5.982		2.519		5.326		4.381
Prob(F-statistic)		0.000		0.000		0.000		0.000		0.000
Mean dependent var		15.524		11.027		4.497		14.048		1.487
S.D. dependent var		6.270		5.182		1.934		5.338		1.695
Durbin-Watson stat		1.648		1.561		1.957		1.704		1.566
Redundant Fixed Effects Tests										
Test cross-section and period fixed effects										
Effects Test		Prob.		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000		0.000
Period F		0.844		0.391		0.870		0.821		0.076
Period Chi-square		0.658		0.160		0.704		0.621		0.012
Cross-Section/Period F		0.000		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000		0.000
Periods included: 14										
Cross-sections included: 65										
Total panel (unbalanced) observations: 376										

Table-7: The Association between Environmental Disclosure and Environmental Performance in Sustainability Reports – Firms with Sustainability Reports (Un-Balanced Panel) – (continue)

	Quantitative		Firm Specific		Qualitative		Economic	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	4.2937	0.398	3.5659	0.525	10.7061 ***	0.000	-1.0133	0.709
Performance	-0.0877	0.522	0.1533	0.357	-0.1979 ***	0.006	0.0738	0.235
GRI	2.7032	0.000	2.7227 ***	0.000	0.3184 *	0.075	0.4139 ***	0.006
Beta	-0.0067	0.990	-0.9884 **	0.028	-0.1511	0.569	-0.0591	0.774
Trading Volume	0.0213	0.118	0.0166	0.291	-0.0175 **	0.041	0.0157 *	0.082
Debt to Equity Change	-0.0023	0.445	-0.0064 **	0.035	-0.0019	0.364	-0.0008	0.513
Common Stock Change	0.0002	0.105	-0.0001	0.576	0.0000	0.623	-0.0001	0.312
Block_Insider	-0.0796	0.174	-0.0875	0.247	-0.0492	0.174	-0.0904 ***	0.005
Block_Highest	-0.0586	0.109	0.0535	0.150	-0.0124	0.537	0.0174	0.320
ROA	-0.2014	0.950	-1.5055	0.603	-0.8266	0.604	-0.5363	0.701
Debt to Assets	3.4191 *	0.093	5.3145 **	0.019	-0.8496	0.462	1.2952	0.228
Return	-0.9266 **	0.029	-0.3392	0.444	0.1275	0.647	-0.2652	0.296
Negative News	-0.1091	0.462	-0.0328	0.839	0.0852	0.318	-0.0479	0.518
Total News	0.2290 ***	0.003	0.1647 **	0.023	-0.0528	0.171	0.1061 **	0.017
Media Legitimacy	-0.3141	0.247	-0.2940	0.315	-0.1011	0.530	-0.1337	0.344
Size	-0.1328	0.907	-0.9799	0.438	-1.3263 *	0.054	0.1736	0.781
Cross-section fixed (dummy variables)								
Period fixed (dummy variables)								
Adjusted R-squared		0.530		0.470		0.303		0.469
F-statistic		5.593		4.615		2.769		4.603
Prob(F-statistic)		0.000		0.000		0.000		0.000
Mean dependent var		6.766		5.622		3.146		1.399
S.D. dependent var		3.214		3.129		1.426		1.497
Durbin-Watson stat		1.433		1.768		2.170		1.239
Redundant Fixed Effects Tests								
Test cross-section and period fixed effects								
Effects Test		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000
Period F		0.110		0.489		0.613		0.018
Period Chi-square		0.021		0.235		0.353		0.001
Cross-Section/Period F		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000

Periods included: 14
Cross-sections included: 65
Total panel (unbalanced) observations: 376

The association between environmental disclosures and environmental performance in sustainability reports – case of firms that issued sustainability reports according to the GRI guideline

Furthermore, I study 184 cases where firms disclosed environmental information in sustainability reports prepared according to the GRI guideline. Table-8 shows that environmental disclosure is not associated with environmental performance (except for the positive association between firm specific qualitative disclosure and performance). These findings suggest that adopting the GRI guidelines has successfully reduced the reporting bias between the high and low performers. Furthermore, higher levels of insider-holdings and reliance on the capital market (change in common stock) are positively associated with the different measures disclosure. Higher levels of environmentalists' pressures (negative news) are associated with lower level of disclosure. Meanwhile, society awareness (total news) is associated with higher levels of disclosure. Finally, firms with high media legitimacy are associated with lower levels of disclosure.

Table-8: The Association between Environmental Disclosure and Environmental Performance in Sustainability Reports (GRI-Disclosure) – (to be continued)

	Total Disclosure		Hard Disclosure		Soft Disclosure		Positive/Neutral		Negative	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	-11.3288	0.644	-31.2496 *	0.074	19.9208 **	0.046	3.9562	0.842	-15.2850 **	0.021
Performance	0.4090	0.343	0.4701	0.140	-0.0610	0.686	0.2648	0.462	0.1443	0.189
Beta	-1.7998	0.160	-1.4830	0.106	-0.3169	0.517	-1.1704	0.284	-0.6294 **	0.046
Trading Volume	-0.0070	0.905	0.0248	0.560	-0.0318	0.180	-0.0345	0.466	0.0275 *	0.081
Debt to Equity Change	-0.0029	0.850	0.0001	0.994	-0.0030	0.490	-0.0028	0.822	-0.0001	0.982
Common Stock Change	0.0003	0.257	0.0004 **	0.040	-0.0001	0.391	0.0004 *	0.073	-0.0001	0.155
Block_Insider	0.5259 **	0.027	0.4135 **	0.024	0.1124	0.242	0.4833 **	0.012	0.0427	0.605
Block_Highest	0.1059	0.319	0.0692	0.339	0.0367	0.449	0.0513	0.566	0.0546 *	0.059
ROA	-2.3913	0.692	-0.9638	0.832	-1.4274	0.526	0.1598	0.974	-2.5511	0.137
Debt to Assets	2.7415	0.683	5.7333	0.274	-2.9918	0.164	0.0012	1.000	2.7404	0.147
Return	0.7865	0.542	-0.1882	0.851	0.9747 **	0.045	0.7250	0.485	0.0615	0.873
Negative News	-0.3874	0.238	-0.5004 **	0.041	0.1130	0.422	-0.3446	0.210	-0.0428	0.707
Total News	0.5473 ***	0.008	0.6166 ***	0.000	-0.0694	0.426	0.4390 ***	0.009	0.1083	0.131
Media Legitimacy	-1.4932 *	0.051	-1.1897 **	0.035	-0.3035	0.289	-1.2959 **	0.040	-0.1973	0.410
Size	5.5913	0.339	8.6212 **	0.035	-3.0299	0.211	2.3515	0.610	3.2398 **	0.048
Cross-section fixed (dummy variables)										
Period fixed (dummy variables)										
Adjusted R-squared		0.467		0.519		0.370		0.494		0.484
F-statistic		3.196		3.701		2.475		3.449		3.349
Prob(F-statistic)		0.000		0.000		0.000		0.000		0.000
Mean dependent var		18.109		13.310		4.799		16.391		1.717
S.D. dependent var		5.280		4.119		1.991		4.590		1.473
Durbin-Watson stat		1.949		1.967		2.120		2.003		2.163
Redundant Fixed Effects Tests										
Test cross-section and period fixed effects										
Effects Test		Prob.		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000		0.000
Period F		0.859		0.261		0.658		0.884		0.025
Period Chi-square		0.531		0.026		0.242		0.587		0.000
Cross-Section/Period F		0.000		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000		0.000

Periods included: 12
Cross-sections included: 49
Total panel (unbalanced) observations: 184

Table-8: The Association between Environmental Disclosure and Environmental Performance in Sustainability Reports (GRI-Disclosure) – (continue)

	Quantitative		Firm Specific		Qualitative		Economic	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	-14.7236	0.110	-14.9707	0.306	18.3655 ***	0.001	-2.6413	0.590
Performance	-0.0300	0.831	0.5213 *	0.069	-0.0823	0.405	0.0239	0.745
Beta	-0.3016	0.506	-1.6655 **	0.039	0.1673	0.595	-0.2545	0.316
Trading Volume	0.0169	0.444	-0.0041	0.905	-0.0198	0.131	0.0164	0.349
Debt to Equity Change	-0.0007	0.911	0.0000	0.997	-0.0022	0.482	0.0048	0.107
Common Stock Change	0.0002 *	0.088	0.0001	0.576	0.0000	0.809	0.0000	0.778
Block_Insider	0.1967 **	0.027	0.2655	0.120	0.0637	0.349	0.0319	0.536
Block_Highest	0.0110	0.799	0.1200 *	0.055	-0.0252	0.461	0.0279	0.276
ROA	-0.2484	0.909	-0.1117	0.977	-2.0312	0.156	0.5546	0.682
Debt to Assets	3.6926	0.131	1.7187	0.678	-2.6698 *	0.077	0.2641	0.843
Return	-0.0446	0.939	0.3878	0.592	0.4433	0.253	-0.1450	0.689
Negative News	-0.3473 **	0.011	-0.1298	0.530	0.0896	0.392	-0.1843 **	0.018
Total News	0.3453 ***	0.000	0.2728 **	0.027	-0.0709	0.273	0.1936 ***	0.000
Media Legitimacy	-0.6594 **	0.014	-0.6270	0.189	-0.2069	0.315	-0.3144 **	0.048
Size	4.6294 **	0.032	3.9248	0.260	-2.9629 **	0.028	0.7298	0.545
Cross-section fixed (dummy variables)								
Period fixed (dummy variables)								
Adjusted R-squared		0.589		0.423		0.372		0.462
F-statistic		4.596		2.840		2.485		3.149
Prob(F-statistic)		0.000		0.000		0.000		0.000
Mean dependent var		7.924		6.929		3.255		1.500
S.D. dependent var		2.488		3.096		1.389		1.272
Durbin-Watson stat		1.905		2.037		2.390		1.940
Redundant Fixed Effects Tests								
Test cross-section and period fixed effects								
Effects Test		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000
Period F		0.514		0.261		0.447		0.066
Period Chi-square		0.128		0.027		0.091		0.002
Cross-Section/Period F		0.000		0.000		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000

Periods included: 12
Cross-sections included: 49
Total panel (unbalanced) observations: 184

The association between environmental disclosures and environmental performance in sustainability reports – case of firms that issued sustainability reports without a reporting guideline

In this section, I examine the association between disclosure and performance in the cases where firms issued sustainability reports without relying on a reporting guideline (192 cases). Table-9 shows that the low performers disclose more information in their sustainability reports; they especially disclose more qualitative information in these reports. High trading volumes are associated with higher levels of disclosures in these sustainability reports (see association with total, hard, positive, and firm specific disclosures). Reliance on the capital market is also associated with higher levels of disclosures. Highest levels of insider-holdings are associated with lower levels of proprietary information (see the association with negative, quantitative, and economic disclosures). Highest levels of outsider-holdings are associated with lower levels of disclosures (see the association with total, hard, positive, and quantitative disclosures). Firms with higher debt-to-assets disclose less economic information in the non-guided sustainability reports. Environmentalists' pressures (negative news) are associated with higher levels of less-proprietary information (see the association with total, soft, positive, and qualitative disclosures). While society awareness (total news) is associated with higher levels of disclosure of proprietary information such hard and quantitative disclosures, but not associated with negative or economic disclosures.

Table-9: The Association between Environmental Disclosure and Environmental Performance in Sustainability Reports (Non-GRI Disclosure) – (to be continued)

	Total Disclosure		Hard Disclosure		Soft Disclosure		Positive/Neutral		Negative	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	24.3585 **	0.033	14.2329	0.114	10.1256 **	0.032	20.5113 **	0.042	4.4301	0.360
Performance	-0.5531 *	0.100	-0.4016	0.108	-0.1514	0.339	-0.3786	0.230	-0.1274	0.252
Beta	-1.0072	0.367	-0.9663	0.326	-0.0409	0.941	-0.7084	0.482	-0.2340	0.546
Trading Volume	0.0648 **	0.031	0.0513 **	0.036	0.0135	0.445	0.0502 **	0.042	0.0116	0.418
Debt to Equity Change	-0.0003	0.959	-0.0020	0.689	0.0017	0.672	0.0024	0.693	-0.0028	0.109
Common Stock Change	0.0179 *	0.083	0.0117	0.171	0.0062 *	0.071	0.0173 **	0.045	0.0006	0.864
Block_Insider	-0.3160 **	0.022	-0.2232 *	0.052	-0.0928	0.116	-0.1328	0.268	-0.1893 ***	0.008
Block_Highest	-0.2080 **	0.012	-0.1634 **	0.014	-0.0446	0.171	-0.1698 **	0.020	-0.0273	0.224
ROA	8.0516	0.472	6.3511	0.471	1.7005	0.636	6.3456	0.462	1.5396	0.701
Debt to Assets	0.5636	0.917	1.1144	0.804	-0.5509	0.809	2.0367	0.662	-1.8143	0.339
Return	0.2461	0.814	-0.2968	0.719	0.5429	0.229	0.3711	0.681	-0.1415	0.772
Negative News	0.6218 *	0.092	0.3686	0.192	0.2532 *	0.090	0.7482 **	0.023	-0.1372	0.339
Total News	0.4761 ***	0.002	0.4382 ***	0.000	0.0379	0.471	0.3882 ***	0.001	0.0705	0.303
Media Legitimacy	0.6856	0.272	0.3213	0.510	0.3642	0.206	0.9974 *	0.069	-0.2151	0.459
Size	-2.1838	0.356	-1.0066	0.599	-1.1771	0.233	-2.1127	0.304	-0.2102	0.858
Cross-section fixed (dummy variables)										
Period fixed (dummy variables)										
Adjusted R-squared		0.622		0.646		0.222		0.550		0.591
F-statistic		4.980		5.416		1.689		3.955		4.491
Prob(F-statistic)		0.000		0.000		0.005		0.000		0.000
Mean dependent var		13.047		8.839		4.208		11.802		1.266
S.D. dependent var		6.154		5.161		1.836		5.039		1.861
Durbin-Watson stat		2.325		2.280		2.106		2.263		1.561
Redundant Fixed Effects Tests										
Test cross-section and period fixed effects										
Effects Test		Prob.		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.001		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000		0.000
Period F		0.446		0.258		0.994		0.637		0.400
Period Chi-square		0.067		0.018		0.943		0.178		0.051
Cross-Section/Period F		0.000		0.000		0.005		0.000		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000		0.000

Periods included: 14
Cross-sections included: 53
Total panel (unbalanced) observations: 192

Table-9: The Association between Environmental Disclosure and Environmental Performance in Sustainability Reports (Non-GRI Disclosure) – (*continue*)

	Quantitative		Firm Specific		Qualitative		Economic	
Variable	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.	Coeff.	Prob.
C	10.8502 *	0.065	9.1259	0.133	4.9652	0.190	4.1628	0.183
Performance	-0.1286	0.448	-0.1734	0.350	-0.2040 *	0.076	-0.0180	0.827
Beta	-0.0674	0.925	-0.3947	0.406	-0.4803	0.261	-0.0949	0.752
Trading Volume	0.0128	0.443	0.0371 **	0.021	0.0119	0.424	0.0019	0.854
Debt to Equity Change	0.0018	0.559	-0.0036	0.196	0.0013	0.639	-0.0012	0.336
Common Stock Change	0.0078 *	0.099	0.0031	0.574	0.0069 ***	0.008	0.0015	0.571
Block_Insider	-0.1628 **	0.035	-0.0791	0.235	-0.0802	0.117	-0.1537 ***	0.001
Block_Highest	-0.1652 ***	0.001	-0.0045	0.900	-0.0274	0.275	-0.0241	0.195
ROA	9.1775	0.161	-2.9566	0.547	1.6643	0.456	0.5836	0.827
Debt to Assets	-0.4482	0.877	0.8208	0.784	-0.1501	0.937	-3.3133 **	0.017
Return	-0.0411	0.934	-0.2928	0.575	0.5634 *	0.082	-0.0250	0.932
Negative News	0.2329	0.261	0.1457	0.466	0.2325 **	0.034	-0.0501	0.694
Total News	0.2419 **	0.011	0.2161 ***	0.001	0.0006	0.988	0.0838	0.195
Media Legitimacy	0.1806	0.616	0.3026	0.355	0.2991	0.194	0.0579	0.749
Size	-0.9156	0.454	-1.2057	0.351	-0.2017	0.814	-0.0286	0.969
Cross-section fixed (dummy variables)								
Period fixed (dummy variables)								
Adjusted R-squared		0.649		0.482		0.308		0.696
F-statistic		5.479		3.250		2.075		6.548
Prob(F-statistic)		0.000		0.000		0.000		0.000
Mean dependent var		5.656		4.370		3.042		1.302
S.D. dependent var		3.438		2.610		1.457		1.682
Durbin-Watson stat		1.802		2.465		2.317		1.572
Redundant Fixed Effects Tests								
Test cross-section and period fixed effects								
Effects Test		Prob.		Prob.		Prob.		Prob.
Cross-section F		0.000		0.000		0.000		0.000
Cross-section Chi-square		0.000		0.000		0.000		0.000
Period F		0.033		0.994		0.873		0.171
Period Chi-square		0.000		0.946		0.503		0.007
Cross-Section/Period F		0.000		0.000		0.001		0.000
Cross-Section/Period Chi-square		0.000		0.000		0.000		0.000

Periods included: 14
Cross-sections included: 53
Total panel (unbalanced) observations: 192

Brief Summary

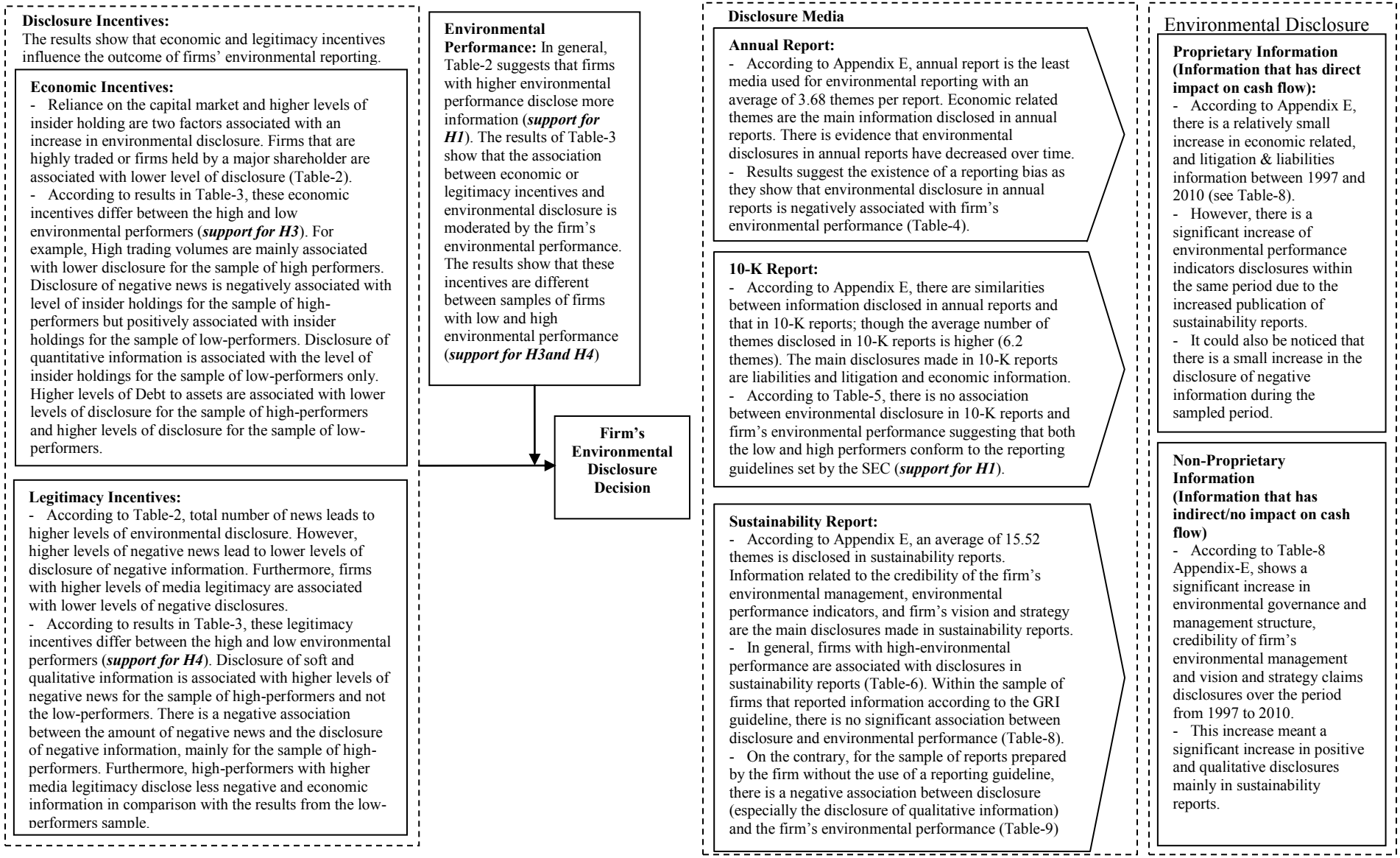
Based on the findings of this study, Figure-2 shows an ex-post model of the one presented in Figure-1. In general, a reporting bias exists based on the firm's environmental performance whereas the high-performers disclose more environmental information in the three media annual, 10-K, and sustainability reports combined (***support for H1***). The results also suggest that environmental disclosures are motivated by economic and legitimacy incentives combined. However, it shows that economic and legitimacy factors influence the disclosure decisions of the low and high environmental performers differently (***support for H3 and H4***).

An examination of annual reports shows that the low-performers disclose more information in annual reports; taking into consideration that economic and liabilities & litigation information are the main themes disclosed in annual reports. There are similarities between the type of information disclosed in annual and 10-K reports (i.e. economic and liabilities & litigation information); however, the level of disclosure of these themes is significantly higher in 10-K reports (refer to Appendix E for a comparison between 10-K and annual reports). In contrast to annual reports, there is no association between the different measures of environmental disclosure and environmental performance in 10-K reports; suggesting that the SEC oversight over 10-K reporting was successful in reducing the disclosure bias and inducing the high-performing firms to disclose more information about their environmental operations(***support for H2***).

The information disclosed in sustainability reports is different from that in annual or 10-K reports. The emphasis in sustainability reports is on the disclosure of governance & management, credibility of the firm's environmental information, environmental performance indicators, and environmental vision and strategy information. In general, the high-performers

resort to adopting and disclosing more information in sustainability reports. A considerable number of firms prepare their sustainability reports according to the GRI guideline. For the sample of reports issued according to GRI, there is no association between disclosures and firms' environmental performance suggesting that providing clear reporting guidelines may help reduce reporting bias. On the other hand, an examination of sustainability reports that were not prepared according to the GRI guidelines shows that the low-performers use these reports to communicate more qualitative information which raises questions about the incentives of the low-performers for issuing these reports.

