

# An empirical investigation of environmental performance and the market value of the firm

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## ARTICLE INFO

### Article history:

Received 4 November 2008

Received in revised form 8 January 2010

Accepted 14 January 2010

Available online 25 January 2010

### Keywords:

Market value

Environmental performance

Environmental initiatives

Awards

Certifications

Stock market reaction

## ABSTRACT

This paper analyzes the shareholder value effects of environmental performance by measuring the stock market reaction associated with announcements of environmental performance. We examine the market reaction to two categories of environmental performance. The first category includes 417 announcements of Corporate Environmental Initiatives (CEIs) that provide information about self-reported corporate efforts to avoid, mitigate, or offset the environmental impacts of the firm's products, services, or processes. The second category includes 363 announcements of Environmental Awards and Certifications (EACs) that provide information about recognition granted by third-parties specifically for environmental performance. Although the market does not react significantly to the aggregated CEI and EAC announcements, we find statistically significant market reactions for certain CEI and EAC subcategories. Specifically, announcements of philanthropic gifts for environmental causes are associated with significant positive market reaction, voluntary emission reductions are associated with significant negative market reaction, and ISO 14001 certifications are associated with significant positive market reaction. The difference between the market reactions to the CEI and EAC categories is statistically insignificant. Overall, the market is selective in reacting to announcements of environmental performance with certain types of announcements even valued negatively.

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## 1. Introduction

This paper analyzes the shareholder value effects of environmental performance by measuring the stock market reaction (abnormal returns) associated with announcements of environmental performance. We examine the market reaction to two categories of environmental performance. The first category is announcements about self-reported corporate efforts to avoid, mitigate, or offset the environmental impacts of the firm's products, services, or processes. We refer to such announcements as Corporate Environmental Initiatives (CEIs). We examine the market reaction to the broad category of CEIs as well as its subcategories of specific announcement types. The second category is announcements about recognition granted by third-parties specifically for environmental performance. We refer to

such announcements as Environmental Awards and Certifications (EACs), and examine the market reactions to both the broad category of EACs as well as its specific subcategories. We also contrast the market reactions to CEIs and EACs.

The issues addressed in this paper are important for a number of reasons. First, Skapinker (2008) highlights the proactive sustainability initiatives of Unilever and Wal-Mart to frame the ongoing debate over whether such initiatives are merely window dressing. Even though Wal-Mart's energy conservation and recycling initiatives, and Unilever's forays into low-cost water purification and eco-friendly detergents are well received by the popular press, the question remains as to whether the market perceives the returns on such initiatives to be as attractive as returns on alternative investment opportunities. In other words, can a firm increase shareholder value through improvements in its environmental performance? The controversy continues to receive attention in the press (Elgin, 2007; Thomson, 2006). Proponents claim that direct economic benefits from CEIs improve return on investment and market value. Benefits include energy, raw material, and abatement cost reductions, as well as intangible advantages of improved consumer perception, community relations, employee morale, and access to new markets. Skepticism remains, however, due to the perceived high costs of improving environmental performance, and the uncertain and longer term

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payoffs from such efforts (Engardio et al., 2007). By examining the market reaction to environmental performance, we provide evidence for the debate on the potential for environmental initiatives to create value.

Second, academics have studied the relationship between environmental performance and financial performance, both theoretically (Walley and Whitehead, 1994; Hart, 1995; Porter and van der Linde, 1995) as well as empirically (Ullman, 1985; Margolis and Walsh, 2003). Friedman (1970) argues that any environmental expenses beyond those required for regulatory compliance are not in the best interest of shareholders and will result in degradation of firm performance and value. However, Barnett and Salomon (2006) suggest that good social performance attracts resources to the firm, including better quality employees and expanded market opportunities. Also, since proactive approaches to environmental performance require greater intangible skills (e.g., cross-disciplinary activity and problem solving) than do reactive approaches, related efforts create more valuable resources and can be a source of competitive advantage (Hart, 1995; Russo and Fouts, 1997). In contrast, Walley and Whitehead (1994) propose that instances where environmental efforts can improve firm performance are rare. In analyzing the market reaction to a broad range of environmental initiatives, we shed light on whether such initiatives affect firm value.

Third, although the dominant view today is that good environmental performance results in improved financial performance, empirical results have been inconclusive and even conflicting, which highlights the complex nature of the link between environmental and financial performance (Corbett and Klassen, 2006). Related empirical research that use secondary data are of three types: portfolio studies, regression studies, and event studies (King and Lenox, 2001; Guenster et al., 2006). Portfolio studies determine whether the return on a portfolio of firms with good environmental performance outperforms the market. Regression analyses determine the long-term relationships between environmental performance and accounting-based measures of firm performance. These studies require careful matching of the firms under study with control firms to estimate any departures from “normal” financial performance during the study period. Due to the relatively long time periods over which such studies are conducted, they are sensitive to the host of other possible explanatory factors of firm performance.

Event studies estimate market value impacts using announcements of environmental events. A statistically significant market reaction to announcements of environmental events would indicate a causal link. Event studies have been used in the literature to determine the impacts of both positive and negative environmental events, e.g., product- and process-related initiatives (Gilley et al., 2000), environmental awards and crises (Klassen and McLaughlin, 1996), and lawsuits (Karpoff et al., 2005). The work of Klassen and McLaughlin (1996) and Gilley et al. (2000) is particularly relevant to our work. Klassen and McLaughlin (1996) document the market reaction to independent, third-party awards for environmental performance. Using a sample of 140 announcements during the period 1986–1991, they find that environmental awards are associated with a statistically significant average market reaction of 0.63%. Gilley et al. (2000) study the market reaction to environmental activities that improve processes and products. Based on a sample of 71 announcements from *The Wall Street Journal* during 1983–1996, they find that process-related announcements result in a statistically significant average market reaction of –0.45% but the market does not react significantly to product-related announcements.

Our research extends earlier research but also differs from it in several important aspects. First, our approach considers a wide variety of specific CEIs rather than just process and product-related

initiatives considered by Gilley et al. (2000). Second, our study of environmental awards builds upon the work of Klassen and McLaughlin (1996) by examining whether, in the time since their study, the increased pervasiveness of and publicity surrounding environmental efforts has affected the market value of firms that receive recognition for such efforts. Third, we expand upon Klassen and McLaughlin's work by testing environmental certifications, which were new to the US market at the time of their study but are more prevalent today. The impacts of environmental management system (EMS) certifications (such as ISO 14001) on firm performance have mainly been studied using survey data (Delmas, 2001; Melnyk et al., 2003). To the best of our knowledge, the literature has not examined the market reaction to EMS certifications. Fourth, by including both CEIs and EACs in our study, we are able to examine the difference between the market reaction to self-disclosed information and to third-party assessments of environmental performance. Finally, we study the market reaction to specific types of CEIs and EACs, many of which have not been examined in the literature.

Our results are based on an analysis of 780 announcements (417 CEI announcements and 363 EAC announcements) that appeared in the daily business press during the period 2004–2006. Although the market does not react significantly to the aggregated CEI and EAC categories, it does react significantly to certain types of CEI and EAC announcements. Specifically, we find that announcements of: (1) philanthropic gifts for environmental causes, result in statistically significant positive market reaction; (2) pledges or realizations of voluntary emission reductions, result in statistically significant negative market reaction; and (3) attainment of ISO 14001 certification, results in statistically significant positive market reaction. The difference between the market reactions to the aggregate CEI and EAC categories is statistically insignificant. Overall, the market is selective in reacting to announcements of environmental performance with certain types of announcements even valued negatively.

The next section develops our hypotheses. Section 3 describes the sample. Section 4 discusses the event study methodology. Section 5 presents the empirical evidence and Section 6 discusses the managerial implications of our results. Section 7 summarizes the paper, discusses its limitations, and provides directions for future research.

## 2. Hypotheses

We use the framework in Fig. 1 to develop our hypotheses of the impact of environmental performance on financial performance. Researchers have proposed different mechanisms by which environmental performance influences revenue gains and cost reductions. An examination of these mechanisms illustrates how CEIs can impact firm value.

Revenue growth can be achieved either through gains in existing markets or access to new markets. Klassen and McLaughlin (1996) propose that gains in existing markets can be realized through the reputational benefits of positive environmental performance. They argue that demonstration of reduced environmental impacts of products and processes, and the establishment of an EMS can improve brand reputation. Dowell et al. (2000) also note that the development and maintenance of stringent environmental management standards can have positive reputational effects. Corbett and Muthulingam (2008) propose that a primary reason for firms to pursue Leadership in Energy and Environmental Design (LEED) certification for building construction is to signal environmental concern to regulators, employees, and the public. Brand recognition and corporate reputation can also be enhanced through “strategic philanthropy” to support environmental causes (Seifert et al., 2003). Similarly, other environmentally conscious initiatives, such as

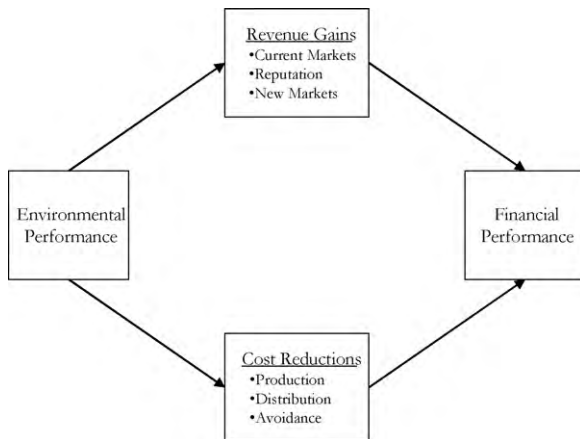


Fig. 1. Conceptual model linking environmental performance and financial performance.

alternative energy purchases or investments to reduce emissions below regulatory requirements, can signal a firm's concern for the environment and can have a positive impact on corporate reputation.

Improved environmental performance can also provide access to new markets. Evolving environmentally conscious markets with their increasing desire for eco-friendly products, can lead to new sales opportunities (Porter and van der Linde, 1995). Examples range from high-fashion clothing produced with organic materials (Binkley, 2007), to hybrid vehicles and data centers that consume less energy (Bulkeley, 2007). US federal agencies, with \$350 billion in annual purchases, are mandated to consider environmental criteria in their purchasing decisions (EPA, 2008).

In addition to its effects on revenues, environmental performance can impact costs in a variety of ways. Environmental practices reduce the amount of waste, the consumption of various production inputs including energy and materials (Rothenberg et al., 2001; Sroufe, 2003), and the number of components in products (Ashley, 1993). Both inbound and outbound logistics benefit from reduced product weights and packaging (Rao and Holt, 2005). Pollution prevention may not only reduce disposal and mitigation costs but may also avoid the cost of installing and operating pollution control devices (Hart, 1995; Hart and Ahuja, 1996). Other cost avoidance benefits of effective environmental management include mitigation of risks of losses from crises or regulation (Reinhardt, 1999), and preventing expenses associated with lawsuits and legal settlements (Karpoff et al., 2005). Dowell et al. (2000) note that stringent environmental standards can lower the cost to develop, maintain, and enforce policies and procedures, thus allowing easy transfer of accrued knowledge and increasing employee morale and productivity. Similarly, von Paumgarten (2003) argues that LEED-certified buildings can improve worker productivity and retention. Given the above discussion, our first hypothesis is

#### H1. The market reacts positively to CEIs.

To provide further insight, we subdivide our CEI sample into specific initiative types, several of which have not been previously examined in the literature (details of these subcategories are discussed later in Section 3). *A priori*, we expect that the market will react positively to each of the CEI subcategories.

CEI announcements represent self-disclosed information by the firm without independent verification of the initiatives. EACs, however, are the result of third-party reviews of environmental performance. In the quality management context, the positive

impact of third-party assessments on financial performance is documented by Hendricks and Singhal (1996) for awards, and by Corbett et al. (2005) for ISO 9001 certification. Klassen and McLaughlin (1996) find that announcements of environmental awards are associated with significant positive market reaction. Using surveys, Melnyk et al. (2003) demonstrate that both financial performance and environmental performance are associated with the level of formality of the firm's EMS, with an ISO 14001 certified EMS correlated with the best overall performance. Thus, our second hypothesis is

#### H2. The market reacts positively to EACs.

To provide further insight, we subdivide our EAC sample into specific types of certifications and awards (details of these subcategories are discussed in Section 3). *A priori*, we expect that the market will react positively to each of the EAC subcategories.