Figure-2: Ex-Post Environmental Disclosure Model



6. Discussion of results

The descriptive analysis of disclosures presents a comprehensive view of the development of environmental disclosures in annual, 10-K, and sustainability reports. There are similarities between disclosures in annual reports and 10-K reports. Both reports focus on the disclosure of proprietary information such as economic and litigation information. Further analysis shows that both reports communicate higher levels of negative information about the firm operations; in comparison to sustainability reports. However, the level of proprietary information disclosure (economic, litigation, and negative disclosure) in 10-K reports is higher than that in annual reports. I suggest that this is due to the specificity of the guidelines and the level of enforcement exercised by the SEC over reporting in 10-K reports. The decrease of environmental disclosures over the period from 1997 to 2010 provides evidence of the lax enforcement over disclosures in annual reports; in comparison to the steady levels of disclosures in 10-K reports. That decline in annual report disclosures may also hint at the weak demand for environmental disclosures in annual reports. This may be due to the similarity of disclosures in annual and 10-K reports.

In comparison, sustainability reports emphasize the reporting of pollution abatement and environmental performance indicators and the disclosure of the management vision and strategy towards the environment. There is continuous growth in the adoption of sustainability reports over the sampled period (from 4 reports in 1997 to 50 reports in 2010) and the adoption of GRI guidelines for environmental reporting (from 0 in 1997 to 34 in 2010). In contrast to the decline in annual report disclosures, this increase in sustainability report adoption suggests that the demand for environmental disclosure in this media is growing. Furthermore, the adoption of the

GRI guideline results in an increase in sustainability report disclosure (average total disclosure using GRI guideline is 18.11 versus 13.05 for firms reporting without the GRI guideline).

Discussion of aggregate disclosure in annual, 10-K, sustainability reports

The significant positive association between aggregate measures of environmental disclosure and environmental performance shows that there is a bias in the disclosure of environmental information (support for *Hypothesis 1 suggesting that there is a difference between the amounts of information disclosed by firms with high and low environmental performance*). There is no evidence that the low-performers disclose more non-proprietary information to enhance their reputation. The results show that higher levels of performance are associated with disclosure of more soft, positive, and qualitative information. However, the lack of association between performance and disclosure of negative and economic information suggests that there is no bias between the high and low performers regarding the disclosure of proprietary information.

The results also show that both legitimacy and economic incentives affect environmental disclosures. The negative association between total disclosure and the firm's trading volume suggests that the capital market assesses that the costs of disclosure are higher than its benefits (except for the disclosure of negative information). Higher following by the media is associated with higher levels of disclosures of proprietary and non-proprietary information. However, the negative association between measure of negative disclosure and negative news or media legitimacy shows that firms attempt to maintain a positive image by disclosing less negative information.

There are differences between how the groups of high and low-performers respond to the legitimacy and economic motivations. The disclosures are negatively associated with the level of

trading-volume; however, this association is higher in the case of the high-performing firms. It implies that – in general - the benefits of disclosing environmental information are relatively low for the high-performing firms in comparison to the low-performing firms (support for *Hypothesis 3*). In other words, for firms with higher trading volumes, there is more demand for environmental information for the low-performers than for the high-performers. In terms of legitimacy incentives, there is no evidence to suggest that the low-performers attempt to legitimize their actions. In general, the responses of the high and low performers to the amount of negative news, total news, and the level of media legitimacy is similar. Moreover, high-performers with higher levels of media legitimacy attempt to maintain their positive image by disclosing less negative information. The low-performers exhibit similar behavior but are willing to disclose more negative information than the high performers (support for *Hypothesis 4*). These results do not provide evidence that the low-performers are attempting to use their disclosures to legitimize their actions or create a favorable reputation.

Discussion of annual, 10-K, and sustainability reports' disclosures

The negative association between disclosure and performance shows that there is a bias in annual report environmental disclosure (support for *Hypothesis 1*). Economic incentives seem to be the main driver of annual report disclosures. Furthermore, total news following leads firms to disclose more information in annual reports.

There is no significant association between disclosure and performance in 10-K reports (support for *Hypothesis 2*). This finding suggest that detailed guideline and the high level of enforcement by the SEC induce firms to comply with requirements; hence, improve the quality of disclosures. Firms' 10-K disclosures are affected by economic and legitimacy incentives. Unlike annual reports, high-trading volumes are associated with higher levels of disclosures. I

suggest that this finding is due to high levels of demand for environmental information in 10-K reports; hence, making it more beneficial to disclose[26].

Since the adoption of sustainability reports is voluntary, there is a need to consider the disclosures made within these reports. First, the descriptive statistics show that sustainability reports communicate private information that is not communicated in annual or 10-K reports. In terms of disclosure, the positive association between the different measures of disclosure and environmental performance provides evidence of reporting bias in sustainability reports (support for *Hypothesis 1*) - which include firms that did not issue a sustainability report. Higher trading volumes are negatively associated with this type of voluntary disclosure and higher debt to assets is associated with lower levels of disclosure. Total news following (proxy for society awareness) is associated with higher levels of disclosure in sustainability reports.

Regarding the sample of firms that issued sustainability reports (376 observations), there is no significant association between disclosure and performance except for the negative association between performance and measures of soft and qualitative disclosures. The adoption of the GRI guidelines makes the disclosure of firms more consistent (no association between disclosure and performance). While for the non-GRI sample, I find a negative association between performance and total disclosures (especially qualitative disclosures) which implies that the low-performers choose to disclose less proprietary information. In sustainability reports, society awareness (total news following) is positively associated with measures of disclosures in GRI guided sustainability reports, while negative news and higher levels of media legitimacy is negatively associated with different measures of disclosures.

---

[26] Kothari (2000, p. 95) suggests that higher level of enforcement of shareholders' rights has a positive impact on the capital market; thus, increases the demand for private information.

General Discussion

This aim of this research is to examine the association between environmental disclosure and environmental performance to understand whether a bias exist between reporting practices of the high and low environmental performers and to determine the reasons that lead to that bias. The study suggests that firms' environmental disclosures are motivated by both economic and legitimacy incentives. These incentives are moderated by the firm's environmental performance; meaning that firms performance would determine the level of economic costs-and-benefits associated with disclosure. Further, the level of environmental performance would also determine the firm's needs to legitimize its actions and how the firm would use its environmental disclosures to do so. Finally, the study suggests that the type of media (10-K, annual, or sustainability reports) mediated the firm's incentives to disclose according to the level of guideline and enforcement associated with each media.

The findings of this research contribute to the literature on the association between environmental disclosure and environmental performance (see Clarkson et al., 2008; Al-Tuwaijri et al., 2004; Patten, 2002; Cho & Patten, 2007; Hughes et al., 2001; Hughes et al., 2000). Results of prior research are divided between two opposing views; supporters of economic theory suggest that the costs-and-benefits of disclosure are higher for firms with high environmental performance which explains – according to their findings – why these firms disclose more information (Clarkson et al., 2008, Al-Tuwaijri et al., 2004). Their findings imply that disclosures made by high environmental performers are informative since they are driven by market demand for information. On the other hand, proponents of legitimacy theory suggest that low performers disclose more environmental information since they use these disclosures as an impression management tool to alleviate any threats to their legitimacy (Patten, 2002; Cho &

Patten, 2007; Hughes et al., 2001; Hughes et al., 2000). Whether firms' environmental disclosures are informative or opportunistic is still unclear in environmental disclosure literature. In fact, considering legitimacy and economic theory as mutually exclusive is a shortcoming of prior research since firms' disclosure decision is complicated by both economic and legitimacy factors (see Neu et al., 1998; Cormier & Magnan, 1999; Cormier & Magnan, 2003). Second, previous research infers the disclosure incentives of the high and low performers rather than study them. Third, the gap in prior research could also be due to the fact that the different studies examine environmental disclosures in different media – i.e. annual, 10-K, or sustainability reports.

This essay extends previous literature on the association between environmental disclosure and environmental performance by (1) testing the association between disclosure and performance using a comprehensive disclosure model of the different economic and legitimacy factors that motivate firms to disclose their environmental information, (2) examining whether these economic and legitimacy factors are moderated by the firm's environmental performance and (3) by considering all information disclosed in annual, 10-K, and sustainability reports. The main theoretical contribution of this study is the reconciliation of the two opposing views by providing evidence that environmental disclosures are motivated by both economic and legitimacy incentives for both types of firms - the high and low environmental performers. In other words, the findings of this study suggest that both the high and low performers make informative and free from bias disclosures – such as those made in 10-K reports or GRI guided sustainability reports - but could also use environmental disclosures as tool for impression management as in the case of firms issuing sustainability reports without the GRI guidelines.

The results of this study suggest that there is a bias in the environmental disclosure process as there is evidence of a positive association between disclosure and performance that is mainly due to the voluntary disclosure of information in sustainability reports. In contrast to some previous findings by (Patten, 2002; Cho & Patten, 2007), this research shows that low-performers adopt a more conservative approach towards disclosure of environmental information. The results suggest that low-performers comply with the minimum disclosure requirements such as the disclosure of economic and negative information caused by firms' compliance with mandated disclosures in 10-K reports, which is due to the specificity of guidelines and the level of enforcement by the SEC. In general, there is little evidence that the low performers attempt to use their environmental disclosure as a tool for impression management; expect in the case of information disclosed in sustainability reports prepared without the GRI guideline where the low performers attempt to disclose more qualitative information. The study suggests that if the low performers attempt to use environmental disclosures to legitimize their actions, they would do so by withholding information rather than disclosing them.

Finding that economic and legitimacy incentives are moderated by the firm's environmental performance is another contribution of this study. There is evidence that the effects of economic costs-and-benefits differ between the groups of high and low-performers. The cost of disclosure for the low-performers is high; therefore, unless there is demand for environmental information the low-performers find it less beneficial to disclose. Concerning the firm's legitimacy incentives, the study finds that firms respond to legitimacy threats using their environmental disclosures. In general, society awareness (total news following) about the firm's environmental impacts is associated with higher levels of disclosure. On the other hand,

legitimacy threats - higher levels of environmentalist pressures – lead firms to disclose less information. There is no significant difference on how high or low-performers respond to these threats. Higher media legitimacy is associated with lower level of disclosure for the high-performers but less so for low-performers. In other words, there is not enough evidence to suggest the low-performers try to legitimize their actions. In fact, the low-performers disclose more proprietary information (economic disclosures) and less non-proprietary information (qualitative disclosures) in response to higher levels of threats to their legitimacy.

The examination of environmental disclosures in annual, 10-K, and sustainability reports shows that firms communicate different types of environmental information in each media. Finding that the role of annual reports in disseminating environmental information is reduced over time is another contribution of this study. There is evidence that annual reports' disclosures are similar to those made in 10-K reports (though 10-K reports provide more details). Furthermore, there is also evidence that enforcement by the SEC reduces the bias between the disclosures of the low and high-performers in the 10-K reports. In addition, sustainability reports communicate information that is neither reported in 10-K reports nor in annual reports. The findings of this study also suggest that adopting a reporting guideline (such as the GRI guidelines) plays an important role in improving the quality of disclosures in sustainability reports by increasing the amount of information disclosed and reducing the gap between the disclosures of the low and high-performers. In brief, the study provides evidence that firms' environmental disclosures are not limited to one media of disclosure but communicated using annual, 10-K, or sustainability reports; albeit the decline in using annual reports as a significant media for communicating environmental information in recent years.

Finally, according to the findings of this study, I make three main recommendations. First, unlike some prior research endorsing the legitimacy framework as the main theory that explains why firms disclose their environmental information (Patten, 2002; Cho & Patten, 2007), I do not find enough evidence to suggest that low-performers are mainly tailoring their disclosure process to legitimize their actions to portray a positive image of the firm's environmental operations. The low-performers conform to the regulatory disclosure requirements albeit adopting a conservative approach towards voluntary disclosure of additional information. The study provides assurances to the financial market over the current reporting system but also suggests that there is room for improving environmental reporting activities.

Second, the study shows that higher level of enforcement and higher levels of guidelines improve the reporting process. Therefore, regulators need to ensure the enforcement of any mandatory disclosure requirements. The results suggest that SEC supervision of 10-K disclosures enhances the reporting of firms by eliminating the reporting bias created by differences in their environmental performances. On the other hand, low levels of enforcement lead to a decline in the use of annual reports as a disclosure media and contribute to the creation of a reporting bias evidenced by the fact that firms with low-environmental performance disclose more information in these reports. The study also shows that adopting the GRI guidelines improves the quality of voluntary reporting and reduces the reporting bias between firms. Therefore, I also suggest that regulators should enforce the adoption of the guideline as a first step to improve the reporting practices of firms in environmentally sensitive industries.

Finally, I recommend researchers of environmental reporting to consider disclosures made in annual, 10-K, and sustainability reports to ensure that future research provides a complete and impartial picture of firms' reporting processes. The study shows that firms channel

different information in the three types of media. Information reported in sustainability reports complements that in annual and 10-K reports. For example, firms use annual and 10-K reports to disclose economic and litigation information. Meanwhile, the reporting of environmental performance indicators and firms' strategy and vision towards the environment is the main emphasis of sustainability reports. In addition, the results of this study also show that the role of annual reports in disseminating environmental information has been declining over the years. These complementarities between annual or 10-K reports and sustainability reports and the declining role of annual reports mean that overlooking one of these reporting channels will affect the comprehensiveness and impartiality of future environmental disclosure research and will cast the doubt about the validity of the results.

Limitations

One limitation of this study is that coding of environmental disclosures in annual, 10-K, and sustainability reports and the coding of firms' environmental news was performed by one coder. One reason for this limitation is that coding more than 2600 reports and 1000 newspaper and magazine articles consumed an extensive amount of time (approximately one and half year of coding). Hence, engaging more coders in this research project may have extended the data collection period to an extent where the time frame of this study would become less relevant. Though this limitation may affect the reliability of the environmental disclosure scores, the disclosure index employed in this study is developed based on previous indices by Clarkson et al. (2008), Wiseman (1982), and Aerts et al. (2008) which means that clear guidelines on how to code environmental disclosures were provided during the data collection period.

Due to the timeliness of their disclosures, corporate websites are considered as an important venue for disseminating environmental information. Overlooking information on

corporate websites could be considered a limitation of this study. The lack of historical website disclosures is the main reason behind their exclusion from this study; which relies on performing a longitudinal analysis of firms' environmental disclosures. Therefore, I suggest that website environmental disclosures could be a subject of future studies conditional upon constructing an ex-ante database for this type of disclosure.

This study presents an operational model to measure environmental disclosures based on indices provided by previous studies by Aerts et al. (2008),Wiseman (1982) and Clarkson et al. (2008). Some of the variables included in this model such as environmental expenditures, liabilities and litigation, environmental performance indicators, and governance structure and management systems have been validated by prior research (refer to the first essay of this dissertation) that shows that these measures are either relevant to the firm's capital providers or to the firm's non-financial stakeholders. Other variables used in this model are meant to measures constructs such as conformity with laws and regulations, environmental profile, or environmental initiatives that are not yet validated; meaning that there is no research that confirms the relevance of these constructs or how to measure them.

Opportunities for future research

The association between environmental disclosure and environmental performance is not consistent among the three media; annual, 10-K, and sustainability reports. There is a negative association between annual report's disclosure and firms' environmental performance (Table-4), no association is found when examining 10-K disclosures (Table-5), and positive association was find between sustainability reports' disclosures and environmental performance (Table-6 to Table-9). This inconsistency provides an opportunity for future research to examine how firms use different media to communicate environmental information knowing that each media is used

to communicate different types of information (refer to Appendix E). Future research should examine the disclosure determinants of environmental information in each media separately to understand the different factors that influence firms' reporting in each media.

Chapter 4 - the Determinants of Disclosure of non-Financial Environmental Performance Indicators

1. Introduction

Research shows that non-financial indicators provide incremental information about firm's current and future performance (Amir & Lev, 1996; Ittner & Larcker, 1998; Rajgopal et al., 2003; Hall et al., 2005). Among these non-financial indicators, environmental performance indicators (EPI) are output measures that inform the different stakeholders about the firm's environmental management. EPIs include the type and amount of pollutants that firms release into air, water, and soil. By providing such information, firms reveal their environmental performance to shareholders, environmentalists, regulators, and other stakeholders of the firm. Epstein & Wisner (2001) point out the importance of environmental performance indicators as a "lagging measure of process efficiency and also a leading indicator of environmental costs" (page 2). Regarding the disclosure of these indicators, there is a debate whether firms disclose truthful information or whether they make disclosures that portray a positive image about the firm's environmental activities (Hughes et al., 2001). This study examines the reliability of EPI disclosures by examining if firms were involved in the disclosure of positive news.

The disclosure of EPI information is largely voluntary by firms and though reporting guidelines – such as the Global Reporting Initiative (GRI)[27] guidelines – call for disclosure of EPI information, there is evidence that the level of information reported is very low (Clarkson et

[27] Requirements EN16 to EN25 of the GRI guidelines demand that firms disclose the amount of emissions, effluents, and waste they release into air, water and land.

al., 2008). Henri & Journeault (2008) find that although firms measure their environmental performance to monitor compliance with environmental laws, they are less concerned about reporting this information to external stakeholders. These findings suggest that firms are not keen on disclosing EPI information although there are concerns about how firms manage their environmental operations (Azzone & Noci, 1996).

On the other hand, accounting research highlights the importance of non-financial information in explaining the gap between a firm's book and market valuation. Research on the value relevance of non-financial indicators suggests that the financial market integrates this type of information in investment decisions (Amir & Lev, 1996; Ittner & Larker, 1998; Klock & Megna, 2000; Rajgopal et al., 2003; Hall et al., 2005). The results of prior research show that non-financial indicators provide investors with incremental information about the firm's intangibles – such as human capital, technological advancements, or management capability – that could not be quantified in financial terms (Wyatt, 2008).

In regards to the disclosure of non-financial environmental performance indicators, prior research shows that investors also value environmental performance indicators since they provide incremental information about the firm's environmental management (Cormier & Magnan, 1997; Clarkson et al., 2004; Hughes, 2000; Johnston et al., 2008). However, since the disclosure of these indicators is totally voluntary, there are doubts about the truthfulness of these disclosures and whether firms use them as self-laudatory tools (Cho & Patten, 2013). Meanwhile, there is a lack of research about the reliability of firms' EPI disclosures. Wyatt (2008) suggests that the reliability of non-financial indicators increases the relevance of the information disclosed. The objective of this paper is to examine the reliability of EPI disclosures made by firms from environmental sensitive industries by studying the determinants of disclosure and

whether firms reporting of environmental performance indicators are biased towards the disclosure of positive information.

Previous research by Cormier & Magnan (1999), Cormier & Magnan, (2003), and Neu, et al. (1998) suggests that the level of environmental disclosure is determined by market forces – cost and benefit of disclosure – and by external pressures that drive firms in environmental sensitive industries to legitimize their environmental operations. Other research finds that firms' environmental disclosures are a function of the firm's environmental performance. These studies find a difference between the disclosures made by firms with high-environmental performance and those with low-environmental performance (see Patten 2002; Cho & Patten, 2007; Al-Tuwaijri et al., 2004; Clarkson et al., 2008). A more relevant study by Clarkson et al. (2008) examines voluntary disclosures in sustainability reports and concludes that firms with high environmental performance disclose more information in their sustainability reports. Such a difference signals the presence of a reporting bias suggesting that firms with low environmental performance attempt to hide information about their environmental performance.

Disclosing environmental performance indicators allows firms to provide their stakeholders with information about their environmental performance or to manage the impressions of these stakeholders by selective EPI disclosure. Whether these voluntary disclosures are informative or opportunistic is still unknown since there is little research about the determinants of EPI disclosures and the reliability of the information disclosed. Prado-Lorenzo et al. (2009) is one study that examines the disclosure determinants of environmental performance indicators – mainly greenhouse gas emissions (GHG) – and they find an association between the disclosure of GHG information and the firm's size, industry membership, and return on equity. However, Prado-Lorenzo et al. (2009) uses an economic model to explain

environmental disclosures and ignore that environmental disclosures are also motivated by social threats to legitimacy. Furthermore, their model does not examine the reliability of the information disclosed by testing the association between environmental disclosure and environmental performance. Finding an association between the level of firms' EPI disclosure and their environmental performance is indicative of a reporting bias. For example, a positive association between EPI disclosure and environmental performance may indicate a bias towards the disclosure of good news. In brief, besides the lack of research on the determinants of EPI disclosure, prior research did not provide a comprehensive disclosure model that includes all the factors that affect the firm's disclosure decision.

In this study, I extend previous research by Prado-Lorenzo et al. (2009) on the determinants of environmental disclosure by examining whether firms' disclosures of EPIs are biased towards the reporting of positive news. Shedding the light on the reliability of EPI disclosures is the main contribution of this study since it was not examined previously. Furthermore, studies by Cormier & Magnan (1999), and Cormier & Magnan, (2003) confirm that economic factors are the main determinant of environmental disclosure. Meanwhile, Neu et al., 1998 suggest that legitimacy factors – such a society interest in information, regulator's scrutiny, or environmentalist pressures also affect firms' environmental disclosure decision. In this study, I extend the use of these disclosure models to study the extent to which EPI disclosure is motivated by economic factors, legitimacy factors or both factors combined.

Contrary to the findings of the most recent study by Clarkson et al. (2008), the results of this study could not find a significant difference between the disclosures of high and low environmental performers. Furthermore, the study finds that a decline in environmental performance is associated with an increase in environmental disclosure. Unlike previous research

casting doubt about the reliability of the environmental information being disclosed, the findings of this study suggest that EPI disclosures by firms from environmental sensitive industries may be reliable and free from bias.

The study also finds that previous disclosure models of Cormier & Magnan (1999), Cormier & Magnan, (2003), and Neu, et al. (1998) explain the disclosure of environmental performance indicators. The results show that firms integrate the cost-and-benefits of disclosure in their decision to report EPI information. Furthermore, the study also finds that higher news followings of the firm's environmental activities are associated with lower levels of disclosure. In brief, this study provides further evidence that environmental disclosures are motivated by economic and legitimacy incentives.

2. Literature Review and Hypothesis Development

With limited amounts of natural resources, Wyatt (2008) highlights the increasing importance of intangible assets that enable firms to derive maximum benefits from these resources. She suggests that firm's intangible assets manifest in different forms such as technological development, human resources, production management, and social and environmental management. The difficulty of accounting for these intangibles may explain why the disclosure of financial information is not sufficient in determining firms' valuation. Thus, accounting research shows that investors integrate non-financial indicators in their investment decisions since it provides incremental information about the firm's future cash flow.

For example, Amir & Lev (1996) examine the value relevance of non-financial indicators and find that population size served by telecommunication firms multiplied by the firm's percentage ownership (POPS) is positively and significantly associated with firm's stock price. Similarly, Klock & Megna (2000) find that advertising, research and development, radio

spectrum licenses, and customer base are all associated with telecommunication firms' value. Rajgopal et al. (2003) find that information about website traffic of E-commerce firms explains their stock returns. Hall et al. (2005) find a positive association between patent citations and firm's value. Regarding human capital, Colombo and Grilli (2005) find an association between founder's education and firm's growth. Another line of research examines the association between the firm's technological capital and its financial performance. Aral & Weill (2007) find a positive association between investments in the different types of IT assets and firms' return on assets and net margins.

Furthermore, many studies find an association between customer satisfaction indicators (CSI) – a proxy for the firm's internal process of managing its operations - and firms' financial performance, stock market performance and shareholder's value (Anderson et al., 1994; Anderson et al., 1997, Anderson et al., 2004; Ittner & Larker, 1998). For example, Ittner & Larcker (1998) find that customer satisfaction indicators are associated with higher level of customer retention, improved financial performance, and hence higher levels of stock returns.

There is a difficulty in defining the intangibles associated with firms' environmental management; therefore, accounting research examines the value relevance of environmental performance indicators – an output measure of firms' environmental management. Researchers find that these indicators help determining firms' value. For example, Cormier & Magnan (1997) find a negative association between the market value of equity for a sample of Canadian firms and their levels of water pollution. Other studies find a negative association between firms' value and the level of SO_2 discharge (Hughes, 2000; Johnston et al., 2008). Finally, Clarkson et al. (2004) find that the market value of firms with good environmental performance (TRI releases) is higher than for firms with low environmental performance.

These findings indicate that investors include environmental performance indicators in their investment decision. However, Wyatt (2008) suggests that the relevance of non-financial indicators is associated with the reliability of the information disclosed. Since the disclosure of environmental performance indicators is completely voluntary, there are no guarantees that firms reveal their true environmental performance. On the other hand, there is little research on the determinants of environmental performance indicators' disclosure to explain whether firms are biased towards the disclosure of positive indicators that serve to paint a favorable image of the firm's environmental management or whether disclosures could be reliably used to assess the firm's environmental performance.

Prado-Lorenzo et al. (2009) examine the factors influencing the disclosure of greenhouse gas emissions (GHG) on the websites of Fortune 500 companies. In conformity with prior research, they find that size and industry effects influence disclosure decision about GHG. They also find that economic indicators such as leverage and return on assets (ROA) are not associated with environmental disclosure of GHG information. In contrast to their hypothesis, they find a negative association between return on equity (ROE) and environmental disclosure of GHG. The study focuses only on economic costs and benefits to explain the determinants of disclosure; whereas prior literature suggests that firms' environmental disclosures are also influenced by other factors such as social threats to legitimacy (Aerts & Cormier, 2009; Aerts, et al. 2008; Neu et al., 1998). Further, Lorenzo et al. (2009) do not examine the association between the information disclosed and the firm's environmental performance to determine whether the level of environmental performance influences the disclosure decision. In this study, I aim to extend previous literature on the disclosure determinants of EPI and examine whether EPI disclosures are associated with disclosure of positive news.

2.1. Economic factors influencing environmental disclosure of environmental information

Previous literature shows that there are economic costs and benefits associated with the disclosure of proprietary information. Diamond (1985) suggests that in the absence of disclosure, traders will engage in private information gathering which will increase the cost of trading for each individual investor. Therefore, by disclosing their private information, firms benefit from reducing the cost of information gathering and improving the trading process. By examining annual report disclosures, Botosan (1997) finds that higher levels of disclosure were associated with lower cost of capital. On the other hand, Verrecchia (1983) suggests that disclosing proprietary information entails costs associated with increased scrutiny from regulatory bodies, which might affect the firm's competitive position or cash flow. Hence, firms would only disclose their proprietary information if the benefits of disclosure outweigh the costs.

Cormier & Magnan (1999) reckon that the decision to disclose environmental information is based on a cost and benefit analysis of that disclosure. On one hand, firms disclose relevant information to reduce the information asymmetry between managers and shareholders and to reduce the cost of information gathering; thus, ensuring that investors would not discount the firm's share prices (Botosan, 1997). On the other hand, disclosing proprietary information – such as the disclosure of greenhouse gas emissions or amounts of sulfur dioxide emitted – may cost the firm through increased regulators and environmentalists scrutiny resulting in penalties or tighter environmental regulations. Cormier & Magnan (1999) control for information gathering costs using several proxies such as a firm's volatility, reliance on capital markets, trading volume, control by a single shareholder, or being a subsidiary of another firm. Volatility, trading volume, and reliance on capital market are proxies for firm riskiness and dependence on equity

financing, two factors that require firms to disclose more information to satisfy the needs of current and potential shareholders. Therefore, it is expected that these measures will be positively associated with increased disclosure of EPIs. On the other hand, firms that are closely held or subsidiary of another company rely less on capital market and have less pressure to disclose EPI information.

Cormier & Magnan (1999) also control for a firm's financial conditions. They expect that firms in superior financial condition are better able to withstand the cost of disclosing proprietary information and benefit from an open disclosure policy. Meanwhile, firms with a poor financial condition would be aware of the political and reputational costs associated with disclosure of proprietary information. Thus, these firms would try to avoid the disclosure of EPI information. They control for financial condition using return on assets, market returns, and leverage. They assume that higher level of leverage is associated with less disclosure of environmental information. However, Clarkson et al. (2008) find that leverage is associated with higher levels of environmental disclosure in corporate sustainability reports and websites. They refer this finding to the increased supervisory role of debt-holders.

H1: Environmental disclosure of EPI information is positively associated with the firm's information cost gathering.

H2: Environmental disclosure of EPI information is positively associated with the firm's financial condition.

2.2. Social pressure and environmental disclosure

Economic costs and benefits underlie the rationale of disclosing environmental information to satisfy the information needs of shareholders. However, other stakeholders – including regulators, environmentalists, and members of the society – have interests in firms'

environmental performances and can influence firms' disclosure decision. Environmental disclosure research suggests that increased interests from outside stakeholders represent a threat to the firm's legitimacy to which the firm would respond – using environmental disclosures – to confirm that the firm acts in congruence with the expected norms of operations (Aerts & Cormier, 2009; Cho & Patten, 2007; Cho, 2009; Deegan, et al., 2002; Gray et al., 1995; Patten, 1992). For example, Neu et al. (1998) find that social and regulatory concerns are associated with a higher level of environmental disclosure. They find that pressure from environmentalist groups is associated with lower levels of disclosure. On the contrary, Aerts & Cormier (2009) find that news exposure – a measure of community concern – is positively associated with the level of economic-based environmental disclosures and social-related environmental disclosures. How firms respond to legitimacy threats remains ambiguous. The environmental reporting literature suggests that firms choose different disclosure strategies to respond to pressure from interested groups. O'Donovan (2002) finds that firms adopt one of four disclosure strategies in response to legitimacy threats generated by media or interest groups: (1) they could avoid the disclosure of information about the subject matter, (2) attempt to alter social values by educating the public about the subject matter, (3) attempt to alter perceptions by disclosing positive information about firms' achievements, or (4) conform to social values by acknowledging their low performance. Therefore, I suggest that pressure by interest groups could either induce the firm to disclose EPI information or avoid the disclosure of such information if the disclosure generates more damage to the firm's legitimacy.

H3: There is an association between the disclosure of EPI information and the level of interest groups' pressures.

2.3. The information content in EPIs

Although conservatism is a major trait of financial disclosure (Ball et al., 2000); there are suggestions environmental reporting is biased towards the disclosure of positive news (Deegan & Gordon, 1996; Deegan & Rankin, 1996). Previous research does not provide empirical evidence as to whether the content of the information is a disclosure determinant. This may be due to the fact that environmental disclosure is proxied by aggregate measures – i.e. content indices - that encapsulate different types of information and combine voluntary and mandatory disclosures. EPI disclosures are directly related to the firm's environmental performance; therefore, firms who suffer from low-performance provide negative news to their stakeholders by disclosing their environmental performance indicators.

2.3.1. The relation between environmental disclosure and environmental performance

There is an ongoing debate about the association between environmental disclosure and environmental performance. Studies of total environmental disclosure suggest that firms with low environmental performance disclose more environmental information to defend the legitimacy of their operations (Hughes et al., 2000; Hughes et al., 2001; Patten, 2002). On the contrary, Al-Tuwaijri et al. (2004) and Clarkson et al. (2008) suggest that firms with high-environmental disclosure would disclose more environmental information to obtain the economic benefits associated with the disclosure of their performance. With respect to EPI, the disclosure of this information could either bear good or bad news depending on the firm's performance. Deegan & Gordon (1996) and Deegan & Rankin (1996) suggest that firms are biased towards the disclosure of positive environmental news. Deegan & Rankin (1996) examine the disclosures of 20 firms prosecuted for violation of environmental regulations and find that only six companies provided negative information about their performance. Since EPI disclosures are completely

voluntary and since they provide good or bad news depending on the firm's performance, I expect that firms with low environmental disclosure will totally or partially avoid the disclosure of such information. From a legitimacy perspective, disclosure may subject the firm to scrutiny from interested stakeholders. Furthermore, as EPI are leading indicators of future performance, the disclosure of such information may be reflected negatively in the firm's market value.

H4: There is a positive association between the disclosure of EPI information and the firm's environmental performance

2.3.2. Reporting continuous improvement

Accounting research finds that reporting firms attempt to meet two conditions: to report continuous improvements and to meet stakeholder's expectations (Burgstahler & Dichev, 1997; Degeorge, 1999). For example, firms use their discretion within the boundaries of mandatory reporting to report positive earnings to their shareholders. Burgstahler & Dichev (1997) finds that firms manage their earnings to avoid reporting of losses or earnings decrease. Degeorge (1999) also finds that firms manage earnings to meet three thresholds. They attempt to report positive profits, show that previous performance is sustainable, and meet analysts' forecasts. Concerning reporting of EPI information, since disclosure is voluntary, firms do not need to manage the reported information. They have full discretion over the disclosure process and may decide to fully disclose, partially disclose, or avoid disclosure. Therefore, I hypothesize that firms experiencing positive change in performance will disclose more EPI information.

H5: There is a positive association between the disclosure of EPI information and the change in the firm's environmental performance

2.3.3. Meeting stakeholders' expectations

The findings of Burgstahler & Dichev (1997) & Degeorge (1999) also imply that firms attempt to meet interested parties' expectations. In the case of financial reporting, analysts' forecasts have an influential role in setting the market's expectations. Hence, firms attempt to manage earnings to meet earnings' forecasts. Regarding the firm's environmental performance, expectations are set by the performance of other firms in the same industry. For example, Clarkson et al. (2004) state that regulators use the performance of the top 50 percent firms in the pulp and paper industry as a guideline to set new environmental regulations in the industry. Furthermore, they find that investors positively value the environmental capital investments made by firms with high-environmental performance. On the other hand, investors do not value the investments made by the low-performers and assess an un-booked liability due to their performance. In brief, firms who show above-average environmental performance – in comparison to their industries - set the expectations of interested stakeholders. Therefore, I hypothesize that firms with above-average environmental performance – in comparison to their industry average - are associated with higher levels of disclosure of EPI.

H6: Firms with above average environmental performance are associated with higher levels of EPI disclosures

3. Methodology

3.1. Disclosure model

Using the following model, I examine the determinants of EPI disclosure by employing a panel data analysis.

$$EPI\ Disclosure = \alpha_0 + \alpha_1 * Environmental\ performance + \alpha_2 * beta + \alpha_3 * Trading\ Volume + \alpha_4 * Debt\ to\ Equity\ Change + \alpha_5 * Common\ Stock\ Change + \alpha_6 * Block\_Insider + \alpha_7 * Block\_Highest + \alpha_8 * ROA + \alpha_9 * Debt\ to\ Assets + \alpha_{10} * Return + \alpha_{11} * Negative\ News + \alpha_{12} * Total\ News + \alpha_{13} * Media\ Legitimacy + \alpha_{14} * Size$$

This model is based on previous disclosure models by Cormier & Magnan (1999b), Cormier & Magnan, (2003), and Neu, et al. (1998). Cormier & Magnan (1999b), and Cormier & Magnan, (2003) suggest that environmental disclosure is function of economic costs and benefits of disclosure, while Neu et al. (1998) introduce the influence of other stakeholders – such as environmentalists or the society – that may drive firms to legitimize their actions using environmental disclosures.

Definition of variables:

a. *EPI Disclosure*: To examine the determinants of disclosure of environmental performance indicators, I use three measures of disclosure provided by Trucost database. The first measure is the number of items disclosed (*Item Disclosure*) in annual or sustainability reports which proxies for the firm's decision to disclose or withhold the information. The second measure is a disclosure ratio based on a technical evaluation - made by Trucost - of firms' disclosures of its EPIs (*Weighted Disclosure*). The numerator of that ratio consists of total number of material environmental impacts for direct operations disclosed by the company in annual reports, or environmental reports (amount of emitted pollutants disclosed by the firm). The denominator is the total number of material environmental impacts for direct operations based on Trucost profiling of each company (amount of emitted pollutants estimated by Trucost). The ratio is also weighted based on the cost associated with each source of pollution. The

third measure is a binary variable equal 1 if the firm discloses information about its CO_2 releases and 0 otherwise (*CO2 Disclosure*)

b. Environmental Performance: to proxy for the bias in disclosing environmental information, I use three measures of performance:

i. *Performance*: the tons of pollutants disclosed could proxy for the firm's environmental performance. However, adding the tons of different pollutants is not indicative of the firm performance since some emissions are more significant than others. Trucost provides a dollar value for the cost of these pollutants; therefore, I use the cost of pollution as a proxy for the firm's performance scaled by firm's revenue.

ii. *Performance_Change*: is the change in the firm environmental performance. I proxy the change in environmental performance using yearly change.

iii. *Performance_Average*: This variable is the difference between the firm's environmental performance and the average performance of its industry.

I extract the environmental disclosure and performance variables from Trucost database. Trucost is a company based in the UK that specializes in the analysis of firms' environmental performances and quantifying the external impact of the firm's performance into monetary terms. Trucost database provides performance assessment of firms that do not disclose EPI information in their annual report or sustainability report. Trucost contacts firms to request this information or estimate it using an econometric model.

c. Measures of information cost gathering:

The following measures proxy for the need for private information and the asymmetry gap between management and the outside shareholders:

ii. Risk (*beta*): measured using the firm beta. Firms' beta is calculated using the five year monthly returns.

iii. Trading volume (*Trading Volume*): using the firm trading volumes divided by the outstanding number of shares. Trading volumes are provided by the Center for Research in Security Prices (CRSP).

iv. Reliance on the capital market (*Debt to Equity Change*; *Common Stock Change*): using the change in the firm's debt to equity and the change in the firm's common stock. Data is provided by Compustat database.

v. Insider holdings (*Block_Insider*): measured by the percentage of shares held by the firm's officers and directors. Information is gathered from firms' proxy statements.

vi. Outsider holdings (*Block_Highest*): measured by the percentage of shares held by the highest shareholder. Information is gathered from firms' proxy statements.

According to Cormier & Magnan (1999), firm's beta, trading volume, reliance on the capital market are proxies for information demand from investors. Hence, I hypothesize that these measures are positively associated with environmental disclosure since disclosure would reduce the cost of information gathering for outside shareholders. Meanwhile, significant holdings by insider and outsider owners attenuate the cost of information gathering and hence are associated with lower levels of disclosure.

d. Measures of financial condition:

iv. Accounting performance measured by the firm's return on assets (ROA).

v. Market performance measured by the firm's return (Return).

vi. Leverage measured using the firm's debt to assets (Debt to Assets).

Cormier & Magnan (1999) suggest that good financial condition would enable firms to withstand the cost of disclosing proprietary information. Hence, higher return on assets and market return are associated with higher levels of disclosure, while higher levels of debt to assets would be associated with lower levels of disclosure.

e. Measures of firm's legitimacy

vii. Media legitimacy (*Media Legitimacy*): is a measure of the media's perception of the firm's environmental performance. According to Aerts & Cormier (2009) media legitimacy is measured using the Janis-Fadner Coefficient.

viii. Environmentalists pressure (*Negative News*) : Neu et al. (1998) account for environmentalists' concerns by measuring the number of negative articles containing negative criticism of the firm's environmental performance. They find that firms subject to negative criticism reduce their environmental disclosure.

ix. Society awareness (*Total News*): news exposure has been used in prior research as a proxy for society awareness and concern about the firm environmental performance (Aerts & Cormier, 2009; Neu et al., 1998)

f. Control Variables:

Size (*Size*): larger firms are more visible to the public and more followed by analysts (Aerts & Cormier, 2009). Therefore, I assume that the level of environmental performance will depend on the firm's size which proxies for the visibility of the firm within its society

3.2. Sample Selection

The sampled firms should meet the following criteria:

1. The firm should be available on Compustat.
2. The firm should exist on Trucost database during the period from 2003 to 2010.

3. The firm belongs to an environmentally-sensitive industry.

The selection criteria result in 82 firms distributed as following: 3 firms in SIC 10xx (metal mining), 12 firms in SIC 13xx (oil exploration), 9 firms in SIC 20xx (food manufacturing), 10 firms in SIC 26xx (paper), 16 firms in SIC 28xx (chemical and allied products), 7 firms in SIC 29xx (petroleum refining), 2 firms in SIC 30xx (rubber and plastic manufacturing) 6 firms in SIC 33xx (metals), and 17 firms in SIC 49xx (electric and gas services). The sampled firms are listed in Appendix F.

4. Results

4.1. Descriptive Statistics:

Using three EPI measures, Chart-1 shows there is a continuous increase in disclosure of environmental performance indicators over the period from 2003 to 2010. Interestingly, this increase is not consistent as evidenced by the decline in disclosure during the years 2007 and 2009 which suggests that firms use their discretion over the reporting of their EPIs.

Chart 1: Descriptive Statistics – Environmental Performance Indicators Disclosure

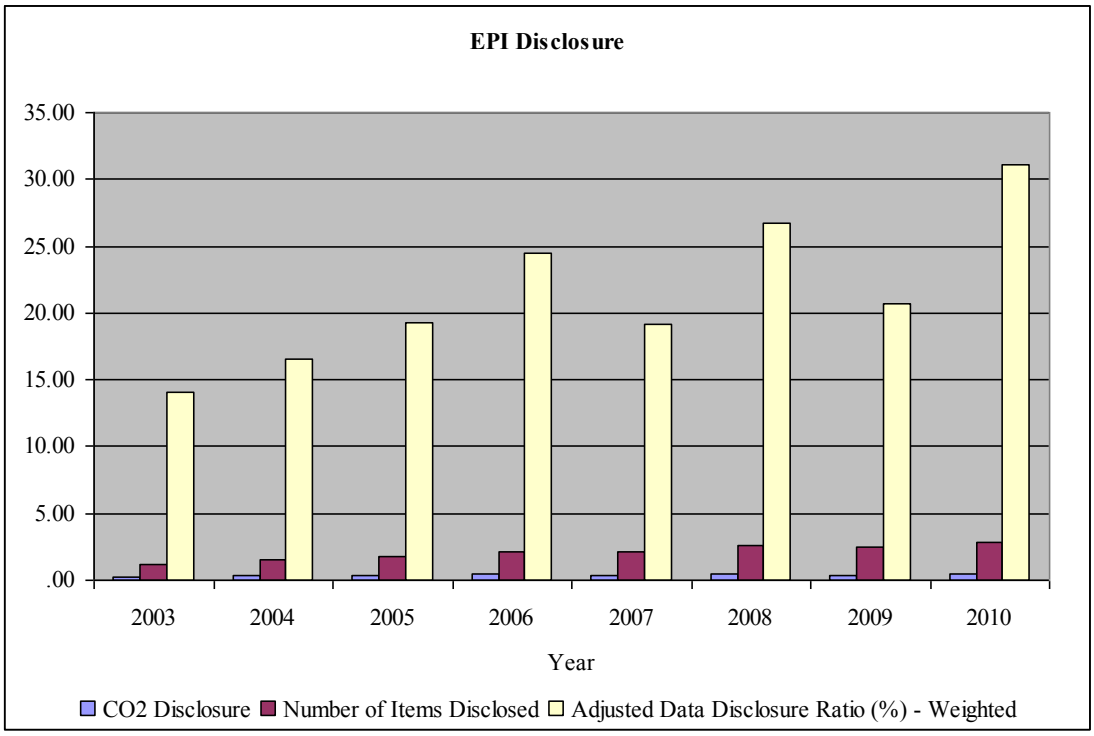


Table-1 shows the Pearson correlation between the disclosure of EPIs and the other dependent variables. The correlation shows a positive association between disclosure and the three measures of performance meaning that lower levels of performance, performance below industry average, and negative change in performance are associated with higher levels of disclosures. Higher levels of holdings by insiders or by the highest outside-holders are associated with lower levels of disclosure. Finally, total news following are associated with higher levels of disclosure.

Table-1 Pearson Correlation

	Items Disclosed	Weighted Disclosure	Performance	Performance_Average	Performance_Change	Beta	Trading Volume	Debt to Equity Change	Common Stock Change	Return	ROA	Size	Debt to Assets	Change in debt to Equity	Change in Common Stock	Block_Insider	Block_Highest	Negative News	Media Legitimacy	Total News
Items Disclosed	1																			
Weighted Disclosure	.834**	1																		
Performance	.259**	.288**	1																	
Performance_Average	.195**	.274**	.767**	1																
Performance_Change	.121**	.152**	.153**	.122**	1															
Beta	-0.05	-0.018	-0.003	-0.002	-0.005	1														
Trading Volume	-0.015	0.014	0.01	0.025	0.025	-0.053	1													
Debt to Equity Change	0.02	0.013	0.01	-0.014	0.007	-0.034	-0.001	1												
Common Stock Change	-0.029	-0.026	-0.023	0	-0.002	0.03	-0.001	-0.002	1											
Return	-0.025	-0.045	0.025	-0.033	0.023	0.057	0.058	-0.054	-0.024	1										
ROA	0.019	0.022	-.237**	-0.052	-.084*	.163**	-.099*	0.061	-0.029	0.017	1									
Size	.306**	.316**	-0.029	.086*	-0.035	-0.027	-.077*	0.005	-0.018	-.103**	0.076	1								
Debt to Assets	-0.045	-.108**	.199**	-0.005	0.033	.088*	-.084*	-.122**	-0.027	-0.002	-.365**	0.005	1							
Change in debt to Equity	0.02	0.013	0.01	-0.014	0.007	-0.034	-0.001	1.000**	-0.002	-0.054	0.061	0.005	-.122**	1						
Change in Common Stock	-0.029	-0.026	-0.023	0	-0.002	0.03	-0.001	-0.002	1.000**	-0.024	-0.029	-0.018	-0.027	-0.002	1					
Block_Insider	-.118**	-.127**	-.124**	0.001	-0.015	0.011	-0.024	0.014	0.072	-0.009	-.079*	-0.012	-.077*	0.014	0.072	1				
Block_Highest	-.161**	-.173**	-.098*	0	-0.011	0.076	-0.015	-0.003	0.022	-0.017	-.081*	-0.054	0.013	-0.003	0.022	.822**	1			
Negative News	.176**	.219**	0.067	.113**	-0.034	-0.014	-0.057	0.022	-0.012	-0.037	.121**	.387**	-.146**	0.022	-0.012	-0.032	-0.074	1		
Media Legitimacy	-0.019	-0.027	-0.019	-0.019	0.002	0.031	-0.058	-.077*	-0.001	-0.007	0.039	-0.045	.079*	-.077*	-0.001	-.092*	-0.061	-.423**	1	
Total News	.227**	.268**	.172**	.229**	-0.041	-0.037	-.101**	0.016	-0.018	-0.073	.089*	.486**	-.094*	0.016	-0.018	-0.068	-.103**	.814**	-.115**	1

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

4.2. Multivariate Analysis:

Table-2 shows the results of a panel data least-square regression of the determinants of EPI's disclosure – using the number of items disclosed. The results show that the number of items disclosed is positively associated with the trading volume and the firm's yearly return. These results confirm previous findings by Cormier & Magnan (1999), that the higher the cost of information gathering and the higher the firm's ability to withstand the cost of disclosure, the more the firm would disclose proprietary information (support for *Hypothesis 1* and *Hypothesis 2*). On the other hand, Total News is associated with lower level of EPI disclosure (*support for Hypothesis 3*). This finding suggests that higher levels of society awareness about the firm's environmental performance lead firms to conceal information about its environmental performance. Finally, there is no significant association between the amount of disclosure and firms' environmental performance or firm's performance in comparison to industry average (lack of support for *Hypothesis 4* or *Hypothesis 6*). However, unlike the prediction of Hypothesis 5, a decline in performance is positively associated with higher levels of disclosure. This finding suggests that firms continue to disclose EPI information albeit experiencing decline in their performance which provides empirical evidence that disclosure is not biased towards the disclosure of positive news.