Finally, we posit that a firm's successful attainment of third-party recognition as reflected in an EAC announcement, sends a stronger signal of environmental performance to the market than a CEI announcement. Prior to issuing certifications or awards, third-parties typically examine detailed company information and often conduct onsite reviews. Such objective evidence is likely to be valued more by the market. Thus, our third hypothesis is

#### H3. The market reaction to EACs is greater than that for CEIs.

### 3. Sample and data description

To generate our sample, we use a preliminary set of keywords to collect a small set of CEI and EAC announcements from different publications. We read these announcements to identify additional phrases and words that are commonly used in announcements of environmental initiatives, awards, and certifications. Panel A of Table 1 presents the keywords that we use in our search. We search the headlines and lead paragraphs of announcements in the three major business wire services, the ten most widely circulated US daily newspapers, and the leading European business daily during the period 2004–2006. Panel B of Table 1 lists the sources that we use in the search. We download all announcements that meet the search criteria in these publications and read the full text of each announcement. We exclude the following types of announcements in generating our sample:

- Announcements that are environmental in nature but pertain to firms not publicly traded.
- Announcements that are very minor in nature, such as participation in a local community event.
- Announcements that appear in more than one publication. In such cases, we retain the announcement with the earliest publication date.
- Multiple announcements for the same firm within a span of five trading days. We exclude these announcements since any market reactions for the firm could be confounded by multiple events.

Some announcements in our search suggest that information about the specific CEI or EAC may have been announced earlier. In such cases, we search relevant sources during the preceding year to check for earlier announcements. If we find earlier announcements, we use the date of the earliest announcement in our analysis.

Our final sample consists of 780 announcements (417 CEI and 363 EAC announcements) spanning 340 unique firms. Table 2 provides descriptive statistics of our sample. The sample has wide variation in firm characteristics but is generally weighted towards

**Table 1**

Keywords and sources used in search for announcements.

Panel A: Keywords used in search for announcements		
(conservation or conservational or eco or ecosystem or ecology or ecological or environment or environmental or green or greener or greenest or greening or greened or recycle or recycles or recycling) Near7		
(accomplishment or accomplishments or admire or admiration or admirable or advantage or advantages or analysis or announcement or approve or approves or approval or approvals or award or awards or awarded or best or breakthrough or breakthroughs or celebrate or celebrates or celebration or celebrations or certification certified or consult or consultant or contribute or contributes or contribution or discovery or distinction or donate or donates or donation or donations or effort or efforts or endeavor or endeavors or endowment or example or excellent or excellence or exceptional or exemplary or gift or gifts or grant or grants or granted or great or greatest or honor or honors or honored or idea or ideas or initiative or innovate or innovates or innovation or innovations or innovative or invent or invents or invention or inventions or inventive or involvement or key or lead or leads or leader or leadership or master or mastery or message or messages or model or outstanding or patent or patents or patented or preeminent or preeminence or principle or principles or principled or prize or prizes or program or proactive or proclamation or proclamations or quality or qualities or qualify or qualified or qualification or recognize or recognizes or recognition or recognitions or reputation or research or researcher or respect or respected or reward or rewards rewarded or solution or standard or standards or star or strategy or strategies or strategic or study or success or successes or successful or super or superb or technology or technologies or top or tribute or tributes or tremendous or trust or venture or win or wins or won)		
Panel B: Search sources		
Business Wire	Houston Chronicle	The New York Times
Chicago Tribune	Los Angeles Times	The Wall Street Journal
Denver Post	New York Daily News	USA Today
Dow Jones Business News	Philadelphia Inquirer	Washington Post
Financial Times	PR Newswire (US)	

larger firms. The sample includes firms from 22 unique two-digit and 63 unique three-digit NAICS codes.

To investigate the impacts of specific CEIs, we separate our sample into the following seven subcategories based on announcement content and the CEI types identified in the literature:

- *Environmental business strategies*: Acquisitions of environmental-friendly capabilities, joint ventures or alliances, and new corporate environmental policies or standards.
- *Environmental philanthropy*: Substantial gifts for environmental causes, such as conservation efforts; the majority of such announcements are cash gifts although some are in kind.
- *Voluntary emission reductions*: Pledges, investments, or achievements related to reducing emissions levels beyond those required by regulation.
- *Eco-friendly products*: Introductions of eco-friendly products, environmental enhancements to existing products, or the incorporation of future regulatory requirements into existing products.
- *Renewable energy*: Supply or purchase of power from alternative energy sources.
- *Recycling*: Recycling of post-consumer waste and recycling to reduce raw material consumption.
- *Miscellaneous*: All remaining CEI announcements, including joining environmental groups or councils, engaging in energy conservation efforts, and developing eco-friendly technologies.

The CEI types that have been empirically tested in the event study literature include product- and process-related initiatives (Gilley et al., 2000), participation in voluntary environmental programs such as US EPA Climate Leaders (Fisher-Vanden and Thorburn, 2008), and voluntary commitments towards pollution abatement (Dasgupta et al., 2001). While there is some overlap

between the types of CEI announcements in our sample and the types of initiatives previously examined in the literature, there are important types of initiatives that have not been empirically examined before. These include environmental philanthropy and the use or supply of renewable energy. Panel A of Table 3 lists the sample sizes of the seven CEI subcategories. Panel B of Table 3 presents some examples of CEI announcements.

We separate our EAC announcements into two certification subcategories, namely, ISO 14001 and LEED, and three award subcategories, namely, federal, state or local government, and non-government. We include RC 14001 certifications within the EAC subcategory of ISO 14001 certifications. Modeled after ISO 14001, RC 14001 is a chemical industry standard developed by Responsible Care® but with additional industry requirements. The awards mentioned in EAC announcements are specifically those given to recognize environmental performance, including pollution prevention, energy conservation, and habitat conservation. Panel A of Table 4 presents the sample sizes for the five EAC subcategories. Panel B of Table 4 presents some examples of EAC announcements.

### 3.1. Operations issues involved in CEIs and EACs

Our analyses of the text of CEI and EAC announcements clearly highlight the operations issues involved in implementing environmental initiatives and improving environmental performance. To identify these issues, we read the text of each announcement to identify and categorize issues pertinent to the CEI or EAC announcement. Using words from the text of the announcements, we record phrases representative of the issues being faced. Examples of issues include *technology adoption*, *facility upgrade*, *process improvement*, *project management*, *quality*, etc. We categorize these issues into 13 operations-related and 10 non-operations-

**Table 2**

Descriptive statistics for the Sample of 780 announcements. Sample statistics are based on the most recent fiscal year completed before the date of the announcement.

	Market value (\$M)	Total assets (\$M)	Sales (\$M)	Net income (\$M)	Employees (000s)
Mean	37,602.3	68,513.1	34,977.8	2102.7	104.63
Median	11,338.3	14,147.0	10,822.3	445.9	26.99
Std Dev	68,050.5	188,339.7	62,408.8	4309.6	254.91
Max	386,402.1	1,494,037.0	313,335.0	25,330.0	1800.0
Min	14.2	13.2	4.8	−17,462.2	0.04



**Table 3**

Corporate Environmental Initiatives (CEIs) subcategory: sample sizes and example announcements.

Panel A: CEI subcategories	Sample size
	417
Environmental business strategies	53
Environmental philanthropy	30
Voluntary emission reductions	39
Eco-friendly products	60
Renewable energy	40
Recycling	64
Miscellaneous	131
Panel B: Examples of CEI announcements	
<p>"Caterpillar Sets Aggressive Greenhouse Gas Reduction Target, Goal is Part of EPA's Climate Leaders program", PR Newswire (US), 18 January 2005. Caterpillar pledged to reduce its greenhouse gas emissions by 20% from 2002 levels, by 2010.</p> <p>"Liz Claiborne Inc. Adopts prAna Natural Power Initiative", PR Newswire (US), 3 November 2005. Liz Claiborne Inc. announced that it would purchase only wind power for its New Jersey headquarters.</p> <p>"Abitibi-Consolidated Launches its largest Recycling Expansion; Paper Retriever begins collection in seven additional US markets", PR Newswire (US), 15 November 2005. Abitibi announced an expansion of its paper recycling program from 16 to 23 US cities.</p>	

tions-related categories. We note that an announcement may have multiple issues falling into different categories.

Table 5 lists the 13 operations-related categories. The table also indicates the number of CEI and EAC announcements that fall into a particular issue category. The most frequent operations issues faced are implementing environmental management systems, designing products/services, managing R&D and technology, improving resource efficiency, managing facilities, designing and managing processes, managing forward and reverse logistics, and preventing and controlling pollution. Table 6 lists the 10 non-operations-related categories. The most frequent non-operations issues faced are managing partnerships and alliances, educating and involving stakeholders, and managing human resources. We note that 85% of the announcements cite one or more operations issues, attesting to the link between operations and environmental management.

#### 4. Methodology

We use event study methodology to estimate the market reaction to announcements of environmental performance. This

**Table 4**

Environmental Awards and Certifications (EACs) subcategory: sample sizes and example announcements.

Panel A: EAC subcategories	Sample size
	363
ISO 14001 certifications	50
LEED certifications	21
Federal awards	96
State/local government awards	65
Non-government awards	131
Panel B: Examples of EAC announcements	
<p>"Smithfield Achieves International 'Gold Standard' for its Environmental Management Practices", PR Newswire (US), 27 April 2005. Smithfield attained ISO 14001 certification for the EMS used at its US-based hog production and processing facilities.</p> <p>"Corning's Wilmington, NC, Optical Fiber Manufacturing Facility To Be Recognized as an Environmental Steward", Business Wire, 2 March 2005. A Corning plant was recognized as an "Environmental Steward" by the North Carolina Department of Environment and Natural Resources for its environmental performance.</p>	

methodology offers an approach to estimate market returns associated with specific events, while controlling for market-wide influences on stock prices (see Brown and Warner, 1985 for a review of this methodology). The "adjusted" or "abnormal" returns provide an estimate of the percent change in stock price associated with an event. The underpinning of event study methodology is that in an efficient market, the wealth impact of an event will be reflected immediately in the stock price. Thus, a measure of such impact can be obtained by observing stock prices over a relatively short interval of time.

The first step in executing an event study is determining the event period—the period over which to estimate abnormal returns. Consistent with most event studies, we use a two-day event period consisting of the day of the announcement and the preceding trading day. To translate calendar days into event days, we designate the announcement publication day as Day 0. If the announcement is made on either a non-trading day or after 4:00 pm Eastern Time on a trading day, the subsequent trading day is treated as Day 0. We measure all other trading days relative to Day 0. Thus, the trading day immediately preceding the announcement day is Day −1, while that immediately following the announcement day is Day 1.

Consistent with most event studies, we use the "market model" to estimate abnormal returns. This model posits a linear relationship between the return on a stock and the market return (i.e., the return on the market portfolio) over a given time period as:

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

where  $R_{it}$  is the return of stock  $i$  on Day  $t$ ,  $R_{mt}$  is the market return on Day  $t$ ,  $\alpha_i$  is the intercept of the relationship for stock  $i$ ,  $\beta_i$  is the slope of the relationship for stock  $i$  with respect to the market return, and  $\varepsilon_{it}$  is the error term for stock  $i$  on Day  $t$ . The term  $\beta_i R_{mt}$  is the portion of stock  $i$ 's return attributable to market movements. The error term  $\varepsilon_{it}$  is the portion of the return that cannot be explained by market movements and therefore captures the effect of firm-specific information. To compute the expected return for each sample firm, we estimate  $\hat{\alpha}_i$ ,  $\hat{\beta}_i$ , and  $\hat{\sigma}_{\varepsilon_i}^2$  (the variance of the error term  $\varepsilon_{it}$ ) using ordinary least squares regression (see Eq. (1)) over the estimation period of 200 trading days. We begin the estimation period from Day −210 and end it on Day −11. We end the estimation period two weeks (10 trading days) prior to the event day in order to shield the estimates from effects of the announcement and to ensure that any non-stationarities in the estimates are not an issue. In some cases, a firm may not have complete data over the estimation period; we require that a firm must have a minimum of 40 stock returns during the 200-day period for us to estimate Eq. (1).