Table-2: The Association between EPI Disclosure (items) and Environmental Performance

Variable	Item Disclosure Coeff.	Prob.	Variable	Item Disclosure Coeff.	Prob.	Variable	Item Disclosure Coeff.	Prob.
C	0.9699	0.801	*C*	1.1367	0.766	*C*	2.1427	0.556
Performance	0.0771	0.211	*Performanc_Average*	0.0893	0.151	*Performanc_Change*	0.0047 ***	0.000
Beta	0.1492	0.345	*Beta*	0.1180	0.462	*Beta*	0.0818	0.588
Trading Volume	0.0125 *	0.059	*Trading Volume*	0.0123 *	0.063	*Trading Volume*	0.0119 *	0.066
Debt to Equity Change	-0.0196	0.170	*Debt to Equity Change*	-0.0185	0.196	*Debt to Equity Change*	-0.0201	0.181
Common Stock Change	-0.0003	0.275	*Common Stock Change*	-0.0003	0.280	*Common Stock Change*	-0.0003	0.310
Block_Insider	0.0257	0.210	*Block_Insider*	0.0268	0.187	*Block_Insider*	0.0280	0.175
Block_Highest	-0.0109	0.556	*Block_Highest*	-0.0117	0.526	*Block_Highest*	-0.0148	0.423
ROA	0.8829	0.677	*ROA*	0.7930	0.704	*ROA*	1.2185	0.586
Debt to Assets	1.4261	0.320	*Debt to Assets*	1.5728	0.273	*Debt to Assets*	1.4359	0.318
Return	0.6626 **	0.010	*Return*	0.6820 ***	0.008	*Return*	0.7375 ***	0.004
Negative News	0.0921	0.277	*Negative News*	0.0945	0.262	*Negative News*	0.0909	0.281
Total News	-0.1199 **	0.030	*Total News*	-0.1196 **	0.028	*Total News*	-0.1155 **	0.037
Media Legitimacy	0.3154	0.124	*Media Legitimacy*	0.3326	0.106	*Media Legitimacy*	0.2920	0.156
Size	-0.1718	0.854	*Size*	-0.1195	0.899	*Size*	-0.3522	0.693
Cross-section fixed (dummy variables)								
Period fixed (dummy variables)								
Adjusted R-squared		0.567	Adjusted R-squared		0.568	Adjusted R-squared		0.581
F-statistic		9.395	F-statistic		9.433	F-statistic		9.888
Prob(F-statistic)		0.000	Prob(F-statistic)		0.000	Prob(F-statistic)		0.000
Mean dependent var		2.087	Mean dependent var		2.087	Mean dependent var		2.087
S.D. dependent var		2.823	S.D. dependent var		2.823	S.D. dependent var		2.823
Durbin-Watson stat		1.817	Durbin-Watson stat		1.806	Durbin-Watson stat		1.799
Redundant Fixed Effects Tests								
Test cross-section and period fixed effects								
Effects Test		Prob.	Effects Test		Prob.	Effects Test		Prob.
Cross-section F		0.000	Cross-section F		0.000	Cross-section F		0.000
Cross-section Chi-square		0.000	Cross-section Chi-square		0.000	Cross-section Chi-square		0.000
Period F		0.000	Period F		0.001	Period F		0.000
Period Chi-square		0.000	Period Chi-square		0.000	Period Chi-square		0.000
Cross-Section/Period F		0.000	Cross-Section/Period F		0.000	Cross-Section/Period F		0.000
Cross-Section/Period Chi-square		0.000	Cross-Section/Period Chi-square		0.000	Cross-Section/Period Chi-square		0.000
Periods included: 8			Periods included: 8			Periods included: 8		
Cross-sections included: 82			Cross-sections included: 82			Cross-sections included: 82		
Total panel (balanced) observations: 656			Total panel (balanced) observations: 656			Total panel (balanced) observations: 656		

Table-3 examines the association between weighted disclosure – a proxy for the accuracy of the disclosures made - and the other disclosure determinants. The results show that lower levels of performance, below industry average performance and decline in performance are associated with higher levels of precision in EPI disclosure (results do not support H4, H5, or H6). Further, reliance on the capital market is associated with lower level of precision (lack of support for H1). This finding suggests that new stock issuance is associated with low demand for EPI information; therefore, firms that issue new stocks do not find it beneficial to disclose precise information about their environmental performance. Combined with previous findings presented in Table-2, this negative association suggests that firms' reliance on the capital market does not influence the firm's disclosure policy but rather influence the precision of the disclosure. In other words, firms that rely on the capital market would disclose their environmental indicators but would not disclose all the information that would enable new investors to determine the firm's performance with precision. Finally, firms with higher media legitimacy make more precise EPI disclosures. This finding suggests that firms that have higher media legitimacy are able to withstand the resulting perception created by their disclosure (support for *Hypothesis 3*).

Table-3: The Association between EPI Disclosure (weighted) and Environmental Performance

Variable	Weighted Disclosure Coeff.	Prob.	Variable	Weighted Disclosure Coeff.	Prob.	Variable	Weighted Disclosure Coeff.	Prob.
C	26.2756	0.548	*C*	28.5651	0.512	*C*	41.5874	0.317
Performance	1.0086	0.107	*Performanc_Average*	1.1576 *	0.066	*Performanc_Change*	0.0685 ***	0.000
Beta	3.5892	0.105	*Beta*	3.1796	0.152	*Beta*	2.6618	0.151
Trading Volume	0.1113	0.107	*Trading Volume*	0.1095	0.115	*Trading Volume*	0.1041	0.116
Debt to Equity Change	-0.1268	0.512	*Debt to Equity Change*	-0.1124	0.560	*Debt to Equity Change*	-0.1325	0.519
Common Stock Change	-0.0044 *	0.073	*Common Stock Change*	-0.0044 *	0.075	*Common Stock Change*	-0.0042 *	0.083
Block_Insider	0.1191	0.610	*Block_Insider*	0.1345	0.562	*Block_Insider*	0.1487	0.523
Block_Highest	-0.2232	0.309	*Block_Highest*	-0.2338	0.288	*Block_Highest*	-0.2766	0.202
ROA	8.3562	0.685	*ROA*	7.1805	0.723	*ROA*	13.3719	0.540
Debt to Assets	-1.4181	0.922	*Debt to Assets*	0.4928	0.973	*Debt to Assets*	-1.3930	0.923
Return	2.2109	0.422	*Return*	2.4649	0.370	*Return*	3.2700	0.227
Negative News	1.0795	0.445	*Negative News*	1.1124	0.431	*Negative News*	1.0493	0.442
Total News	-0.9667	0.170	*Total News*	-0.9645	0.163	*Total News*	-0.8931	0.176
Media Legitimacy	5.4065 **	0.026	*Media Legitimacy*	5.6268 **	0.021	*Media Legitimacy*	5.1037 **	0.035
Size	-3.0063	0.776	*Size*	-2.3470	0.826	*Size*	-5.3577	0.598
Cross-section fixed (dummy variables)								
Period fixed (dummy variables)								
Adjusted R-squared		0.547	Adjusted R-squared		0.549	Adjusted R-squared		0.572
F-statistic		8.765	F-statistic		8.807	F-statistic		9.577
Prob(F-statistic)		0.000	Prob(F-statistic)		0.000	Prob(F-statistic)		0.000
Mean dependent var		21.507	Mean dependent var		21.507	Mean dependent var		21.507
S.D. dependent var		31.960	S.D. dependent var		31.960	S.D. dependent var		31.960
Durbin-Watson stat		1.865	Durbin-Watson stat		1.861	Durbin-Watson stat		1.828
Redundant Fixed Effects Tests								
Test cross-section and period fixed effects								
Effects Test		Prob.	Effects Test		Prob.	Effects Test		Prob.
Cross-section F		0.000	Cross-section F		0.000	Cross-section F		0.000
Cross-section Chi-square		0.000	Cross-section Chi-square		0.000	Cross-section Chi-square		0.000
Period F		0.001	Period F		0.003	Period F		0.000
Period Chi-square		0.000	Period Chi-square		0.001	Period Chi-square		0.000
Cross-Section/Period F		0.000	Cross-Section/Period F		0.000	Cross-Section/Period F		0.000
Cross-Section/Period Chi-square		0.000	Cross-Section/Period Chi-square		0.000	Cross-Section/Period Chi-square		0.000
Periods included: 8			Periods included: 8			Periods included: 8		
Cross-sections included: 82			Cross-sections included: 82			Cross-sections included: 82		
Total panel (balanced) observations: 656			Total panel (balanced) observations: 656			Total panel (balanced) observations: 656		

Table-4: The Association between EPI Disclosure (CO2) and Environmental Performance

Variable	CO2 Disclosure Coeff.	Prob.	Variable	CO2 Disclosure Coeff.	Prob.	Variable	CO2 Disclosure Coeff.	Prob.
C	-0.1920	0.745	*C*	-0.0727	0.902	*C*	-0.0159	0.978
Performance	0.0279 ***	0.000	*Performanc_Average*	0.0316 ***	0.000	*Performanc_Change*	0.0003 ***	0.000
Beta	0.0344	0.282	*Beta*	0.0300	0.351	*Beta*	0.0307	0.321
Trading Volume	0.0026 ***	0.005	*Trading Volume*	0.0024 **	0.011	*Trading Volume*	0.0021 **	0.017
Debt to Equity Change	-0.0015	0.604	*Debt to Equity Change*	-0.0014	0.629	*Debt to Equity Change*	-0.0018	0.551
Common Stock Change	-0.0001 **	0.040	*Common Stock Change*	-0.0001 **	0.043	*Common Stock Change*	-0.0001 **	0.036
Block_Insider	0.0043	0.317	*Block_Insider*	0.0043	0.311	*Block_Insider*	0.0045	0.303
Block_Highest	-0.0049	0.178	*Block_Highest*	-0.0050	0.177	*Block_Highest*	-0.0056	0.130
ROA	0.1913	0.533	*ROA*	0.1872	0.537	*ROA*	0.1904	0.525
Debt to Assets	0.0923	0.697	*Debt to Assets*	0.1230	0.605	*Debt to Assets*	0.0808	0.732
Return	0.0864 *	0.063	*Return*	0.0882 *	0.058	*Return*	0.0868 *	0.062
Negative News	0.0049	0.771	*Negative News*	0.0059	0.723	*Negative News*	0.0026	0.879
Total News	-0.0108	0.340	*Total News*	-0.0110	0.324	*Total News*	-0.0090	0.414
Media Legitimacy	0.0019	0.961	*Media Legitimacy*	0.0049	0.900	*Media Legitimacy*	-0.0006	0.988
Size	0.0910	0.521	*Size*	0.0789	0.580	*Size*	0.0733	0.601
Cross-section fixed (dummy variables)								
Period fixed (dummy variables)								
Adjusted R-squared		0.486	Adjusted R-squared		0.488	Adjusted R-squared		0.489
F-statistic		7.073	F-statistic		7.123	F-statistic		7.152
Prob(F-statistic)		0.000	Prob(F-statistic)		0.000	Prob(F-statistic)		0.000
Mean dependent var		0.369	Mean dependent var		0.369	Mean dependent var		0.369
S.D. dependent var		0.483	S.D. dependent var		0.483	S.D. dependent var		0.483
Durbin-Watson stat		1.910	Durbin-Watson stat		1.905	Durbin-Watson stat		1.895
Redundant Fixed Effects Tests								
Test cross-section and period fixed effects								
Effects Test		Prob.	Effects Test		Prob.	Effects Test		Prob.
Cross-section F		0.000	Cross-section F		0.000	Cross-section F		0.000
Cross-section Chi-square		0.000	Cross-section Chi-square		0.000	Cross-section Chi-square		0.000
Period F		0.038	Period F		0.049	Period F		0.035
Period Chi-square		0.014	Period Chi-square		0.020	Period Chi-square		0.013
Cross-Section/Period F		0.000	Cross-Section/Period F		0.000	Cross-Section/Period F		0.000
Cross-Section/Period Chi-square		0.000	Cross-Section/Period Chi-square		0.000	Cross-Section/Period Chi-square		0.000
Periods included: 8			Periods included: 8			Periods included: 8		
Cross-sections included: 82			Cross-sections included: 82			Cross-sections included: 82		
Total panel (balanced) observations: 656			Total panel (balanced) observations: 656			Total panel (balanced) observations: 656		

Finally, I examine the determinants of disclosing the amount of CO_2 emitted by the firm. The results presented in Table-4 confirm previous findings. Lower levels of performance, below average performance, and decline in performance are associated with higher levels of disclosure of CO_2 performance indicator. Furthermore, higher trading volumes and higher market returns are associated with higher levels of disclosure. The reliance on the capital market (common stock change) is associated with lower levels of disclosure. This latest finding is consistent with the finding about the firm's precision of disclosures since CO2 emissions are the most significant and costly pollutant.

5. Discussion

This research study examines the determinants of EPIs to understand why firms disclose this information and whether there is a bias in these disclosures. The study employs three measures to proxy for EPI disclosures. The first measure is the number of items disclosed in the firm's annual or sustainability reports, the second measure proxies for the precision of these disclosures, and the last measure represents whether the firm discloses information about its CO_2 emissions or not. The findings of this study show that low-performers do not attempt to conceal their environmental information. There is no significant difference between the disclosures of the low and high-environmental performers; however, the precision of the disclosures of the low-performers is higher than that of the high-performers.

The results also suggest that both economic and legitimacy incentives affect the disclosure of environmental performance disclosure. The higher the cost of information gathering, the higher the level but not the precision of the information disclosed. Similarly, firms with better financial condition have the ability to withstand the costs of disclosing this

proprietary information; thus, they exhibit a higher level of disclosure. In contrast, firms react differently to the other stakeholders' needs for information. Higher levels of society awareness about the firm's environmental performance lead to lower levels of disclosure. Furthermore, the higher the level of the firm's media legitimacy, the more the firm would disclose more precise information about its environmental indicators.

The study shows that there is little concern that the reporting of EPI is biased towards the disclosure of positive news. In fact, the results suggest that firms with lower levels of environmental performance are keener on disclosing their EPI in comparison to the high-performers. The study also shows that firms are responsive to the needs of their shareholders as we find that higher demand for EPI information from the financial market is associated with higher levels of disclosure. On the contrary, firms are less responsive to the needs of their outside stakeholders as we find that the level of disclosure is negatively associated with total news following of the firm. Furthermore, firms will not disclose precise information unless they have a high level of media legitimacy. Although there is little doubt about the reliability of the information disclosed, the findings of this paper suggest that firms avoid disclosing precise information when they assess that the disclosures will present a threat to their legitimacy. Therefore, there is a need for more guidelines and more enforcement over the reporting of EPIs to ensure that firms would disclose their environmental performance indicators on a consistent basis.

Chapter 5 - Conclusion

Research on corporate environmental disclosure generates inconclusive results about the reliability of the information disclosed. Furthermore, there is also an ensuing debate about the factors that drive firms to disclose environmental information. Some argue that environmental disclosure is driven by investors' demand for information and that economic costs-and-benefits of disclosure are determinants of firms' disclosure policies (Cormier & Magnan, 1999; Cormier & Magnan, 2003). Others suggest that firms use their environmental disclosures to legitimize their operations and avoid pressures from environmentalists, regulators, or the wide society (Neu et al, 1998; Patten, 2002; Deegan, 2002; O'Donovan, 2002; Cho & Patten, 2007). A third string of research provides evidence that internal and external institutional forces shape firms environmental disclosures (Aerts et al., 2006; Alciatore et al., 2004; Stanny, 1998). That debate has cast doubt about the usefulness of firms' environmental disclosures; whether these disclosures are informative or illusive.

This dissertation contributes to that ongoing debate by studying the development of environmental disclosures over time to understand whether these disclosures are indicative of firms' environmental performance. To answer this question there is a need to first understand what has been disclosed and why do firms disclose environmental information. In the first essay, I review prior research of five environmental themes: capital expenditures, litigation and liabilities, pollution abatement, environmental performance indicators, and governance and management systems. The results show that over time firms have continuously increased the amount of mandatory information – such as the disclosure of environmental capital expenditures or liabilities – due to the tightening of disclosure regulation (Stanny, 1998, Alciatore et al.,

2004). Meanwhile, the level of voluntary disclosures – such as the disclosure of performance indicators or governance and management information - is still very low although firms continuously increased their disclosures over time (Clarkson et al, 2008). These findings highlight the role of regulations in closing the disclosure gap between firms. This study shows that both economic and legitimacy incentives have influenced – or biased – environmental disclosures but it also suggests that disclosure regulations have helped reducing this bias and induced firms to provide more information about their environmental operations even if the information is immaterial.

There is extensive research about mandatory environmental disclosure themes – mainly the disclosure of capital expenditures, liabilities and litigation, and pollution abatement information – that confirm the value relevance of these disclosures to the capital market since it provides them with information about the impact of firms' environmental operations on their future cash flow. However, there is less research about how these types of information is relevant to non-financial stakeholders who are more interested in firms' environmental performance per se. This literature review also suggests that other environmental themes are still under-researched – such as the disclosure of environmental governance and management system information, disclosure of environmental performance indicators, or the disclosure of laws and regulations influencing the firm's operations. There is a need to understand how investors and other stakeholders integrate these disclosures into their assessment of the firm's future environmental and financial performance. Although the value relevance of these disclosures is still unproven, these themes have been extensively used in accounting research as parts of content indexes which raises questions about the findings of many environmental disclosure studies. Therefore, more focused research of these themes is required.

The second research paper studies the reliability of environmental information by examining the association between environmental disclosure and environmental performance. The findings of this study confirm that environmental performance leads to a reporting bias where I find that – on aggregate - the high performing firms disclose more environmental information in their annual, 10-K, and sustainability reports. The study also confirms previous findings that tightening of disclosure regulations and increased scrutiny from regulators improves the reliability of environmental disclosures as witnessed in 10-K disclosures. The results of this study suggest that there is no significant difference between the 10-K disclosures of firms with low environmental performance and those with high environmental performance.

The study also explores the motivation of the low and high performers to disclose their proprietary environmental information. The results suggest that firms' environmental disclosures are motivated by both economic and legitimacy incentives; meaning that, firms use their environmental disclosures to satisfy information demand from different stakeholders such as investors, environmentalists, and members of the society. Although the disclosures of both the low and high performers are motivated by their needs to legitimize their environmental operations, the results do not suggest that the low performers attempt to hide proprietary information or provide disclosures that will portray the firm's environmental performance in a positive light. This is mainly due to two factors; first, that a large amount of proprietary environmental information is regulated and second that the low performers will be penalized by the financial market if they do so. Therefore, I suggest that the impact of legitimacy incentives on environmental disclosures is counterbalanced by market demand for information and other institutional factors such as regulations of environmental disclosures or the issuance of voluntary disclosure guidelines such as the GRI. In brief, I conclude that there has been a positive

development in environmental reporting over the last two decades which resulted in a continuous increase in the amount of information reported and a convergence of the reporting practices between firms. Although there is evidence that firms use their environmental disclosure to legitimize their actions, I do not share the cynical view of some scholars that firms' disclosures only serve this purpose.

The last paper examines the disclosure determinants of environmental performance indicators (EPI); a voluntary disclosure which is indicative of the firms environmental performance. The main objective is to understand whether EPI disclosures are biased towards the disclosure of positive information. The results show that firms' disclosures are not associated with the level of environmental performance suggesting that the information provided by firms are reliable and free from bias. Furthermore, the study also shows that firms continue to provide EPI information even if they witness a decline in their environmental performance. Similar to other studies examining the voluntary disclosure of environmental information, I find that the level of EPI disclosure is still very low and is continuously varying over the sampled period indicating that firms use their discretion to disclose this type of information. The results of this study suggest – in conformance with the findings of the previous study - that firms' environmental disclosures are reliable; however, it also suggests that mandating EPI disclosure may increase the level of information disclosed and reduce firms' discretion over the reporting of such information.

Limitations

That this dissertation does not examine the consequences of environmental disclosures – i.e. value relevance of disclosures or how environmental disclosures affect the social domain – is a shortcoming of this research although the dataset collected for this dissertation could still be

used for that purpose in future studies. To better understand the consequences of environmental disclosures, it would be more beneficial to first know what constitutes these disclosures. Furthermore, understanding why firms decide to disclose their environmental information and whether the information disclosed provides a faithful representation of the firm's environmental performance strengthens the findings of research looking at the consequences of these disclosures.

Recommendations

The outcome of this dissertation indicates that environmental reporting has positively developed over time; however, there is still more work to be done for firms to provide their stakeholders with a complete picture about their environmental performances. It also shows that disclosure regulation has played a fundamental role in increasing the level of environmental disclosure and increasing the reliability of the information reported by reducing the level of reporting bias. There is also a need to regulate other types of environmental information such as the disclosure of environmental performance indicators, environmental governance and management, and others to insure consistent reporting of these types of information. The development of voluntary reporting guidelines – such as the GRI – increased the level of information reported and reduced reporting bias resulting from firms environmental performance; however, the level of information reported is still low due to firms' unwillingness to adopt these guidelines. I suggest that mandating the adoption of the GRI guidelines could provide a step towards a more comprehensive reporting framework that includes environmental themes different from the economic related information required by the FASB and the SEC.

REFERENCES

Aerts, W., & Cormier, D. (2009). Media legitimacy and corporate environmental communication. *Accounting, Organizations and Society, 34*(1), 1-27.

Aerts, W., Cormier, D., & Magnan, M. (2006). Intra-industry imitation in corporate environmental reporting: An international perspective. *Journal of Accounting and Public Policy, 25*(3), 299-331.

Aerts, W., Cormier, D., & Magnan, M. (2008). Corporate environmental disclosure, financial markets and the media: An international perspective. *Ecological Economics, 64*(3), 643-659.

Akerlof, G. A. (1970). The market for "lemons": Quality uncertainty and the market mechanism. *The Quarterly Journal of Economics, 84*(3), 488-500.

Alciatore, M., Carol, C. D., & Easton, P. (2004). Changes in environmental regulation and reporting: The case of the petroleum industry from 1989 to 1998. *Journal of Accounting and Public Policy, 23*(4), 295-304.

Al-Tuwaijri, S. A., Christensen, T. E., & Hughes, K. E.,II. (2004). The relations among environmental disclosure, environmental performance, and economic performance: A simultaneous equations approach. *Accounting, Organizations and Society, 29*(5, 6), 447-471.

Ambec, S., & Lanoie, P. (2008). Does it pay to be green? A systematic overview. *Academy of Management Perspectives, 22*(4), 45-62.

Amir, E., & Lev, B. (1996). Value-relevance of nonfinancial information: The wireless communications industry. *Journal of Accounting & Economics, 22*(1-3), 3-30.

Anderson, E. W., Fornell, C., & Lehmann, D. R. (1994). Customer satisfaction, market share, and profitability: Findings from Sweden. *Journal of Marketing, 58*(3), 53-66.

Anderson, E. W., Fornell, C., & Mazvancheryl, S. K. (2004). Customer satisfaction and shareholder value. *Journal of Marketing, 68*(4), 172-185.

Anderson, E. W., Fornell, C., & Rust, R. T. (1997). Customer satisfaction, productivity, and profitability: Differences between goods and services. *Marketing Science, 16*(2), 129-145.

Aral, S., & Weill, P. (2007). IT assets, organizational capabilities, and firm performance: How resource allocations and organizational differences explain performance variation. *Organization Science, 18*(5), 763-780.

Azzone, G., Manzini, R., & Noci, G. (1996). Evolutionary trends in environmental reporting. *Business Strategy and the Environment, 5*, 219-230.

Ball, R., Kothari, S. P., & Robin, A. (2000). The effect of international institutional factors on properties of accounting earnings. *Journal of Accounting & Economics, 29*(1), 1-51.

Barth, M. E., & McNichols, M. F. (1994). Estimation and market valuation of environmental liabilities relating to superfund sites. *Journal of Accounting Research, 32*, 177-209.

Barth, M., McNichols, M., & Wilson, G. (1997). Factors influencing firms' disclosures about environmental liabilities. *Review of Accounting Studies*, *2*, 35-64.

Basu, S. (1997). The conservatism principle and the asymmetric timeliness of earnings. *Journal of Accounting & Economics, 24*(1), 3-37.

Belkaoui, A. (1976). The impact of the disclosure of the environmental effects of organizational behavior on the market. *Financial Management, 5*(4), 26-31.

Berthelot, S., Cormier, D., & Magnan, M. (2003). Environmental disclosure research: Review and synthesis. *Journal of Accounting Literature, 22*, 1-44.

Bhat, V.N. (1998). Does environmental compliance pay? *Ecotoxicology*, *7*, 221–225.

Blacconiere, W. G., & Patten, D. M. (1994). Environmental disclosures, regulatory costs, and changes in firm value. *Journal of Accounting & Economics, 18*(3), 357-377.

Botosan, C. A. (1997). Disclosure level and the cost of equity capital. *The Accounting Review, 72*(3), 323-349.

Buhr, N. (1998). Environmental performance, legislation and annual report disclosure: the case of acid rain and Falconbridge. *Accounting, Auditing & Accountability Journal, 11*(2), 163-190.

Burgstahler, D., & Dichev, I. (1997). Earnings management to avoid earnings decreases and losses. *Journal of Accounting and Economics*, *24*, 99-126

Campbell, K., Sefcik, S. E., & Soderstrom, N. S. (2003). Disclosure of private information and reduction of uncertainty: Environmental liabilities in the chemical industry. *Review of Quantitative Finance and Accounting*, 21(4), 349-378.

Chen, K. H., Metcalf, R. W., & Spicer, B. H. (1980). The relationship between pollution control records and financial indicators revisited and further comment. *The Accounting Review, 55*(1), 168-177.

Cho, C. H. (2009). Legitimation strategies used in response to environmental disaster: A French case study of total SA's Erika and AZF incidents. *European Accounting Review, 18*(1), 33-62.

Cho, C. H., Freedman, M., & Patten, D. M. (2012). Corporate disclosure of environmental capital expenditures. *Accounting, Auditing & Accountability Journal, 25*(3), 486-507.

Cho, C. H., & Patten, D. M. (2007). The role of environmental disclosures as tools of legitimacy: A research note. *Accounting, Organizations and Society, 32*(7), 639-647.

Cho, C. H., & Patten, D. M. (2013). Green accounting: Reflections from a CSR and environmental disclosure perspective. *Critical Perspectives on Accounting, 24*(6), 443-447.

Cho, C. H., Patten, D. M., & Roberts, R. W. (2006). Corporate political strategy: An examination of the relation between political expenditures, environmental performance, and environmental disclosure. *Journal of Business Ethics, 67*(2), 139-154.

Clarkson, M. (1995). A stakeholder framework for analyzing and evaluating corporate social performance. *The Academy of Management Review, 20*(1), 92-117.

Clarkson, P. M., Fang, X., Li, Y., & Richardson, G. (2013). The relevance of environmental disclosures: Are such disclosures incrementally informative? *Journal of Accounting and Public Policy, 32*(5), 410-431.

Clarkson, P. M., Li, Y., & Richardson, G. D. (2004). The market valuation of environmental capital expenditures by pulp and paper companies. *The Accounting Review, 79*(2), 329-353.

Clarkson, P., Li, Y., Richardson, G., & Vasvari, F. (2008). Revisiting the relation between environmental performance and environmental disclosure: An empirical analysis. *Accounting, Organizations and Society, 33*(4/5), 303-327.

Clarkson, P. M., Li, Y., Richardson, G. D., & Vasvari, F. P. (2011a). Does it really pay to be green? Determinants and consequences of proactive environmental strategies. *Journal of Accounting and Public Policy*, *30*(2), 122-144.

Clarkson, P.M., Overell, M.B., & Chapelle, L. (2011b). Environmental reporting and its relation to corporate environmental performance. *Abacus*, *47*(1), 27-60.

Colombo, M. G., & Grilli, L. (2005). Founders' human capital and the growth of new technology-based firms: A competence-based view. *Research Policy, 34*(6), 795-816.

Cormier, D., & Gordon, I. M. (2001). An examination of social and environmental reporting strategies. *Accounting, Auditing & Accountability Journal, 14*(5), 587-616.

Cormier, D., & Magnan, M. (1997). Investors' assessment of implicit environmental liabilities: An empirical investigation. *Journal of Accounting and Public Policy, 16*(2), 215-241.

Cormier, D., & Magnan, M. (1999). Corporate environmental disclosure strategies: Determinants, costs and benefits. *Journal of Accounting, Auditing & Finance, 14*(4), 429-451.

Cormier, D., & Magnan, M. (2003). Environmental reporting management: A continental European perspective. *Journal of Accounting and Public Policy, 22*(1), 43-62.

Cormier, D., & Magnan, M. (2013). The Economic Relevance of Environmental Disclosure and its Impact on Corporate Legitimacy: An Empirical Investigation. *Business Strategy and the Environment,* forthcoming.

Cormier, D., Magnan, M., Morard, B. (1993). The impact of corporate pollution on market valuation: some empirical evidence. *Ecological Economics*, *8*, 135-155.

Cormier, D., Magnan, M., & Van Velthoven, B. (2005). Environmental disclosure quality in large german companies: Economic incentives, public pressures or institutional conditions? *European Accounting Review*, 14(1), 3-39.

De Villiers, C., & van Staden, C. J. (2006). Can less environmental disclosure have a legitimising effect? Evidence from Africa. *Accounting, Organizations and Society, 31*(8), 763-781.

Deegan, C. (2002). The legitimising effect of social and environmental disclosures - a theoretical foundation. *Accounting, Auditing & Accountability Journal, 15*(3), 282-311.

Deegan, C. (2013). The accountant will have a central role in saving the planet ... really? A reflection on 'green accounting and green eyeshades twenty years later'. *Critical Perspectives on Accounting, 24*(6), 448-458.

Deegan, C., & Gordon, B. (1996). A study of the environmental disclosure practices of Australian corporations. *Accounting and Business Research, 26*(3), 187-199.

Deegan, C., & Rankin, M. (1996). Do Australian companies report environmental news objectively? An analysis of environmental disclosures by firms prosecuted successfully by the environmental protection authority. *Accounting, Auditing & Accountability Journal, 9*(2), 50-67.

Deegan, C., & Rankin, M. (1997). The materiality of environmental information to users of annual reports. *Accounting, Auditing & Accountability Journal, 10*(4), 562-583.

Deegan, C., Rankin, M., & Tobin, J. (2002). An examination of the corporate social and environmental disclosures of BHP from 1983-1997: A test of legitimacy theory. *Accounting, Auditing & Accountability Journal, 15*(3), 312-343.

Degeorge, F., Patel, J., & Zeckhauser, R. (1999). Earnings management to exceed thresholds. *The Journal of Business*, *72*(1), 1-33.

Diamond, D. W. (1985). Optimal release of information by firms. *The Journal of Finance, 40*(4), 1071-1094.

Dhaliwal, D. S., Li, O. Z., Tsang, A., & Yang, Y. G. (2011). Voluntary nonfinancial disclosure and the cost of equity capital: The initiation of corporate social responsibility reporting. *The Accounting Review, 86*(1), 59-100.

Ely, K., & Stanny, E. (1999). User sophistication and the specificity of disclosure as reflected in disclosure of a firm's status as a potentially responsible party. Working paper.

Epstein, M. J., & Wisner, P. S. (2001). Using a balanced scorecard to implement sustainability. *Environmental Quality Management*, *11*(2), 1-10.

Fekrat, M. A., Inclan, C., & Petroni, D. (1996). Corporate environmental disclosures: Competitive disclosure hypothesis using 1991 annual report data. *The International Journal of Accounting, 31*(2), 175-195.

Freedman, M., & Jaggi, B. (2005). Global warming, commitment to the Kyoto protocol, and accounting disclosures by the largest global public firms from polluting industries. *The International Journal of Accounting, 40*(3), 215-232.

Freedman, M., & Stagliano, A. J. (2002). Environmental disclosure by companies involved in initial public offerings. *Accounting, Auditing & Accountability Journal, 15*(1), 94-105.

Freedman, M., & Wasley, C. (1990). The association between environmental performance and environmental disclosure in annual reports and 10Ks. *Advances in Public Interest Accounting, 3*, 183-193.

Gamble, G. O., Hsu, K., Kite, D., & Radtke, R. R. (1995). Environmental disclosures in annual reports and 10Ks: An examination. *Accounting Horizons, 9*(3), 34-54.

Government Accounting Office (GAO). (2004). *Environmental disclosure: SEC should explore ways to improve tracking and transparency of information.* Washington DC: GAO.

Gray, R. (2013). Back to basics: What do we mean by environmental (and social) accounting and what is it for? - A reaction to Thornton. *Critical Perspectives on Accounting, 24*(6), 459-468.

Gray, R., Javad, M., Power, D. M., & Sinclair, C. D. (2001). Social and environmental disclosure and corporate characteristics: A research note and extension. *Journal of Business Finance & Accounting, 28*(3/4), 327-356.

Gray, R., Kouhy, R., & Lavers, S. (1995a). Corporate social and environmental reporting: A review of the literature and a longitudinal study of UK disclosure. *Accounting, Auditing & Accountability Journal, 8*(2), 47-77.

Gray, R., Kouhy, R., & Lavers, S. (1995b). Methodological themes: Constructing a research database of social and environmental reporting by UK companies. *Accounting, Auditing & Accountability Journal, 8*(2), 78-101.

Guthrie, J., & Parker, L. D. (1989). Corporate social reporting: A rebuttal of legitimacy theory. *Accounting and Business Research, 19*(76), 343-352.

Hall, B. H., Jaffe, A., & Trajtenberg, M. (2005). Market value and patent citations. *The Rand Journal of Economics, 36*(1), 16-38.

Hausman, J. A., & Taylor, W. E. (1981). Panel data and unobservable individual effects. *Econometrica*, *49*(6), 1377- 1398.

Heinkel, R., Kraus, A., & Zechner, J. (2001). The effect of green investment on corporate behavior. *Journal of Financial and Quantitative Analysis, 36*(4), 431-449.

Henri, J., & Journeault, M. (2008). Environmental performance indicators: An empirical study of Canadian manufacturing firms. *Journal of Environmental Management*, 87 (1), 165-176.

Hibiki, A., Higashi, M., & Matsuda, A., (2003). Determinants of the firm to acquire ISO14001 certificate and market valuation of the certified firm. Working Paper

Horwath (2008), WHK Horwath Corporate Governance Report, University of Newcastle, Newcastle.

Hughes, K. E.,II. (2000). The value relevance of nonfinancial measures of air pollution in the electric utility industry. *The Accounting Review, 75*(2), 209-228.

Hughes, S. B., Sander, J. F., & Reier, J. C. (2000). Do environmental disclosures in U.S. annual reports differ by environmental performance? *Advances in Environmental Accounting and Management, 1*, 141-161.

Hughes, S. B., Anderson, A., & Golden, S. (2001). Corporate environmental disclosures: Are they useful in determining environmental performance? *Journal of Accounting and Public Policy, 20*(3), 217-240.

Ingram, R. W. (1978). An investigation of the information content of (certain) social responsibility disclosures. *Journal of Accounting Research, 16*(2), 270-285.

Ingram, R. W., & Frazier, K. B. (1980). Environmental performance and corporate disclosure. *Journal of Accounting Research, 18*(2), 614-622.

Ittner, C. D., & Larcker, D. F. (1998). Are nonfinancial measures leading indicators of financial performance? An analysis of customer satisfaction. *Journal of Accounting Research, 36*, 1-35.

Jaggi, B., & Freedman, M. (1982). An analysis of the informational content of pollution disclosures. *The Financial Review, 17*(3), 142-152.

Jaggi, B., & Freedman, M. (1992). An examination of the impact of pollution performance on economic and market performance: Pulp and paper firms. *Journal of Business Finance & Accounting, 19*(5), 697-713.

Johnston, D. (2005). An investigation of regulatory and voluntary environmental capital expenditures. *Journal of Accounting and Public Policy, 24*(3), 175-206.

Johnston, D. M., Sefcik, S. E., & Soderstrom, N. S. (2008). The value relevance of greenhouse gas emissions allowances: An exploratory study in the related United States SO2 market. *European Accounting Review*, *17*(4), 747-764.

Klassen, R. D., & McLaughlin, C. P. (1996). The impact of environmental management on firm performance. *Management Science, 42*(8), 1199-1214.

Klock, M., & Megna, P. (2000). Measuring and valuing intangible capital in the wireless communications industry. *Quarterly Review of Economics and Finance, 40*(4), 519-532.

Kothari, S. P. (2000). "The Role of Financial Reporting in Reducing Financial Risks in the Market" in *Building an Infrastructure for Financial Stability*, edited by E. S. Rosengren and J. S. Jordan. Federal Reserve Bank of Boston Conference Series No. 44, 89–102.

King, A.A., & Lenox, M.J. (2001). Does it really pay to be green? An empirical study of firm environmental and financial performance. *Journal of Industrial Ecology*, *5*(1), 105–116.

King, A.A., & Lenox, M.J. (2002). Exploring the locus of profitable pollution reduction. Management Science 48 (2), 289–299.

Lewis, A. (2001). A focus group study of the motivation to invest: 'Ethical/green' and 'ordinary' investors compared. *Journal of Socio - Economics, 30*(4), 331-341.

Li, Y., Richardson, G. D., & Thornton, D. B. (1997). Corporate disclosure of environmental liability information: Theory and evidence. *Contemporary Accounting Research, 14*(3), 435-474.

Lindblom, C. (1994). The implications of organizational legitimacy for corporate social performance and disclosure. New York, NY.

Marshall, R. S., & Brown, D. (2003). Corporate environmental reporting: What's in a metric? *Business Strategy and the Environment, 12*(2), 87-106.

Meng, X.H., Zeng, S.X., Shi, J.J., Qi G.Y., & Zhang, Z.B. (2014). The relationship between corporate environmental performance and environmental disclosure: An empirical study in China. *Journal of Environmental Management*, *145*, 357-367.

Mobus, J. L. (2005). Mandatory environmental disclosures in a legitimacy theory context. *Accounting, Auditing & Accountability Journal, 18*(4), 492-517.

Moneva, J. M., & Cuellar, B. (2009). The value relevance of financial and non-financial environmental reporting. *Environmental and Resource Economics, 44*(3), 441-456.

Morhardt, J. E., Baird, S., & Freeman, K. (2002). Scoring corporate environmental and sustainability reports using GRI 2000, ISO 14031 and other criteria. *Corporate Social - Responsibility and Environmental Management, 9*(4), 215-233.

Neu, D., Warsame, H., & Pedwell, K. (1998). Managing public impressions: Environmental disclosures in annual reports. *Accounting, Organizations and Society, 23*(3), 265-282.

O'Donovan, G. (2002). Environmental disclosures in the annual report: Extending the applicability and predictive power of legitimacy theory. *Accounting, Auditing & Accountability Journal, 15*(3), 344-371.

Ohlson, J. A. (1995). Earnings, book values, and dividends in equity valuation. *Contemporary Accounting Research, 11*(2), 661-687.

Parker, L. D. (2005). Social and environmental accountability research: A view from the commentary box. *Accounting, Auditing & Accountability Journal, 18*(6), 842-860.

Patten, D. M. (1991). Exposure, legitimacy, and social disclosure. *Journal of Accounting and Public Policy, 10*(4), 297-308.

Patten, D. M. (1992). Intra-industry environmental disclosures in response to the Alaskan oil spill: A note on legitimacy theory. *Accounting, Organizations and Society, 17*(5), 471-475.

Patten, D. M. (2002). The relation between environmental performance and environmental disclosure. *Accounting, Organizations and Society, 27*(8), 763-773.

Patten, D. M. (2005). The accuracy of financial report projections of future environmental capital expenditures: A research note. *Accounting, Organizations and Society, 30*(5), 457-468.

Patten, D. M., & Crampton, W. (2004). Legitimacy and the internet: An examination of corporate web page environmental disclosures. *Advances in Environmental Accounting & Management, 2*, 31-57.

Patten, D. M., & Trompeter, G. (2003). Corporate responses to political costs: An examination of the relation between environmental disclosure and earnings management. *Journal of Accounting and Public Policy, 22*(1), 83-94.

Perez, E. A., Ruiz, C. C., Fenech, F. C. (2007). Environmental management systems as an embedding mechanism: a research note. *Accounting, Auditing, & Accountability Journal*, 20(3), 403-422.

Pondeville, S., Swaen, V., & De Rongé, Y. (2013). Environmental management control systems: The role of contextual and strategic factors. *Management Accounting Research, 24*(4), 317-332.

Prado-Lorenzo, J., Rodríguez-Domínguez, L., Gallego-Álvarez, I., & García-Sánchez, I. (2009). Factors influencing the disclosure of greenhouse gas emissions in companies world-wide. Management Decision, 47(7), 1133-1157.

Hope, O. (2003). Disclosure practices, enforcement of accounting standards, and analysts' forecast accuracy: An international study. *Journal of Accounting Research, 41*(2), 235-272.

Rajgopal, S., Venkatachalam, M., & Kotha, S. (2003). The value relevance of network advantages: The case of e-commerce firms. *Journal of Accounting Research, 41*(1), 135-162.

Rankin, M., Windsor, C., & Wahyuni, D. (2011). An investigation of voluntary corporate greenhouse gas emissions reporting in a market governance system. *Accounting, Auditing & Accountability Journal, 24*(8), 1037-1070.

Rockness, J. W. (1985). An assessment of the relationship between US corporate environmental performance and disclosure. *Journal of Business Finance & Accounting, 12*(3), 339-354.

Rockness, J., Schlachter, P., & Rockness, H. O. (1986). Hazardous waste disposal, corporate disclosure, and financial performance in the chemical industry. *Advances in Public Interest Accounting, 1*, 167-191.

Rodrigue, M., Magnan, M., & Boulianne, E. (2013a). Stakeholders' influence on environmental strategy and performance indicators: A managerial perspective. *Management Accounting Research, 24*(4), 301-316.

Rodrigue, M., Magnan, M., & Cho, C. H. (2013b). Is environmental governance substantive or symbolic? an empirical investigation. *Journal of Business Ethics, 114*(1), 107-129.

Scott, T. W. (1994). Incentives and disincentives for financial disclosure: Voluntary disclosure of defined benefit pension plan information by Canadian firms. *The Accounting Review, 69*(1), 26-43.

Scott, W. R. (2006). Financial accounting theory. Toronto: Pearson Prentice Hall.

Spence, C., Chabrak, N., & Pucci, R. (2013). Doxic sunglasses: A response to "Green accounting and Green Eyeshades: Twenty years later". *Critical Perspectives on Accounting*, 24(6), 469-473.

Spicer, B. H. (1978). Investors, corporate social performance and information disclosure: An empirical study. *The Accounting Review, 53*(1), 94-111.

Stanny, E. (1998). Effect of regulation on changes in disclosure of and reserved amounts for environmental liabilities. *Journal of Financial Statement Analysis, 3*(4), 34-49.

Thomas, A. (2001). Corporate environmental policy and abnormal stock price returns: an empirical investigation. *Business Strategy and the Environment*, *10*, 125–134.

Thornton, D. B. (2013). Green accounting and green eyeshades twenty years later. *Critical Perspectives on Accounting, 24*(6), 438-442.

Verrecchia, R. E. (1983). Discretionary disclosure. *Journal of Accounting & Economics, 5*(3), 179-194.

Walden, W. D., & Stagliano, A. J. (2004). An assessment of the quality of environmental disclosure themes. *Advances in Environmental Accounting & Management, 2*, 137-165.

Wiseman, J. (1982). An evaluation of environmental disclosures made in corporate annual reports. *Accounting, Organizations and Society, 7*(1), 53-63.