The abnormal return  $A_{it}$  for firm  $i$  on Day  $t$  is computed as the difference between the actual and the expected return:

$$A_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt})$$

The mean abnormal return for Day  $t$  is given by:

$$\bar{A}_t = \sum_{i=1}^N \frac{A_{it}}{N} \quad (2)$$

where  $N$  is the number of announcements in the sample. To test the statistical significance of the mean abnormal return in Eq. (2), each abnormal return  $A_{it}$  is divided by its estimated standard deviation  $\hat{\sigma}_{\varepsilon_i}$  to yield a standardized abnormal return. Since the abnormal returns are assumed to be independent across firms, with mean 0 and variance  $\hat{\sigma}_{\varepsilon_i}^2$ , we know from the Central Limit Theorem that the sum of the  $N$  standardized abnormal returns is approximately

**Table 5**

Descriptions of categories of operations-related issues for CEIs and EACs.

Category	Number of announcements			Description
	CEIs	EACs	Total	
Implementing environmental management systems and practices	52	139	191	Developing and implementing environmental management systems (including ISO 14001), practices, and policies
Product design and development	101	57	158	Product or service design and development (improvements, testing, and commercialization)
R&D and technology management	92	58	150	R&D and technology assessment, adoption, development, and transfer
Improving resource efficiency	63	83	146	Reduction, reuse, and recycling of materials or energy through improvements in products, processes, or practices
Facilities management	53	87	140	Facilities location, design, and management
Process design and management	57	64	121	Process design, improvement, and testing; process metrics and process control
Forward and reverse logistics and transportation	90	45	135	Materials handling, transportation, and logistics; reverse logistics network design and management
Pollution prevention and control	63	44	107	Pollution prevention, control, and offsetting
Improving operational performance	27	46	73	Improving cost, efficiency, productivity, quality, delivery, and reliability
Designing incentives and contracts	51	8	59	Incentive alignment and design (across employees, suppliers, and customers); contracts and vertical integration
Input choice	40	10	50	Input choice or mix (based on availability, cost, regulatory incentives, risk, and constraints)
Managing supply and demand	37	11	48	Increasing or sustaining supply, reducing demand, managing capacity (utilization, expansion, and shut-downs)
Operations financing and project management	26	13	39	Financing operations, projects, and suppliers; project management

**Table 6**

Descriptions of categories of non-operations-related issues for CEIs and EACs.

Category	Number of announcements			Description
	CEIs	EACs	Total	
Managing partnerships and alliances	105	45	150	Collaborative relationships, partnerships, strategic alliances, joint ventures, acquisitions
Stakeholder education and involvement	80	52	132	Supplier, consumer, industry, policy-maker, and community education and involvement
Human resources management	19	73	92	Staffing, training, labor relations, and safety
Environmental preservation	25	44	69	Environmental conservation, habitat and species preservation, land reclamation
Designing marketing mix	41	18	59	Assortment choice, market segmentation, promotion, pricing
Event planning	48	9	57	Planning and management of events
Managing business growth	26	4	30	New markets, existing market shrinkage and expansion, changing customer base
Managing certification	15	5	20	Certification of suppliers, inputs, products, and activities
Regulation and risk management	9	5	14	Regulations (including bureaucracy, stringency, and uncertainty), environmental risk management
Philanthropic support	10	2	12	Monetary and other support for research, educational, community, and environmental projects

normal with mean 0 and variance  $N$ . Thus, the test statistic  $TS_t$  for Day  $t$  is calculated as:

$$TS_t = \frac{\sum_{i=1}^N A_{it} / \hat{S}_{e_i}}{\sqrt{N}}$$

We use a  $t$ -test to determine the statistical significance of the mean abnormal return. The cumulative abnormal return (CAR) for a given time period  $[t_1, t_2]$  is:

$$CAR[t_1, t_2] = \sum_{t=t_1}^{t_2} \bar{A}_t$$

The test statistic  $TS_e$  for a period spanning multiple days is derived in a manner similar to that for a single day:

$$TS_e = \frac{\sum_{i=1}^N \left( \frac{\sum_{t=t_1}^{t_2} A_{it}}{\sqrt{\sum_{t=t_1}^{t_2} \hat{S}_{e_i}^2}} \right)}{\sqrt{N}}$$

To check for the influence of outliers, we supplement the  $t$ -tests with two non-parametric tests. We test for the statistical significance of the median abnormal return using the Wilcoxon signed-rank test. We use the generalized sign test to determine if the percent positive abnormal returns during the event period are

significantly higher than that during the estimation period. For example, say a sample of 50 announcements has 10,000 abnormal returns during a 200-day estimation period. If 5100 of these returns are positive, 51.0% positive abnormal returns is established as the null. The percent positive of the 50 abnormal returns during the event period are then compared to the null and a Z-statistic is generated by using the normal approximation to the binomial distribution. Note that for all three tests, we report one-tailed  $p$ -values since we hypothesize that abnormal returns are positive. We look for consistencies among the three tests to ensure the robustness of our results.

## 5. Results

### 5.1. Analysis of market reaction to CEIs

For the full sample of 417 CEI announcements, Panel A of Table 7 presents the market reaction for the day preceding the announcement (Day  $-1$ ), the day of the announcement (Day 0), and the two-day event period (Days  $-1$  and 0). The mean abnormal returns for Days  $-1$ , 0, and the two-day event period are all positive (0.04%, 0.07%, and 0.11%, respectively) with the returns for Day 0 significantly different from zero at the 10% level. The median

**Table 7**

Event period abnormal returns for the 417 Corporate Environmental Initiative (CEI) announcements.