Wyatt, A. (2008). What financial and non-financial information on intangibles is value-relevant? A review of the evidence. Accounting and Business Research, *38*(3), 217-256.

Ziegler, A., & Schröder, M. (2010). What determines the inclusion in a sustainability stock index?: A panel data analysis for European firms. *Ecological Economics, 69*(4), 848-856.

Appendix A: Disclosure Requirements in Annual, 10-K, and Sustainability Reports

	Disclosure Requirements	**Enforcement**
Annual Report	FASB statement no 5: accounting for contingencies. FASB interpretation no14: require the reasonable estimation of the amount of loss. Issue no 90-8: capitalization of costs to treat environmental contamination. Issue no 89-13: accounting for the cost of asbestos removal. Issue of no 93-5: accounting for environmental liabilities.	Requirements are set by the FASB and AICPA. No evidence of enforcement.
10-K Report	In addition to FASB requirements the SEC recommends the following in 10-K reports: Item 101: requires the description of business and disclosure of environmental matters affecting the business. Item 103: requires the disclosure of legal proceedings involving the company. Item 303: requires the disclosure of material events and uncertainties, and long-term contractual liabilities. Item 503: requires the disclosure of the company's risk factors. Staff Accounting Bulletin no 92: accounting and disclosure of loss contingencies.	Additional requirements are set by the SEC. Reports are reviewed and enforced by the SEC.
Sustainability Report – GRI Guideline	▪ Disclosure on management approach ▪ Goals and performance ▪ Policy ▪ Organizational responsibility ▪ Training and awareness ▪ Monitoring and follow-up ▪ Environmental performance indicators o Materials o Energy o Water o Biodiversity o Emissions, effluents, and waste o Products and services o Compliance o Transport o Overall	Requirements are set by the Global Reporting Initiative. No evidence of enforcement.

Appendix B: List of Firms for Essay 2

COMPANY NAME	SIC	COMPANY NAME	SIC
3M Company	2670	Heinz (H.J.) Company	2030
AGL Resources Inc.	4924	Helmerich & Payne, Inc.	1381
Air Products & Chemicals, Inc.	2810	Hershey Company (The)	2060
Alberto-Culver Company	2844	IDACORP Inc.	4911
Alcoa, Inc.	3350	International Flavors & Fragrances Inc.	2860
American Electric Power	4911	International Paper Company	2600
Anadarko Petroleum Corporation	1311	Kellogg Company	2040
Anheuser-Busch Companies, Inc.	2082	Kimberly-Clark Corporation	2621
Apache Corporation	1311	Marathon Oil Corporation	2911
Archer-Daniels-Midland Company	2070	Newell Rubbermaid, Inc.	3089
Avery Dennison Corporation	2670	Newmont Mining Corporation	1040
Avon Products, Inc.	2844	Nicor, Inc.	4924
Bemis Company, Inc.	2670	NIKE, Inc.	3021
Cabot Corporation	2890	Nucor Corporation	3312
Calgon Carbon Corporation	2810	Occidental Petroleum Corporation	1311
Campbell Soup Company	2030	OGE Energy Corp.	4922
Church & Dwight Co., Inc.	2840	Pepco Holdings, Inc.	4911
Cleco Corporation	4911	PepsiCo, Inc.	2080
Clorox Company (The)	2842	PG&E Corporation	4931
Coca-Cola Company	2080	PPG Industries, Inc.	2851
Colgate-Palmolive Company	2844	PPL Corporation	4911
ConAgra Foods, Inc.	2000	Praxair, Inc.	2810
Consolidated Edison Inc.	4931	Procter & Gamble Company	2840
Cooper Tire and Rubber Company	3011	Public Service Enterprise Group,	4931
Dominion Resources, Inc.	4911	Rohm and Haas Company	2821
Dow Chemical Company	2821	Rowan Companies, Inc.	1381
DTE Energy Company	4911	Sara Lee Corporation	2000
Duke Energy Corporation	4931	Schlumberger N.V.	1389
DuPont Company	2820	Sealed Air Corporation	2670
Eastman Chemical Company	2821	Sherwin-Williams Company (The)	2851
Ecolab Inc.	2842	Sonoco Products Company	2650
Edison International	4911	Southern Company	4911
Energen Corporation	4924	Sunoco, Inc.	2911
Entergy Corporation	4911	Temple-Inland Inc.	2631
Equitable Resources, Inc.	4923	Tootsie Roll Industries, Inc.	2060
Freeport-McMoRan Copper &	1000	Tupperware Brands Corporation	3089
General Mills Incorporated	2040	United States Steel Corporation	3312
Goodyear Tire & Rubber	3011	WGL Holdings, Inc.	4924
Halliburton Company	1389	Williams Companies, Inc.	4922

Appendix C: Disclosure Index

	Positive/Neutral Disclosure	Negative Disclosure	Specific Disclosures: Quantitative	Specific Disclosures: Firm Specific - Qualitative	Specific Disclosures: General - Qualitative
HARD DISCLOSURES					
Governance structure and management systems					
1. Existence of a department for pollution control and/or management positions for environmental management	X			X	
2. Existence of an environmental and/or public issues committee in the board	X			X	
3. Existence of terms and conditions applicable to suppliers and/or customers regarding environmental practices	X			X	
4. Stakeholder involvement in setting corporate environmental policies	X			X	
5. Implementation of ISO14001 at the plant and/or firm level	X			X	
6. Executive compensation is linked to environmental performance	X			X	
Credibility					
1. Adoption of GRI sustainability reporting guidelines or provision of a CERES report	X			X	
2. Independent verification/assurance about environmental performance and/or systems	X			X	
3. Periodic independent verification/audits on environmental performance and/or systems	X			X	
4. Certification of environmental programs by independent agencies	X			X	
5. Product certification with respect to environmental impact	X			X	
6. External environmental performance awards and/or inclusion in a sustainability index	X			X	
7. Stakeholder involvement in the environmental disclosure process	X			X	
8. Participation in voluntary environmental initiatives endorsed by EPA or Department of Energy	X			X	
9. Participation in industry specific associations/initiatives to improve environmental practices	X			X	

	Positive/Neutral Disclosure	Negative Disclosure	Specific Disclosures		
			Quantitative	Firm Specific - Qualitative	General - Qualitative
10. Participation in other environmental organizations/associations to improve environmental practices	X			X	
Contamination and remediation efforts					
1. Spills (number, nature, efforts of reduction)		X		X	
2. Specific disclosure that the company has been named as a Potentially Responsive Party		X		X	
3. Efforts of remediation or corrective actions	X			X	
Pollution abatement and environmental performance indicators (EPI)					
1. Control, installations, facilities or processes described	X		X		
2. Recycling (description of processes)	X		X		
3. EPI on energy use and/or energy efficiency	X		X		
4. EPI on water use and/or water use efficiency	X		X		
5. EPI on green house gas emissions	X		X		
6. EPI on other air emissions	X		X		
7. EPI on TRI (land, water, air)	X		X		
8. EPI on other discharges releases and/or spills (not TRI)	X		X		
9. EPI on waste generation and/or management	X		X		
10. EPI on land and resources use, biodiversity and conservation	X		X		
11. EPI on environmental impacts of products and services	X		X		

	Positive/Neutral Disclosure	Negative Disclosure	Specific Disclosures		
			Quantitative	Firm Specific - Qualitative	General - Qualitative
12. EPI on compliance performance (e.g. exceedances, reportable, incidents)	X		X		
Economic factors					
1. Past and current expenditures for pollution control equipment and facilities	X		X		
2. Past and current operating costs of pollution control equipment and facilities	X		X		
3. Future estimates of expenditures for pollution control equipment and facilities	X		X		
4. Future estimates of operating costs for pollution control	X		X		
5. Financing for pollution control equipment or facilities	X		X		
6. Summary of dollar savings from environmental initiatives to the company	X		X		
7. Amount spent on fines related to environmental issues		X	X		
8. Disclosure of monetary accruals and/or expenses incurred for remediation		X	X		
9. Dollar amount for environmental liabilities		X	X		
Litigation and liabilities					
1. Present litigation		X		X	
2. Potential litigation		X		X	
3. Orders to conform		X		X	
4. Actual or potential fines		X		X	
5. Environmental debts		X		X	
SOFT DISCLOSURES					

	Positive/Neutral Disclosure	Negative Disclosure	Specific Disclosures		
			Quantitative	Firm Specific - Qualitative	General - Qualitative
Vision and strategy claims					
1. CEO statement on environmental performance in letter to shareholders and/or stakeholders	X				X
2. A statement of corporate environmental policy, value, and principles, environmental codes of conduct	X				X
3. A statement about formal management systems regarding environmental risk and performance	X				X
4. A statement that the firm undertakes periodic reviews and evaluations of its environmental performance	X			X	
5. A statement of measurable goals in terms of future environmental performance	X			X	
6. A statement about environmental innovations and/or new technologies	X			X	
Laws and regulations conformity					
1. Discussion of regulations and requirements	X				X
2. Future legislation and regulations	X				X
3. A statement about the firm compliance (or lack thereof) with specific environmental standards	X				X
Environmental profile					
1. An overview of environmental impact of the industry	X				X
2. An overview of how the business operations and/or products and services impact the environment	X				X
3. An overview of corporate environmental performance relative to industry peers	X				X
Environmental initiatives					
1. A substantive description of employee training in environmental management and operations	X			X	

	Positive/Neutral Disclosure	Negative Disclosure	Specific Disclosures		
			Quantitative	Firm Specific - Qualitative	General - Qualitative
2. Existence of response plans in case of environmental accidents	X			X	
3. Internal environmental awards	X			X	
4. Internal environmental audits	X			X	
5. Internal certification of environmental programs	X			X	
6. Community involvement and/or donations related to environment	X				X

Appendix D: Example of Classifying Firms Disclosures – 2005 disclosures of Alcoa Company

			Type of Disclosure						
Source	Disclosure	Category	Hard	Soft	Positive of Neutral	Negative	Quantitative	Firm Specific Qualitative	Qualitative
Annual Report	Alcoa Shanghai is educating students to sustain the environment by supporting The Jane Goodall Institute's Roots & Shoots® program, which promotes community service and educational activities. Jane Goodall is a renowned primatologist (p.6)	Environmental initiatives		1	1			1	
Annual Report	Alcoa's Tapoco hydroelectric project in Tennessee has been certified as an environmentally responsible, low-impact hydropower project by the Low Impact Hydropower Institute, a U.S. nonprofit (p.18)	Credibility	1		1			1	
10-K Report	As previously reported, since 1989 Alcoa has been conducting investigations and studies of the Grasse River, adjacent to Alcoa's Massena, New York plant site, under order from the U.S. Environmental Protection Agency (EPA) issued under Section 106 of CERCLA. Sediments and fish in the river contain varying levels of polychlorinated biphenyl (PCB) (p.22)	Contamination and remediation efforts	1			1		1	
10-K Report	The range of costs associated with the remedial alternatives evaluated in the 2002 Report was between $2 million and $525 million (p.22)	Economic Factors	1			1	1		
Sustainability Report	We must remain vigilant to reach our goal of a 60% reduction in water use by 2009 and 70% by 2010 from a base year of 2000 (p.9).	Vision and strategy claims		1	1		1		
Sustainability Report	Through 2005, we achieved a 23% reduction in process water (p.9)	Pollution abatement and environmental performance indicators (EPI)	1		1		1		
Sustainability Report	In January 2005 and 2006, Alcoa was named one of the most sustainable corporations in the world during a ceremony at the World Economic Forum in Davos, Switzerland. At the end of 2005, we were also named one of the top green companies in the	Vision and strategy claims		1	1				1

			Type of Disclosure						
Source	Disclosure	Category	Hard	Soft	Positive of Neutral	Negative	Quantitative	Firm Specific Qualitative	Qualitative
	world by BusinessWeek magazine and the Climate Group in recognition of our performance in reducing greenhouse gas emissions (CEO Statement p.2)								

Appendix E: Analysis of information disclosed in annual reports, 10-K reports, and sustainability reports

1. Analysis of environmental information disclosed in annual reports, 10-K reports, and sustainability reports.

Environmental disclosures in annual reports

The sample firms issued 1092 annual reports during the period from 1997 to 2010. Table-1 shows that the average total disclosure in annual reports is around 3.7 themes per year. Annual reports include more hard disclosures than soft disclosures (2.7 vs. 1.0). They include less negative disclosures (1.4 themes) in comparison to positive and neutral disclosures (2.3 themes). In annual reports, firms focus on disclosing firm-specific qualitative disclosures (1.7themes), followed by quantitative disclosures (1.2 themes) and general qualitative disclosures (0.8 themes). Among the different disclosure themes there is slight emphasize on disclosure of economic factors (1.05 themes).

Environmental disclosures in 10-K reports

The sample firms issued 1092 10-K reports during the period from 1997 to 2010. Table-2 shows that the level of total disclosure is higher than that in annual reports with an average 6.2 themes. 10-K reports include higher ratio of hard to soft disclosures (4.9 vs. 1.3 themes). Further, there is more balance in the disclosure of negative versus positive or neutral information (3.3 vs. 2.9 themes). Finally, firm-specific qualitative disclosures amount to 2.7 themes with quantitative and general qualitative disclosures equal to 2.4 and 1.2 themes respectively. In 10-K reports, firms focus on the disclosure of economic factors, and litigation & liabilities information (2.29 and 1.52 themes respectively).

Table-1: Descriptive Statistics of Annual Report Disclosures

Descriptive Statistics						
	N	Minimum	Maximum	Mean		Std. Deviation
				Statistic	Std. error	
Governance Structure and Management System	1092	0	3	.32	.020	.647
Credibility	1092	0	3	.23	.016	.524
Contamination and remediation efforts	1092	0	3	.34	.017	.572
Pollution abatement and environmental performance indicators (EPI)	1092	0	6	.19	.019	.620
Economic factors	1092	0	7	1.05	.050	1.649
Litigation and liabilities	1092	0	4	.57	.028	.935
Vision and strategy claims	1092	0	5	.60	.026	.860
Laws and regulations conformity	1092	0	3	.26	.018	.602
Environmental profile	1092	0	3	.05	.007	.226
Environmental initiatives	1092	0	1	.08	.008	.264
Hard Disclosure Annual Report	1092	0	15	2.70	.102	3.369
Soft Disclosure Annual Report	1092	0	7	.98	.038	1.253
Total Positive or Neutral Disclosure	1092	0	17	2.32	.085	2.804
Negative Disclosure	1092	0	9	1.36	.061	2.027
Quantitative Disclosure	1092	0	8	1.24	.055	1.817
Firm Specific Qualitative Disclosure	1092	0	10	1.66	.060	1.973
Qualitative Disclosure	1092	0	6	.78	.032	1.067
Total Disclosure Annual Report	1092	0	20	3.68	.125	4.144

Table-2: Descriptive Statistics of 10-K Report Disclosure

Descriptive Statistics						
	N	Minimum	Maximum	Mean		Std. Deviation
				Statistic	Std. Error	
Governance Structure and Management System	1092	0	3	.17	.014	.469
Credibility	1092	0	2	.09	.009	.308
Contamination and remediation efforts	1092	0	3	.78	.021	.690
Pollution abatement and environmental performance indicators (EPI)	1092	0	4	.08	.011	.348
Economic factors	1092	0	7	2.29	.061	2.032
Litigation and liabilities	1092	0	5	1.52	.042	1.372
Vision and strategy claims	1092	0	4	.24	.017	.555
Laws and regulations conformity	1092	0	3	.96	.026	.852
Environmental profile	1092	0	2	.04	.006	.212
Environmental initiatives	1092	0	5	.03	.007	.228
Hard Disclosure	1092	0	15	4.92	.116	3.827
Soft Disclosure	1092	0	9	1.28	.033	1.089
Total Positive or Neutral Disclosure	1092	0	14	2.92	.070	2.328
Negative Disclosure	1092	0	10	3.28	.080	2.653
Quantitative Disclosure	1092	0	7	2.37	.064	2.107
Firm Specific Qualitative Disclosure	1092	0	11	2.68	.065	2.153
Qualitative Disclosure	1092	0	5	1.15	.029	.968
Total Disclosure 10K Report	1092	0	20	6.20	.129	4.257

Environmental disclosures in sustainability reports

The sample firms issued 376 sustainability reports during the period from 1997 to 2010. Table-3 provides an analysis of sustainability report disclosures. On average, total disclosure is equal to 15.5 themes and hard and soft disclosures are equal to 11.0 and 4.5 themes respectively. Sustainability reports are biased towards the disclosure of positive or neutral information (14.0 themes) in comparison to negative disclosures (1.5 themes). Furthermore, sustainability reports communicate more quantitative information (6.8 themes) followed by firm-specific qualitative information (5.6 themes) and general qualitative information (3.2 themes). Finally, pollution abatement disclosures and performance indicators (5.4 themes) and vision and strategy disclosures (2.8 themes) are the focus of sustainability reports followed by credibility and governance related disclosures (2.1 and 1.3 themes respectively). Table-4 and Chart-1 show that issuance of stand alone sustainability reports increased over the sampled period from 4 reports in 1997 to 50 reports in 2010. Furthermore, firms increased their adoption of a reporting guideline – mostly the GRI guideline – from zero reports in 1997 to 34 reports in 2010.

Environmental disclosures in sustainability reports: Case of firms that did not adopt a reporting guideline

Among the 376 sustainability reports, there are 192 observations where firms issued the reports without adopting a disclosure guideline. Table-5 shows that total disclosure in these reports averaged 13.0 themes. These reports include 8.9 themes of hard disclosure versus 4.21 themes of soft disclosure. Positive or neutral disclosures versus negative disclosures averaged 11.8 and 1.3 respectively.

Chart 1: Number of Sustainability Reports Issued between 1997 and 2010

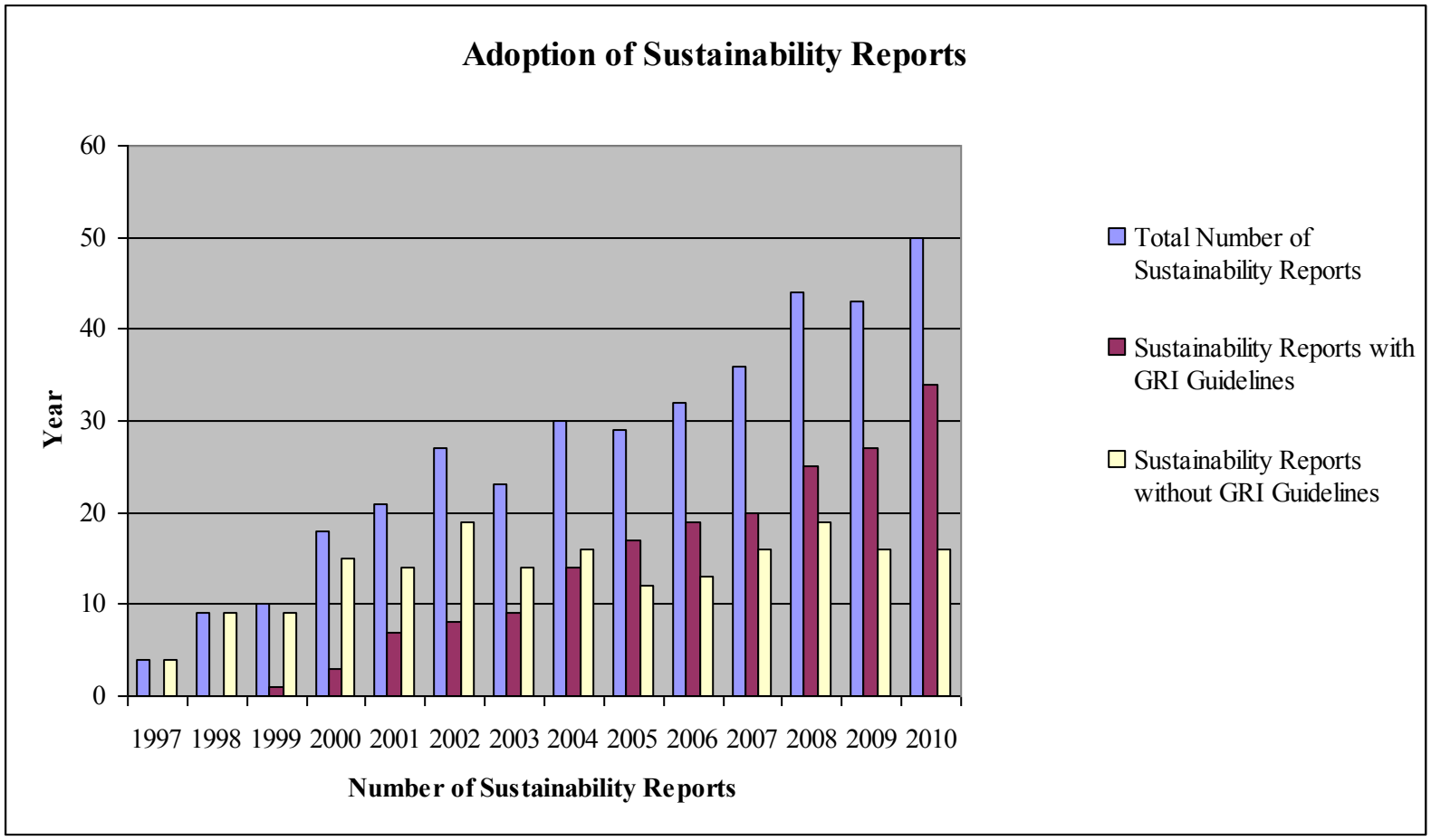


Table-3: Descriptive Statistics of Sustainability Report Disclosure

	N	Minimum	Maximum	Mean		Std. Deviation
				Statistic	Std. Error	
Governance Structure and Management System	376	0	5	1.28	.057	1.106
Credibility	376	0	7	2.12	.073	1.418
Contamination and remediation efforts	376	0	2	.19	.024	.464
Pollution abatement and environmental performance indicators (EPI)	376	0	10	5.37	.120	2.334
Economic factors	376	0	7	1.40	.077	1.497
Litigation and liabilities	376	0	3	.67	.041	.795
Vision and strategy claims	376	0	6	2.82	.061	1.183
Laws and regulations conformity	376	0	3	.23	.026	.503
Environmental profile	376	0	2	.45	.028	.539
Environmental initiatives	376	0	4	.99	.048	.932
Hard Disclosure Sustainability Report	376	0	26	11.03	.267	5.182
Soft Disclosure Sustainability Report	376	0	12	4.50	.100	1.934
Total Positive or Neutral Disclosure	376	1	30	14.05	.275	5.338
Negative Disclosure	376	0	6	1.49	.087	1.695
Quantitative Disclosure	376	0	15	6.77	.166	3.214
Firm Specific Qualitative Disclosure	376	0	16	5.62	.161	3.129
Qualitative Disclosure	376	0	8	3.15	.074	1.426
Total Disclosure Sustainability Report	376	1	33	15.52	.323	6.270

Table-4: Number of Sustainability Reports per Year

	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Total Sustainability Reports	4	9	10	18	21	27	23	30	29	32	36	44	43	50	376
Sustainability Reports with GRI Guidelines	0	0	1	3	7	8	9	14	17	19	20	25	27	34	184
Sustainability Reports without GRI Guidelines	4	9	9	15	14	19	14	16	12	13	16	19	16	16	192

Table-5: Descriptive Statistics of Sustainability Report Disclosure – Reporting without GRI Guideline

	N	Minimum	Maximum	Mean		Std. Deviation
				Statistic	Std. Error	
Governance Structure and Management System	192	0	4	1.04	.068	.943
Credibility	192	0	5	1.43	.083	1.155
Contamination and remediation efforts	192	0	2	.19	.034	.465
Pollution abatement and environmental performance indicators (EPI)	192	0	10	4.35	.168	2.331
Economic factor	192	0	7	1.30	.121	1.682
Litigation and liabilities	192	0	3	.55	.059	.824
Vision and strategy claims	192	0	6	2.72	.082	1.140
Laws and regulations conformity	192	0	3	.19	.037	.511
Environmental profile	192	0	2	.43	.039	.546
Environmental initiatives	192	0	4	.86	.060	.833
Hard Disclosure Sustainability Report	192	0	22	8.84	.372	5.161
Soft Disclosure Sustainability Report	192	1	9	4.21	.132	1.836
Total Positive or Neutral Disclosure	192	1	26	11.80	.364	5.039
Negative Disclosure	192	0	6	1.27	.134	1.861
Quantitative Disclosure	192	0	15	5.66	.248	3.438
Firm Specific Qualitative Disclosure	192	0	12	4.37	.188	2.610
Qualitative Disclosure	192	0	7	3.04	.105	1.457
Total Disclosure Sustainability Report	192	1	31	13.05	.444	6.154

Quantitative disclosure, firms' specific qualitative disclosure and qualitative disclosure averaged 5.7, 4.4, and 3.0 respectively. The main themes included in these reports are pollution abatement and performance indicators (4.35 themes), and vision and strategy claims (2.72 themes).

Environmental disclosures in sustainability reports: Case of firms reporting according to GRI guidelines

There are 184 observations where firms adopted a reporting guideline (mostly the GRI guideline with very few cases where firms adopted CERES guidelines). In comparison to observations where firms did not adopt a reporting guideline, Table-6 shows that there is an increase in total disclosure to 18.1 themes per report. There is also a substantial increase in hard disclosure (13.3 themes) but not in soft disclosure (4.8 themes). Further, there are 16.4 positive or neutral themes versus 1.7 negative themes. There is also an increase of quantitative disclosure (7.92 themes) and firm specific qualitative disclosure (6.93 themes) but not in qualitative disclosure (3.26 themes). Reporting according to the GRI guideline lead to increase in disclosure of pollution abatement and performance indicators (6.4 themes) followed by disclosure of vision and strategy claims (2.93 themes). Finally, total disclosure's standard deviation of firms who report according to the GRI guideline is lower than that of firms who report without the guideline (5.3 vs. 6.2); which provides evidence of the guideline reducing the gap between the disclosing firms.

Aggregate disclosure in annual reports, 10-K reports, and sustainability reports

Aggregate disclosure accounts for the themes disclosed in the three reports combined. Table-7 shows that the average total disclosure is 12 themes over the sampled

Table-6: Descriptive Statistics of Sustainability Report Disclosure – Reporting According to GRI Guideline

	N	Minimum	Maximum	Mean		Std. Deviation
				Statistic	Std. Error	
Governance Structure and Management System	184	0	5	1.54	.089	1.205
Credibility	184	1	7	2.85	.096	1.301
Contamination and remediation efforts	184	0	2	.20	.034	.465
Pollution abatement and environmental performance indicators (EPI)	184	1	10	6.42	.134	1.815
Economic factors	184	0	5	1.50	.094	1.272
Litigation and liabilities	184	0	2	.80	.055	.745
Vision and strategy claims	184	0	6	2.93	.090	1.219
Laws and regulations conformity	184	0	2	.27	.036	.493
Environmental profile	184	0	2	.48	.039	.533
Environmental initiatives	184	0	4	1.12	.075	1.012
Hard Disclosure Sustainability Report	184	4	26	13.31	.304	4.119
Soft Disclosure Sustainability Report	184	0	12	4.80	.147	1.991
Total Positive or Neutral Disclosure	184	5	30	16.39	.338	4.590
Negative Disclosure	184	0	5	1.72	.109	1.473
Quantitative Disclosure	184	2	13	7.92	.183	2.488
Firm Specific Qualitative Disclosure	184	2	16	6.93	.228	3.096
Qualitative Disclosure	184	0	8	3.26	.102	1.389
Total Disclosure Sustainability Report	184	5	33	18.11	.389	5.280

Table-7: Aggregate Disclosure in Annual, 10-K, Sustainability Report - Descriptive Statistics

	N	Minimum	Maximum	Mean		Std. Deviation
				Statistic	Std. Error	
Governance Structure and Management System	1092	0	5	.77	.032	1.059
Credibility	1092	0	7	.90	.042	1.375
Contamination and remediation efforts	1092	0	3	.83	.022	.716
Pollution abatement and environmental performance indicators (EPI)	1092	0	10	1.99	.087	2.883
Economic factors	1092	0	8	2.66	.066	2.168
Litigation and liabilities	1092	0	5	1.71	.042	1.386
Vision and strategy claims	1092	0	6	1.46	.047	1.545
Laws and regulations conformity	1092	0	3	1.02	.026	.851
Environmental profile	1092	0	3	.21	.013	.439
Environmental initiatives	1092	0	5	.42	.023	.759
Hard Disclosure	1092	0	31	8.86	.220	7.267
Soft Disclosure	1092	0	13	3.12	.078	2.584
Positive/Neutral Disclosure	1092	0	32	8.29	.233	7.691
Negative Disclosure	1092	0	10	3.69	.082	2.720
Quantitative	1092	0	16	4.64	.129	4.249
Firm Specific - Qualitative	1092	0	19	4.91	.121	3.998
General - Qualitative	1092	0	8	2.43	.059	1.941
Total Disclosure	1092	0	40	11.99	.283	9.363

period. On average, the main theme disclosed in these reports is economic factors (2.66 themes) followed by pollution abatement (2.0 themes), litigation and liabilities (1.7 themes), and vision and strategy claims (1.5 themes).

Table-8 and Chart-2 show a continuous increase of the aggregate disclosure from 1997 to 2010. In 2010, total disclosure reached a high of 16.3 themes. The main themes disclosed by firms in their 2010 reports are pollution abatement and performance indicators (3.9 themes), economic factors (2.7 themes), vision and strategy claims (2.1 themes), and litigation factors (1.9 themes). Chart-3 shows that average total disclosure in sustainability reports increased over the period from 1997 to 2010. On the other hand, average total disclosure in 10-K reports slightly increased between 1997 and 2010 while annual reports' disclosures drastically declined over the same period. Aggregate total disclosure in the three reports continuously increased between 1997 and 2010. Finally, aggregate disclosure in the three reports is higher than the disclosure level in each report separately.

In Table-9, the paired differences between disclosures made in 2010 and those made in 1997 show that there is a significant increase in total disclosure by 9.7 themes. Hard disclosure increased by 6.9 themes while soft disclosure increased by only 2.7 themes. There is also a significant increase in quantitative disclosure by 4.1 themes. On the other hand, there is small increase in negative information by 1.2 themes. Pollution abatement and environmental performance indicators increased by 3.6 themes followed by disclosures about credibility of the firm's environmental operations (1.5 themes) and vision and strategy claims (1.5 themes). There is little increase in disclosures related to economic factors (0.5 themes) or litigation and liabilities (0.5 themes).

Chart 2: Aggregated Measures of Average Environmental Disclosure in Annual, 10-K, and Sustainability Reports

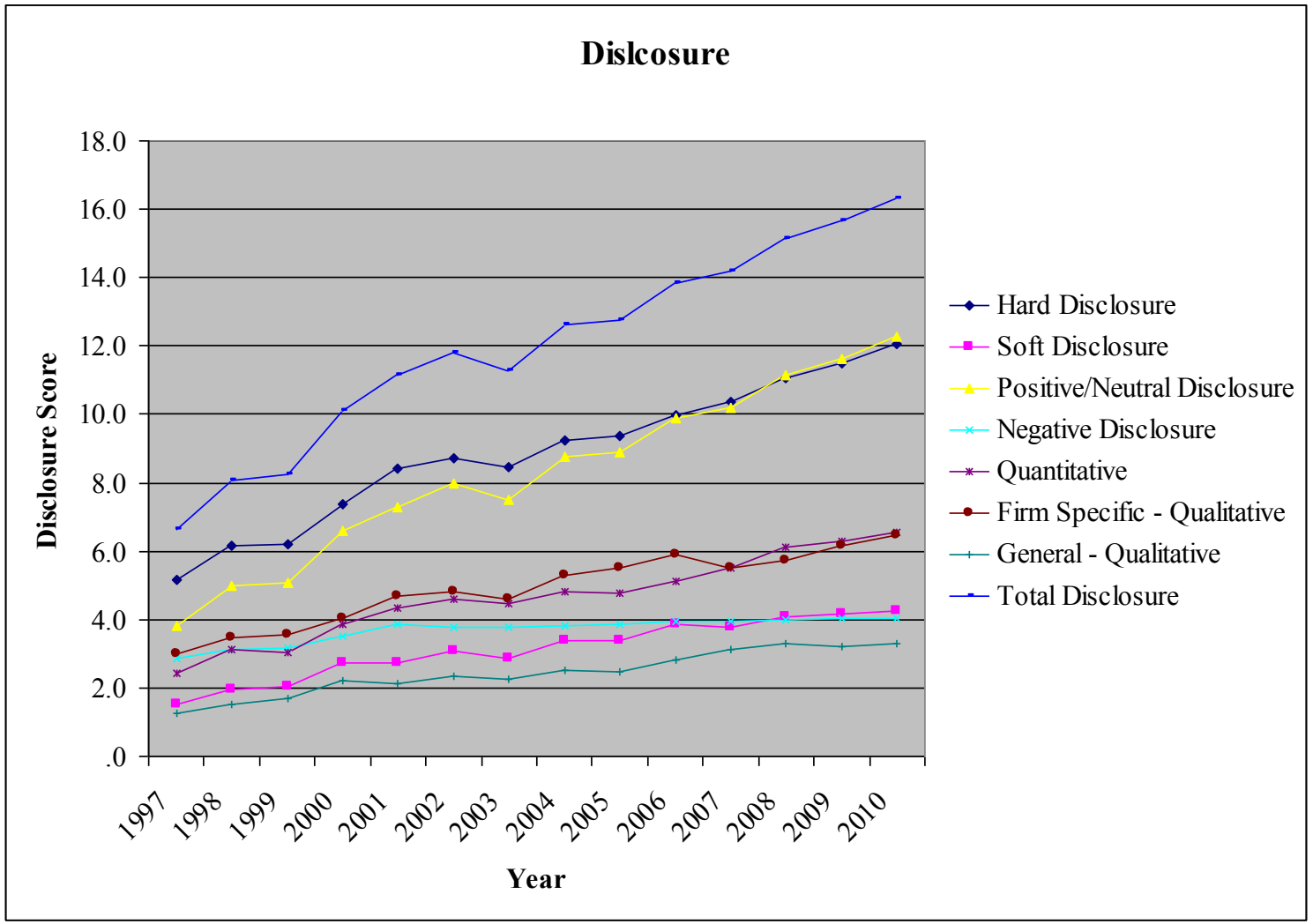


Chart 3: Average Environmental Disclosure in Annual, 10-K, and Sustainability Reports.

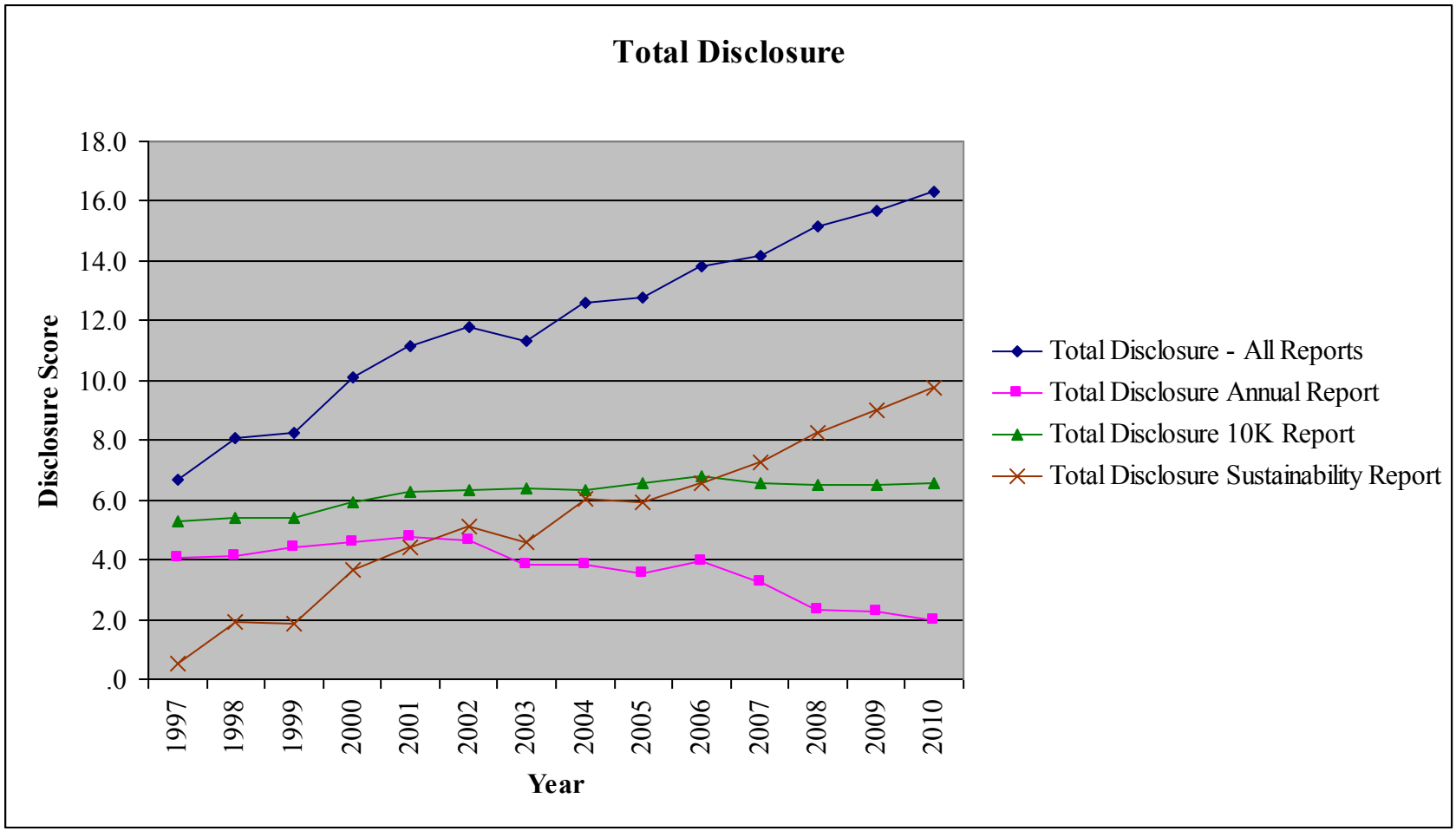


Table-8: Total Disclosure - Descriptive Statistics per Year

YEAR	1997		1998		1999		2000		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Governance Structure and Management System	.5	.8	.5	.8	.6	1.0	.6	1.0	.7	1.1	.8	1.0	.7	1.0	.8	1.0	.9	1.1	.9	1.2	.9	1.2	.9	1.1	1.0	1.2	1.0	1.1
Credibility	.2	.5	.3	.8	.3	.9	.5	.9	.7	1.1	.7	1.2	.7	1.1	1.0	1.3	1.1	1.5	1.3	1.7	1.2	1.6	1.4	1.5	1.5	1.6	1.7	1.8
Contamination and remediation efforts	.7	.7	.8	.6	.7	.7	.9	.8	.9	.7	.8	.7	.8	.7	.8	.8	.8	.7	.9	.8	.9	.8	.8	.7	.8	.7	.9	.8
Pollution abatement and environmental performance indicators (EPI)	.3	1.0	.9	2.1	.8	1.9	1.4	2.6	1.6	2.7	1.8	2.8	1.7	2.9	2.1	2.9	1.9	2.8	2.3	2.9	2.7	3.2	3.2	3.0	3.4	3.1	3.9	3.4
Economic factors	2.1	2.1	2.2	2.2	2.3	2.2	2.5	2.2	2.7	2.3	2.8	2.3	2.8	2.2	2.7	2.2	2.9	2.2	2.8	2.1	2.8	2.1	2.9	2.0	2.9	2.1	2.7	2.0
Litigation and liabilities	1.4	1.3	1.4	1.3	1.5	1.4	1.6	1.4	1.8	1.5	1.8	1.4	1.8	1.4	1.8	1.4	1.8	1.3	1.8	1.4	1.8	1.4	1.8	1.4	1.9	1.4	1.9	1.4
Vision and strategy claims	.6	.9	.8	1.4	.8	1.1	1.1	1.3	1.3	1.4	1.4	1.5	1.3	1.5	1.7	1.6	1.6	1.6	1.8	1.7	1.8	1.6	2.0	1.6	2.1	1.7	2.1	1.6
Laws and regulations conformity	.8	.8	.8	.8	.9	.8	1.0	.9	.9	.8	.9	.8	.9	.9	1.0	.8	1.1	.8	1.2	.8	1.2	.9	1.2	.8	1.2	.9	1.3	.9
Environmental profile	.0	.2	.1	.3	.1	.3	.1	.4	.1	.4	.2	.4	.2	.5	.2	.4	.2	.4	.2	.5	.3	.5	.4	.6	.3	.5	.4	.5
Environmental initiatives	.1	.3	.2	.6	.2	.5	.5	.9	.5	.8	.5	.8	.5	.8	.5	.9	.5	.8	.6	.9	.5	.8	.5	.7	.5	.7	.5	.8
Hard Disclosure	5.1	4.6	6.1	6.0	6.2	5.9	7.4	6.8	8.4	7.5	8.7	7.5	8.4	7.3	9.2	7.5	9.4	7.5	10.0	7.8	10.4	7.5	11.1	6.7	11.5	7.3	12.1	7.7
Soft Disclosure	1.5	1.4	1.9	2.0	2.0	1.9	2.7	2.5	2.7	2.4	3.1	2.4	2.8	2.4	3.4	2.6	3.4	2.6	3.8	3.0	3.8	2.8	4.1	2.7	4.2	2.7	4.2	2.6
Positive/Neutral Disclosure	3.8	3.7	5.0	5.6	5.1	5.6	6.6	6.9	7.3	7.3	8.0	7.5	7.5	7.4	8.8	7.7	8.9	8.0	9.9	8.5	10.2	8.3	11.2	7.7	11.6	8.2	12.3	8.3
Negative Disclosure	2.8	2.5	3.1	2.6	3.2	2.7	3.5	2.8	3.9	2.9	3.8	2.7	3.8	2.8	3.8	2.7	3.9	2.7	3.9	2.8	4.0	2.8	4.0	2.6	4.0	2.6	4.0	2.7
Quantitative	2.4	2.5	3.1	3.6	3.0	3.3	3.9	4.1	4.3	4.4	4.6	4.4	4.5	4.4	4.8	4.3	4.8	4.4	5.1	4.3	5.5	4.3	6.1	4.1	6.3	4.4	6.6	4.5
Firm Specific - Qualitative	3.0	2.7	3.4	3.2	3.6	3.2	4.0	3.6	4.7	4.0	4.8	4.0	4.6	3.8	5.3	4.2	5.5	4.3	5.9	4.8	5.5	4.1	5.7	3.7	6.2	3.9	6.5	4.3
General - Qualitative	1.2	1.1	1.5	1.3	1.7	1.5	2.2	2.0	2.1	1.9	2.3	1.9	2.2	1.8	2.5	1.8	2.5	1.8	2.8	2.0	3.1	2.2	3.3	2.2	3.2	2.1	3.3	1.9
Total Disclosure	6.7	5.3	8.1	7.3	8.3	7.3	10.1	8.8	11.1	9.4	11.8	9.5	11.3	9.3	12.6	9.6	12.8	9.7	13.8	10.2	14.2	9.8	15.1	9.0	15.7	9.5	16.3	9.7

Table-9: Difference between Environmental Disclosures in 2010 and 1997

	Paired Differences					t	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference			
				Lower	Upper		
Governance Structure and Management System 2010 - 1997	.538	1.224	.139	.262	.814	3.885	.000
Credibility 2010 - 1997	1.538	1.771	.200	1.139	1.938	7.674	.000
Contamination and remediation efforts 2010 - 1997	.205	.745	.084	.037	.373	2.432	.017
Pollution abatement and environmental performance indicators (EPI) 2010 - 1997	3.615	3.343	.379	2.862	4.369	9.552	.000
Economic factors 2010 - 1997	.513	1.905	.216	.083	.942	2.377	.020
Litigation and liabilities 2010 - 1997	.513	1.365	.155	.205	.821	3.318	.001
Vision and strategy claims 2010 - 1997	1.474	1.756	.199	1.078	1.870	7.415	.000
Laws and regulations conformity 2010 - 1997	.526	.990	.112	.302	.749	4.690	.000
Environmental profile 2010 - 1997	.359	.558	.063	.233	.485	5.685	.000
Environmental initiatives 2010 - 1997	.372	.884	.100	.172	.571	3.713	.000
Hard Disclosure 2010 - 1997	6.923	7.318	.829	5.273	8.573	8.355	.000
Soft Disclosure 2010 - 1997	2.731	2.996	.339	2.055	3.406	8.049	.000
Positive/Neutral Disclosure 2010 - 1997	8.474	8.366	.947	6.588	10.361	8.946	.000
Negative Disclosure 2010 - 1997	1.179	2.411	.273	.636	1.723	4.321	.000
Quantitative 2010 - 1997	4.128	4.403	.499	3.135	5.121	8.281	.000
Firm Specific - Qualitative 2010 - 1997	3.487	4.158	.471	2.550	4.425	7.406	.000
General - Qualitative 2010 - 1997	2.038	2.276	.258	1.525	2.552	7.910	.000
Total Disclosure 2010 - 1997	9.654	9.534	1.080	7.504	11.804	8.942	.000

2. Comparison between information in annual reports, 10-K reports, and sustainability reports

In this section, I provide a comparison between annual, 10-K, and sustainability reports to understand the differences between the disclosures made in the three media.