Panel A: Corporate Environmental Initiatives (CEIs)							
	Day −1		Day 0		Days −1 and 0		
Mean abnormal return	0.04%		0.07%		0.11%		
<i>t</i> -statistic	0.34		1.34*		1.17		
Median abnormal return	−0.02%		−0.05%		0.02%		
Wilcoxon signed-rank Z-statistic	−0.00		−0.40		−0.13		
% abnormal returns positive	49.4%		48.0%		51.1%		
Generalized Sign test Z-statistic	0.51		−0.08		1.20		
Panel B: CEI subcategory results for event period (Days −1 and 0)							
Subcategory	<i>N</i>	Mean abnormal return	<i>t</i> -statistic	Median abnormal return	Wilcoxon signed-rank Z	% positive	Generalized sign Z
Environmental business strategies	53	0.63%	2.77***	−0.01%	0.36	49.1%	0.44
Environmental philanthropy	30	0.46%	1.41*	0.36%	1.74**	66.7%	2.07**
Voluntary emission reductions	39	−0.95%	−2.96***	−0.72%	−2.63***	30.8%	−2.17**
Eco-friendly products	60	0.01%	0.04	0.07%	0.05	51.7%	0.48
Renewable energy	40	0.13%	0.28	0.07%	0.86	55.0%	0.94
Recycling	64	0.33%	1.14	0.05%	0.46	51.6%	0.54
Miscellaneous	131	0.05%	0.13	0.07%	0.09	52.7%	1.02

All tests are one-tailed: \* $p \leq 0.10$ ; \*\* $p \leq 0.05$ ; \*\*\* $p \leq 0.01$ .

abnormal return for the two-day event period is 0.02%, but is statistically insignificant. 51.1% of the abnormal returns for the two-day event period are positive, insignificantly different than the percent positive abnormal returns during the estimation period. The results indicate that the market reaction to CEI announcements is marginally positive but insignificant.

One possibility for the lack of a strong market reaction could be that the market partially anticipates CEI announcements based on certain characteristics of the announcing firms. To explore this, we examine whether the market reaction is influenced by the size of the firm and the environmental reputation of the firm. Firm size has been found to be influential in several event studies (e.g., Klassen and McLaughlin, 1996; Hendricks and Singhal, 2003). Typically, smaller firms have stronger market reactions than larger firms due to the greater relative impact of any one event to the firm's profits. Also, since smaller firms tend to be less closely followed by analysts, their announcements may have more of a surprise element as compared to announcements by larger firms. Thus, environmental announcements may result in stronger market reactions for smaller firms. To test for the effect of firm size, we divide our sample into quartiles by total assets. We then compare the market reactions for firms in the lowest quartile (median total assets are \$1.9 billion) with those for firms in the highest quartile (median total assets are \$160.1 billion).

Market reaction could also depend upon the firm's environmental reputation. The announcement of an environmental initiative by a firm not known to be a strong environmental performer will be more of a surprise to the market than that by a firm with a favorable environmental reputation. We capture a firm's environmental reputation as the indicator of whether the firm was included in the Dow Jones World Sustainability Index (DJSI World) at the time of the announcement. Launched in 1999, the DJSI World uses weights for economic, environmental, and social criteria to annually determine the top performers among the world's 3000 largest publicly traded firms (Dow Jones, 2008). To test for the effect of environmental reputation, we compare the market reactions for the two announcement groups corresponding to firms either listed or not listed in the DJSI World as of the announcement day.

For firm size and environmental reputation, we test for differences in means and medians between the respective groups using *t*-tests and Mann–Whitney *Z*-tests. In each case, the differences are in the theorized directions but statistically insignificant. For example, small firms have a mean (median)

abnormal return of 0.32% (0.07%) compared to –0.07% (–0.11%) for large firms. The mean (median) difference in abnormal returns is 0.39% (0.18%) but is insignificantly different from zero. Thus, the results suggest that firm size and environmental reputation do not influence the market reaction to CEI announcements.

#### 5.1.1. Analysis of market reactions to subsamples of CEIs

It is plausible that the market reaction could differ by CEI subsample. The market may react positively, negatively, or not at all, depending on the subsample. By aggregating CEI announcements of different types, the average reaction could well be insignificantly different from zero. We examine three different subsamples, namely, the subcategories listed in Panel A of Table 3; “achievements” versus “intentions”; and “reactive” versus “proactive” CEIs.

**5.1.1.1. Market reaction by CEI subcategory.** We provide descriptive results for each of the seven CEI subcategories in Panel B of Table 7. In the subcategory of environmental business strategies, the mean abnormal return during the two-day event period is 0.63%, significant at the 1% level. However, the median return of –0.01% is insignificantly different from zero. Only 49.1% of the abnormal returns are positive, which is insignificantly higher than the percent positive abnormal returns during the estimation period. The evidence suggests that the market does not react to environmental business strategy announcements.

The mean (median) abnormal return for environmental philanthropy is 0.46% (0.36%), statistically significant at the 10% (5%) level. In addition, 66.7% of the abnormal returns are positive, which is significantly higher (at the 5% level) than the percent positive abnormal returns during the estimation period. The positive market reaction to environmental philanthropy could be because such philanthropic actions involve modest investments but generate significant customer goodwill and enhance corporate reputation, thus contributing to future profitability. Of course, the market reaction to environmental philanthropy might also simply be because philanthropy in general has a positive impact on financial performance. However, our review of the literature suggests that the empirical evidence on the impact of philanthropy on financial performance is mixed. Orlitzky et al. (2003) find that corporate philanthropy has a positive relationship with financial performance, while Wang et al. (2008) find that financial performance is increasing in only low-to-moderate levels of philanthropy. In contrast, Griffin and Mahon (1997), Berman et al.

(1999), and Seifert et al. (2004) do not find a significant relationship between the two. Our results on environmental philanthropy add to those in the existing literature on the philanthropy–performance relationship.