Comparison between annual report and 10-K report disclosures

Table-10 presents a pair-wise difference between the means of annual report disclosures and that in 10-K. The average disclosures in 10-K reports are significantly higher than annual reports in the categories of economic factors (by 1.2 themes), litigation & liabilities (by 1.0 themes), and laws and regulations by (by 0.7 themes). The levels of hard disclosures, negative disclosures, quantitative disclosures are also higher in 10-K than annual reports by 2.2, 1.9, and 1.1 themes respectively. On average, total disclosure in 10-K reports is higher than that in annual reports by 2.5 themes.

Table-11 shows the information disclosed in 10-K reports that is not in annual reports. On average, there are 4.0 themes disclosed in 10-K that firms do not reveal in annual reports. This additional information is mainly associated to the disclosure of economic factors (1.4 themes) and litigation & liabilities information (1.0 themes). The additional negative information in 10-K reports is 2.0 themes higher than that in annual reports. In contrast, Table-12 shows that the additional information in annual reports that is not in 10-K reports is around 1.5 themes. There are more vision and strategy claims in annual reports (0.5 themes) that are not disclosed in 10-K reports. In brief, the results show that 10-K reports have more environmental information in comparison to that

Table-10: Comparison between Annual Report and 10-K Report Disclosures

Difference between Annual Report and 10K Report Disclosures	Paired Differences					t	Sig. (2-tailed)	Correlation	Sig.
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Governance Structure and Management System - AR - Governance Structure and Management System - 10K	.148	.617	.019	.112	.185	7.939	.000	.424	.000
Credibility - AR - Credibility - 10K	.143	.515	.016	.112	.173	9.161	.000	.323	.000
Contamination and remediation efforts - AR - Contamination and remediation efforts - 10K	-.437	.717	.022	-.479	-.394	-20.136	.000	.367	.000
Pollution abatement and environmental performance indicators (EPI) - AR - Pollution abatement and environmental performance indicators (EPI) - 10K	.114	.634	.019	.077	.152	5.965	.000	.239	.000
Economic factors - AR - Economic factors - 10K	-1.246	1.946	.059	-1.362	-1.131	-21.161	.000	.457	.000
Litigation and liabilities - AR - Litigation and liabilities - 10K	-.950	1.369	.041	-1.031	-.868	-22.925	.000	.344	.000
Vision and strategy claims - AR - Vision and strategy claims - 10K	.358	.880	.027	.306	.410	13.445	.000	.285	.000
Laws and regulations conformity - AR - Laws and regulations conformity - 10K	-.696	.827	.025	-.745	-.647	-27.793	.000	.393	.000
Environmental profile - AR - Environmental profile - 10K	.005	.248	.007	-.010	.019	.611	.542	.360	.000
Environmental initiatives - AR - Environmental initiatives - 10K	.040	.337	.010	.020	.060	3.946	.000	.063	.037
Hard Disclosure Annual Report - Hard Disclosure 10K Report	-2.222	3.811	.115	-2.448	-1.995	-19.264	.000	.445	.000
Soft Disclosure Annual Report - Soft Disclosure 10K Report	-.293	1.310	.040	-.371	-.215	-7.392	.000	.381	.000
Total Positive or Neutral Disclosure - AR - Total Positive or Neutral Disclosure - 10K	-.602	2.555	.077	-.753	-.450	-7.783	.000	.517	.000
Negative Disclosure - AR - Negative Disclosure - 10K	-1.920	2.688	.081	-2.080	-1.761	-23.612	.000	.365	.000
Quantitative Disclosure - AR - Quantitative Disclosure - 10K	-1.134	2.084	.063	-1.257	-1.010	-17.973	.000	.444	.000
Firm Specific Qualitative Disclosure - AR - Firm Specific Qualitative Disclosure - 10K	-1.016	2.139	.065	-1.143	-.890	-15.707	.000	.466	.000
Qualitative Disclosure - AR - Qualitative Disclosure - 10K	-.372	1.129	.034	-.439	-.305	-10.881	.000	.388	.000
Total Disclosure Annual Report - Total Disclosure 10K Report	-2.515	4.331	.131	-2.772	-2.258	-19.188	.000	.469	.000

Table-11: Incremental Environmental Disclosures Included in 10-K Reports but not in Annual Reports

	Minimum	Maximum	Mean		Std. Deviation	95% Confidence Interval of the Difference		Sig. (2-tailed)
			Statistic	Std. Error		Lower	Upper	
Governance Structure and Management System	0	2	.091	.010	.315	.07	.11	.000
Credibility	0	2	.047	.007	.215	.03	.06	.000
Contamination and remediation efforts	0	3	.471	.020	.661	.43	.51	.000
Pollution abatement and environmental performance indicators (EPI)	0	3	.055	.008	.269	.04	.07	.000
Economic factors	0	7	1.399	.054	1.779	1.29	1.50	.000
Litigation and liabilities	0	5	1.024	.039	1.288	.95	1.10	.000
Vision and strategy claims	0	3	.146	.012	.413	.12	.17	.000
Laws and regulations conformity	0	3	.734	.023	.776	.69	.78	.000
Environmental profile	0	2	.027	.005	.169	.02	.04	.000
Environmental initiatives	0	5	.030	.007	.218	.02	.04	.000
Hard Disclosure	0	13	3.087	.106	3.490	2.88	3.29	.000
Soft Disclosure	0	9	.937	.029	.946	.88	.99	.000
Positive or Neutral Disclosure	0	13	1.935	.057	1.893	1.82	2.05	.000
Negative Disclosure	0	10	2.088	.075	2.482	1.94	2.24	.000
Quantitative Disclosure	0	7	1.454	.056	1.848	1.34	1.56	.000
Qualitative Firm-Specific Disclosure	0	9	1.708	.058	1.928	1.59	1.82	.000
Qualitative Disclosure	0	5	.861	.026	.868	.81	.91	.000
Total Disclosure	0	17	4.024	.118	3.911	3.79	4.26	.000

N= 1092

Table-12: Incremental Environmental Discloure Included in Annual Reports but not in 10-K Reports

	Minimum	Maximum	Mean		Std. Deviation	95% Confidence Interval of the Difference		Sig. (2-tailed)
			Statistic	Std. Error		Lower	Upper	
Governance Structure and Management System	0	3	.239	.016	.532	.21	.27	.000
Credibility	0	3	.190	.014	.467	.16	.22	.000
Contamination and remediation efforts	0	2	.034	.006	.214	.02	.05	.000
Pollution abatement and environmental performance indicators (EPI)	0	6	.169	.017	.573	.14	.20	.000
Economic factors	0	6	.152	.019	.621	.12	.19	.000
Litigation and liabilities	0	3	.074	.010	.336	.05	.09	.000
Vision and strategy claims	0	4	.504	.023	.770	.46	.55	.000
Laws and regulations conformity	0	2	.038	.006	.200	.03	.05	.000
Environmental profile	0	1	.032	.005	.176	.02	.04	.000
Environmental initiatives	0	1	.071	.008	.256	.06	.09	.000
Hard Disclosure	0	12	.858	.047	1.561	.77	.95	.000
Soft Disclosure	0	5	.644	.028	.939	.59	.70	.000
Positive or Neutral Disclosure	0	12	1.333	.055	1.820	1.23	1.44	.000
Negative Disclosure	0	8	.168	.023	.757	.12	.21	.000
Quantitative Disclosure	0	6	.321	.026	.851	.27	.37	.000
Qualitative Firm-Specific Disclosure	0	6	.691	.033	1.100	.63	.76	.000
Qualitative Disclosure	0	4	.489	.023	.771	.44	.53	.000
Total Disclosure	0	15	1.502	.064	2.131	1.38	1.63	.000

N=1092

included in annual reports which confirm previous findings suggesting that annual reports are losing content on sustainability information.

Comparison between sustainability report disclosures and information in both 10-K and annual reports

In this section, I compare between sustainability reports' disclosures and those of 10-K or annual reports. The comparison between average disclosure in10-K reports and sustainability reports in Table-13 shows that 10-K reports include more information about firms' economic factors and litigation & liabilities while sustainability reports include more information on pollution abatement efforts, firm's vision and strategy, credibility, and firm's governance and management systems. It is to be noticed that 10-K reports include more negative information about a firm's operations than sustainability reports.

Table-14 shows the difference between average disclosure in annual reports and sustainability reports. In comparison to annual reports, the average disclosure of pollution abatement efforts and performance indicators, firm's vision and strategy, and firms' credibility is higher in sustainability reports. The difference between economic factors and litigation and liabilities information in both reports is not significant. Furthermore, there is no significant difference between the amounts of negative information in sustainability reports and annual reports.

Table-15 presents additional environmental disclosures in sustainability reports that are neither in 10K reports or annual reports. The results show that there are on average 12.4 additional disclosure themes in sustainability reports that are neither disclosed in 10-K reports or annual reports. The majority of these themes are disclosures

Table-13: Comparison between 10-K Reports and Sustainability Report Disclosures

Difference between 10K and Sustainability Report Disclosures	Paired Differences					t	Sig. (2-tailed)	Correlation	Sig.
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Governance Structure and Management System (10K) - Governance Structure and Management System (SR)	-1.06	1.21	.062	-1.18	-.93	-17.0	.000	.059	.253
Credibility (10K) - Credibility (SR)	-1.98	1.47	.076	-2.13	-1.83	-26.1	.000	.011	.825
Contamination and remediation efforts (10K) - Contamination and remediation efforts (SR)	.75	.78	.040	.67	.83	18.8	.000	.052	.312
Pollution abatement and environmental performance indicators (EPI) (10K) - Pollution abatement and environmental performance indicators (EPI) (SR)	-5.25	2.33	.120	-5.48	-5.01	-43.6	.000	.089	.085
Economic factors (10K) - Economic factors (SR)	1.65	2.21	.114	1.42	1.87	14.4	.000	.262	.000
Litigation and liabilities (10K) - Litigation and liabilities (SR)	1.26	1.67	.086	1.09	1.42	14.6	.000	.004	.938
Vision and strategy claims (10K) - Vision and strategy claims (SR)	-2.56	1.33	.069	-2.70	-2.43	-37.3	.000	.026	.617
Laws and regulations conformity (10K) - Laws and regulations conformity (SR)	.83	.95	.049	.73	.93	16.9	.000	.175	.001
Environmental profile (10K) - Environmental profile (SR)	-.38	.61	.032	-.44	-.32	-12.0	.000	-.030	.561
Environmental initiatives (10K) - Environmental initiatives (SR)	-.97	.93	.048	-1.06	-.87	-20.1	.000	.061	.237
Hard Disclosure (10K) - Hard Disclosure (SR)	-4.61	6.34	.327	-5.25	-3.97	-14.1	.000	.061	.241
Soft Disclosure (10K) - Soft Disclosure (SR)	-3.08	2.20	.113	-3.30	-2.85	-27.1	.000	.047	.359
Total Positive or Neutral Disclosure (10K) - Total Positive or Neutral Disclosure (SR)	-10.40	5.85	.302	-10.99	-9.81	-34.5	.000	.006	.907
Negative Disclosure (10K) - Negative Disclosure (SR)	2.70	3.18	.164	2.37	3.02	16.4	.000	.038	.464
Quantitative Disclosure (10K) - Quantitative Disclosure (SR)	-3.60	3.68	.190	-3.97	-3.23	-19.0	.000	.105	.042
Firm Specific Qualitative Disclosure (10K) - Firm Specific Qualitative Disclosure (SR)	-2.30	3.91	.202	-2.69	-1.90	-11.4	.000	-.014	.781
Qualitative Disclosure (10K) - Qualitative Disclosure (SR)	-1.81	1.71	.088	-1.98	-1.63	-20.5	.000	.062	.231
Total Disclosure (10K) - Total Disclosure (SR)	-7.69	7.63	.394	-8.46	-6.92	-19.5	.000	.013	.809

N= 376

Table-14: Comparison between Annual Reports and Sustainability Report Disclosures

	Paired Differences					t	Sig. (2-tailed)	Correlation	Sig.
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Governance Structure and Management System (AR) - Governance Structure and Management System (SR)	-.78	1.36	.07	-.92	-.64	-11.10	.00	.02	.73
Credibility (AR) - Credibility (SR)	-1.69	1.48	.08	-1.84	-1.54	-22.08	.00	.14	.01
Contamination and remediation efforts (AR) - Contamination and remediation efforts (SR)	.16	.70	.04	.09	.23	4.32	.00	.11	.03
Pollution abatement and environmental performance indicators (EPI) (AR) - Pollution abatement and environmental performance indicators (EPI) (SR)	-5.07	2.45	.13	-5.32	-4.82	-40.10	.00	.01	.77
Economic factors (AR) - Economic factors (SR)	-.14	2.25	.12	-.36	.09	-1.17	.24	.08	.12
Litigation and liabilities (AR) - Litigation and liabilities (SR)	-.11	1.20	.06	-.23	.02	-1.71	.09	.05	.37
Vision and strategy claims (AR) - Vision and strategy claims (SR)	-1.93	1.48	.08	-2.08	-1.78	-25.35	.00	.11	.03
Laws and regulations conformity (AR) - Laws and regulations conformity (SR)	.07	.70	.04	.00	.14	1.83	.07	.23	.00
Environmental profile (AR) - Environmental profile (SR)	-.36	.62	.03	-.42	-.30	-11.21	.00	-.03	.55
Environmental initiatives (AR) - Environmental initiatives (SR)	-.90	.91	.05	-.99	-.81	-19.12	.00	.22	.00
Hard Disclosure Annual Report - Hard Disclosure Sustainability Report	-7.61	6.12	.32	-8.23	-6.99	-24.14	.00	.07	.15
Soft Disclosure Annual Report - Soft Disclosure Sustainability Report	-3.13	2.26	.12	-3.35	-2.90	-26.86	.00	.13	.01
Total Positive or Neutral Disclosure (AR) - Total Positive or Neutral Disclosure (SR)	-10.69	5.93	.31	-11.30	-10.09	-34.94	.00	.11	.03
Negative Disclosure (AR) - Negative Disclosure (SR)	-.06	2.65	.14	-.33	.21	-.45	.65	.03	.52
Quantitative Disclosure (AR) - Quantitative Disclosure (SR)	-5.21	3.76	.19	-5.59	-4.83	-26.88	.00	.02	.69
Firm Specific Qualitative Disclosure (AR) - Firm Specific Qualitative Disclosure (SR)	-3.47	3.55	.18	-3.83	-3.11	-18.95	.00	.14	.01
Qualitative Disclosure (AR) - Qualitative Disclosure (SR)	-2.07	1.76	.09	-2.25	-1.89	-22.87	.00	.10	.05
Total Disclosure (AR) - Total Disclosure (SR)	-10.74	7.33	.38	-11.48	-10.00	-28.42	.00	.11	.03

N = 376

Table-15: Environmental Disclosures in Sustainability Reports that are not in 10-K reports or Annual Reports

	Minimum	Maximum	Mean		Std. Deviation	95% Confidence Interval of the Difference		Sig. (2-tailed)
	Statistic	Statistic	Statistic	Std. Error	Statistic	Lower	Upper	
Governance Structure and Management System (in ER)	0	5	1.05	.054	1.050	.94	1.15	.000
Credibility (in ER)	0	7	1.82	.071	1.375	1.68	1.96	.000
Contamination and remediation efforts (in ER)	0	2	.06	.013	.251	.04	.09	.000
Pollution abatement and environmental performance indicators (EPI) (in ER)	0	10	5.06	.123	2.378	4.82	5.30	.000
Economic factors (in ER)	0	4	.62	.047	.905	.53	.71	.000
Litigation and liabilities (in ER)	0	3	.35	.030	.573	.29	.40	.000
Vision and strategy claims (in ER)	0	6	2.09	.064	1.250	1.96	2.21	.000
Laws and regulations conformity (in ER)	0	1	.08	.014	.271	.05	.11	.000
Environmental profile (in ER)	0	2	.40	.027	.532	.34	.45	.000
Environmental initiatives (in ER)	0	4	.93	.045	.879	.84	1.01	.000
Hard Disclosure (in ER)	0	23	8.95	.227	4.397	8.51	9.40	.000
Soft Disclosure (in ER)	0	9	3.49	.097	1.873	3.30	3.68	.000
Positive or Neutral Disclosure (in ER)	0	26	11.73	.260	5.050	11.21	12.24	.000
Negative Disclosure (in ER)	0	6	.72	.057	1.115	.61	.83	.000
Quantitative Disclosure (in ER)	0	13	5.68	.145	2.813	5.39	5.96	.000
Qualitative Firm-Specific Disclosure (in ER)	0	15	4.46	.145	2.815	4.17	4.75	.000
Qualitative Disclosure (in ER)	0	6	2.31	.072	1.395	2.17	2.45	.000
Total Disclosure (in ER)	0	28	12.44	.286	5.541	11.88	13.01	.000

N= 367

of pollution abatement efforts (5.0 themes), firm's vision and strategy (2.1 themes), credibility (1.8 themes), and firm's governance and management systems (1.1 themes). Further analysis shows that these additional disclosures are mainly positive or neutral in nature (11.7 themes) and that the majority of these themes are quantitative in nature (5.7 themes). In contrast, Table-16 presents additional information in 10-K reports or annual reports that is not disclosed in sustainability reports. On average, there are 7.1 additional environmental themes disclosed in 10-K reports or annual reports that are not in sustainability reports. Mainly, these themes involve the disclosure of economic factors (2.5 themes) and litigation and liabilities (1.7 themes). Consequently, the disclosure of negative information in 10-K or annual reports is higher than that in sustainability reports by an average of 3.6 themes.

Table-16: Environmental Disclosures in 10-K reports or Annual Reports that are not in Sustainability Reports

	Minimum	Maximum	Mean		Std. Deviation	95% Confidence Interval of the Difference		Sig. (2-tailed)
	Statistic	Statistic	Statistic	Std. Error	Statistic	Lower	Upper	
Governance Structure and Management System (in AR or 10K)	0	3	.37	.036	.696	.30	.44	.000
Credibility (in AR or 10K)	0	2	.20	.023	.454	.15	.24	.000
Contamination and remediation efforts (in AR or 10K)	0	3	.85	.037	.712	.78	.92	.000
Pollution abatement and environmental performance indicators (EPI) (in AR or 10K)	0	3	.08	.016	.308	.05	.11	.000
Economic factors (in AR or 10K)	0	7	2.49	.095	1.834	2.30	2.67	.000
Litigation and liabilities (in AR or 10K)	0	5	1.69	.070	1.366	1.55	1.83	.000
Vision and strategy claims (in AR or 10K)	0	3	.32	.030	.578	.26	.38	.000
Laws and regulations conformity (in AR or 10K)	0	3	.94	.043	.839	.86	1.03	.000
Environmental profile (in AR or 10K)	0	2	.08	.015	.285	.05	.11	.000
Environmental initiatives (in AR or 10K)	0	1	.04	.010	.196	.02	.06	.000
Hard Disclosure (in AR or 10K)	0	15	5.68	.191	3.712	5.30	6.05	.000
Soft Disclosure (in AR or 10K)	0	5	1.38	.058	1.118	1.27	1.50	.000
Positive or Neutral Disclosure (in AR or 10K)	0	10	3.43	.115	2.221	3.21	3.66	.000
Negative Disclosure (in AR or 10K)	0	9	3.63	.134	2.602	3.36	3.89	.000
Quantitative Disclosure (in AR or 10K)	0	7	2.57	.098	1.893	2.37	2.76	.000
Qualitative Firm-Specific Disclosure (in AR or 10K)	0	10	3.28	.120	2.327	3.04	3.51	.000
Qualitative Disclosure (in AR or 10K)	0	5	1.22	.052	1.011	1.11	1.32	.000
Total Disclosure (in AR or 10K)	0	18	7.06	.215	4.165	6.64	7.48	.000

N = 376

Appendix F: List of Firms for Essay 3

COMPANY NAME	SIC	COMPANY NAME	SIC
3M Co.	26XX	International Paper Co.	26XX
Air Products & Chemicals Inc.	28XX	Kellogg Co.	20XX
AK Steel Holding Corp.	33XX	Kimberly-Clark Corp.	26XX
Alcoa Inc.	33XX	Kraft Foods Inc.	20XX
Allegheny Technologies Inc.	33XX	Marathon Oil Corp.	29XX
American Electric Power Co. Inc.	49XX	McCormick & Co. Inc.	20XX
Anadarko Petroleum Corp.	13XX	MeadWestvaco Corp.	26XX
Apache Corp.	13XX	Molson Coors Brewing Co. Cl B	20XX
Avery Dennison Corp.	26XX	Murphy Oil Corp.	29XX
Avon Products Inc.	28XX	Nabors Industries Ltd.	13XX
Bemis Co. Inc.	26XX	Newell Rubbermaid Inc.	30XX
Cabot Corp.	28XX	Newmont Mining Corp.	10XX
Celanese Corp. (Series A)	28XX	Gas Natural SDG S.A.	49XX
CenterPoint Energy Inc.	49XX	NiSource Inc.	49XX
Chesapeake Energy Corp.	13XX	Noble Corp.	13XX
Cliffs Natural Resources Inc.	10XX	Nucor Corp.	33XX
Clorox Co.	28XX	Occidental Petroleum Corp.	13XX
Coca-Cola Co.	20XX	ONEOK Inc.	49XX
ConocoPhillips	29XX	Packaging Corp. of America	26XX
Devon Energy Corp.	13XX	Patterson-UTI Energy Inc.	13XX
Dow Chemical Co.	28XX	Pepco Holdings Inc.	49XX
E.I. DuPont de Nemours & Co.	28XX	PepsiCo Inc.	20XX
Eastman Chemical Co.	28XX	PG&E Corp.	49XX
Ecolab Inc.	28XX	Pinnacle West Capital Corp.	49XX
Edison International	49XX	PPG Industries Inc.	28XX
El Paso Corp.	49XX	Praxair Inc.	28XX
Energen Corp.	49XX	Progress Energy Inc.	49XX
Entergy Corp.	49XX	Rowan Cos. Inc.	13XX
EOG Resources Inc.	13XX	Sara Lee Corp.	20XX
Exelon Corp.	49XX	Schlumberger Ltd.	13XX
Exxon Mobil Corp.	29XX	Sealed Air Corp.	26XX
FirstEnergy Corp.	49XX	Sherwin-Williams Co.	28XX
FMC Corp.	28XX	Sonoco Products Co.	26XX
Freeport-McMoRan Copper & Gold Inc.	10XX	Sunoco Inc.	29XX
BTG PLC	33XX	Temple-Inland Inc.	26XX
Goodyear Tire & Rubber Co.	30XX	Tyson Foods Inc. Cl A	20XX
Halliburton Co.	13XX	United States Steel Corp.	33XX
Hershey Co.	20XX	Valero Energy Corp.	29XX
Hess Corp.	29XX	Valspar Corp.	28XX
Huntsman Corp.	28XX	Williams Companies Inc	49XX
International Flavors & Fragrances Inc.	28XX	Xcel Energy Inc.	49XX