Perhaps our most interesting result is for announcements of voluntary emission reductions. The mean (median) abnormal return is  $-0.95\%$  ( $-0.72\%$ ), statistically significant at the 1% (1%) level. The 30.8% positive returns are also significantly lower (at the 5% level) than the percent positive during the estimation period. Thus, announcements of voluntary emission reductions are viewed negatively by the market. This finding has some support in the literature. In addition to the theoretical arguments of Friedman (1970) discussed earlier, Hart and Ahuja (1996) suggest that while initial emission reductions may improve financial performance, subsequent reductions are more likely to result from costly pollution control. Fisher-Vanden and Thorburn (2008) find that membership in the EPA Climate Leaders program yields a negative abnormal return of  $-0.90\%$ ; the negative abnormal returns are even stronger when specific pledges are made for greenhouse gas reductions. The Climate Leaders program is referred to in 12 of the 39 announcements in our voluntary emission reductions subcategory; the remainder of the announcements within the subcategory relate to other air emissions or hazardous waste reductions.

The market reactions for the remaining CEI subcategories – eco-friendly products, renewable energy, recycling, and miscellaneous – are statistically insignificant.

**5.1.1.2. “Achievements” versus “intentions”.** Since self-disclosed initiatives may not necessarily serve as measures of actual environmental performance (Ullman, 1985), we consider whether the market reacts differently to CEIs that are “achievements” as opposed to “intentions”. We read the text of each CEI announcement to separate out achievements of environmental performance from intentions. For example, the realization of emission reduction is an achievement whereas a pledge to reduce emissions is an intent. We compare the mean and median reactions to achievements and intentions. The mean (median) abnormal return for achievements is  $0.19\%$  ( $0.06\%$ ) compared to the mean (median) abnormal return for intentions of  $0.01\%$  ( $-0.01\%$ ). The results show a moderately significant and positive market reaction to achievements but the reaction to intentions is insignificant.

**5.1.1.3. “Reactive” versus “proactive” CEIs.** While our sample excludes measures undertaken only to comply with current environmental regulations, it does include CEI announcements that relate to addressing stakeholder pressures (other than

regulation) or preparing for future environmental regulations. Accordingly, we classify the latter as “reactive” and all other CEI announcements as “proactive”. For example, in response to pressure from environmental activists, Office Depot’s decision to increase the availability of paper products with recycled content (*Business Wire*, 2 June 2004) is classified as reactive. Conversely, the decision by CSX to lease three hybrid yard locomotives (*PR Newswire*, 21 January 2004) is classified as proactive. Note that for environmental regulations already being implemented, we classify achievements that go beyond compliance, as proactive. Given the nature of our sample, only 35 of the 417 CEIs are reactive. The mean (median) abnormal return for the reactive CEIs is  $-0.17\%$  ( $-0.02\%$ ), insignificantly different from zero. The mean (median) abnormal return for proactive CEIs is  $0.13\%$  ( $0.03\%$ ), also insignificantly different from zero. Although the mean and median abnormal returns are greater for proactive as compared to reactive CEIs, the difference between the market reactions to proactive and reactive CEIs is not significant.

## 5.2. Analysis of market reaction to EACs

Panel A of Table 8 presents the results for the full sample of 363 EAC announcements. The mean abnormal return for Days  $-1$ ,  $0$ , and the two-day event period are all negative ( $-0.04\%$ ,  $-0.05\%$ , and  $-0.09\%$ , respectively) but statistically insignificant. Similarly, the median abnormal returns are generally negative but statistically insignificant, and the percent positive abnormal returns are insignificantly different than the percent positive abnormal returns during the estimation period. The evidence suggests that the market does not react significantly to the entire category of EAC announcements.

As with CEIs, we examine whether factors such as firm size and environmental reputation influence the market reaction to EACs. We divide the sample of EACs into respective groups and test for differences in means and medians. The results are statistically insignificant. For example, small firms have a mean (median) abnormal return of  $-0.03\%$  ( $0.05\%$ ) compared to the mean (median) abnormal return of  $-0.12\%$  ( $-0.15\%$ ) for large firms. The mean (median) difference in abnormal returns is insignificantly different from zero. The results suggest that firm size and environmental reputation do not influence the overall market reaction to EAC announcements.

### 5.2.1. Analysis of market reactions to subsamples of EACs

It is plausible that the market may not perceive all subcategories of EACs to be equally value creating. We therefore

**Table 8**

Event period abnormal returns for the 363 Environmental Award and Certification (EAC) announcements.

Panel A: Environmental Awards and Certifications (EACs)							
		Day −1	Day 0			Days −1 and 0	
Mean abnormal return		−0.04%	−0.05%			−0.09%	
t-statistic		−0.34	−1.28			−0.66	
Median abnormal return		0.03%	−0.04%			−0.10%	
Wilcoxon signed-rank Z-statistic		0.52	−1.01			−0.35	
% abnormal returns positive		51.0%	48.5%			46.8%	
Generalized sign test Z-statistic		1.10	0.16			−0.47	
Panel B: EAC subcategory results for event period (Days −1 and 0)							
Subcategory	N	Mean abnormal return	t-statistic	Median abnormal return	Wilcoxon signed-rank Z	% positive	Generalized sign Z
ISO 14001 certifications	50	0.35%	0.84	0.77%	1.56*	60.0%	1.80**
LEED certifications	21	0.02%	0.62	0.39%	0.84	61.9%	1.26
Federal awards	96	−0.03%	−0.07	−0.11%	−0.17	44.8%	−0.60
State/local government awards	65	−0.21%	−0.59	−0.10%	−0.66	49.2%	0.11
Non-government awards	131	−0.26%	−1.51*	−0.21%	−1.59*	39.7%	−1.97**

All tests are one-tailed:  $^*p \leq 0.10$ ;  $^{**}p \leq 0.05$ ;  $^{***}p \leq 0.01$ .



provide descriptive results for each of the five EAC subcategories. Panel B of Table 8 presents the results for the two-day event period. There are several interesting results that we highlight.

First, the market reacts positively to announcements of ISO 14001 certifications. The mean (median) abnormal return during the two-day event period is 0.35% (0.77%); the median abnormal return is statistically significant at the 10% level. 60.0% of the abnormal returns are positive, significantly higher (at the 5% level) than the percent positive during the estimation period. The literature offers some support for the positive impact of ISO 14001 in particular and EMSs in general on firm performance, using survey data (Delmas, 2001; Melnyk et al., 2003). To our knowledge, we are the first to provide empirical evidence of the impact of ISO 14001 certification on the market value of the firm.

Second, although our three measures of market reaction to LEED certifications are all positive, they are statistically insignificant. Thus, despite the benefits of LEED certification cited in the literature (e.g., von Paumgarten, 2003; Corbett and Muthulingam, 2008), the market reaction is insignificant. We conjecture that since LEED certifications are awarded for individual buildings, their relatively narrow scope may contribute to the lack of market reaction, particularly when compared with ISO 14001 certifications that typically span different geographic locations or even the entire firm.

Third, while the average market reactions for both federal and state/local government awards are statistically insignificant, the market reacts negatively to non-government awards. The mean (median) abnormal return of  $-0.26\%$  ( $-0.21\%$ ) is significant at the 10% (10%) level. 39.7% of the abnormal returns are positive, significantly lower (at the 5% level) than the percent positive during the estimation period. We find no substantive differences in the types of behavior recognized by government versus non-government awards. Our finding of negative abnormal returns for non-government awards compared to government awards seems consistent with findings in the literature that less prestigious and potentially less objective awards are valued less positively (Klassen and McLaughlin, 1996; Hendricks and Singhal, 1996). An online search for award criteria provided information for federal awards but not for non-government awards, suggesting that non-government award criteria are perhaps less transparent and less formal. The negative market reaction could be because the market may perceive the efforts associated with such awards as unnecessarily expensive relative to the value they provide.

Our findings on environmental awards are different from those reported by Klassen and McLaughlin (1996). Using announcements from 1985 to 1991, they find a significant abnormal return of 0.63% for environmental awards. The difference between their results and ours could be due to a number of reasons. First, with the growing importance of environmental management, the market may now expect the level of performance required by awards and may have better access to information related to a firm's environmental performance. Thus, winning an environmental award may not convey much new information to the market. In contrast, Klassen and McLaughlin's study considered environmental awards when environmental issues were just gaining importance. Hence, the winning of an environmental award in their study may have conveyed new and significant information to the market. Second, most of the announcements in the sample in Klassen and McLaughlin (1996) are from newswires. Our announcements are from a much broader range of sources and include newswires as well as local and major national newspapers. It is possible that we include less impactful awards in our sample. Third, the lack of market reaction to environmental awards may also be due to the increasing frequency of such awards over time. As an example, the US EPA/DOE Energy Star Program has grown from one award in 1993 to 92 awards in 2007 (Energy Star, 2008).

With the increasing frequency, some of the awards may not even appear in press releases and newspapers. For example, only six awards (eight award winners) in our sample directly correspond to awards (19 award winners) in Klassen and McLaughlin's study.

We note that EACs are typically recognitions of achievement and are typically granted for proactive efforts. Our analysis indicates that more than 95% of the EACs in our sample are for achievements and are proactive in nature. Hence, the comparison between achievements and intents, and reactive versus proactive efforts is not pertinent to EACs.

### 5.3. Self-disclosed information versus third-party assessments

To determine whether the market values self-disclosed information about environmental performance differently than third-party assessments, we test for the difference in the overall market reactions to CEIs and EACs. Using a one-tailed test, we find that the means (medians) are insignificantly different from each other ( $t$ -statistic is  $-1.13$ ; Mann–Whitney  $Z$ -statistic is  $-0.36$ ). Thus, the market does not react differently to the two categories. A possible explanation for this result is that our sample consists of relatively large firms (median total assets are \$14.1 billion), and recent studies have shown that self-disclosed environmental performance increasingly reflects actual environmental performance particularly for large firms (Patten, 2002; Al-Tuwaijri et al., 2004). We therefore test for the significance of the difference in market reactions to CEIs and EACs, by quartile of firm size (as measured by total assets). We find that the differences in means and medians between the market reactions to CEIs and EACs are generally decreasing in firm size. The mean (median) difference for the smallest quartile firms is 0.35% (0.02%), while that for the largest quartile firms is 0.04% (0.04%), indicating that firm size does indeed dampen the difference in market reaction between self-disclosed information and third-party assessments. However, the differences in market reactions to CEIs and EACs are insignificant for each of the quartiles.

### 5.4. Abnormal stock price performance after the announcement

We also analyze the post-announcement abnormal returns of our sample firms. The primary reason for doing this is to determine whether a significant market reaction occurs subsequent to our two-day event period. We begin our post-announcement period on Day 1 and estimate abnormal returns over the next 60 days. Since a month typically has 20 trading days, we are estimating abnormal returns over a three-month period after the announcement. Fig. 2 presents the plot from cumulating average daily abnormal returns for Day 1 through Day 60. The mean 60-day cumulative abnormal return for the CEI sample is 1.44%, significantly different from zero

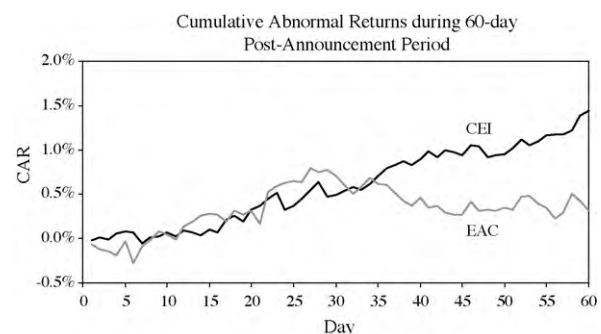


Fig. 2. Average cumulative abnormal return trend when abnormal returns are cumulated on a daily basis (starting on the day after the CEI/EAC announcement, to 60 days after the announcement).

at the 5% level in a one-tailed test, while that for the EAC sample is 0.25%, insignificantly different from zero.

Kothari and Warner (1997) and Barber and Lyon (1997) show that cumulative abnormal returns over long periods have methodological concerns that may lead to incorrect inferences, and they recommend using buy-and-hold abnormal returns. To test for the robustness of the results in Fig. 2, we estimate the 60-day buy-and-hold abnormal returns by comparing the returns of the sample firms against control firms that are similar to the sample firms in terms of size, book-to-market ratio of equity, and prior stock price performance. The mean 60-day buy-and-hold abnormal return for the CEI sample is 0.24% and for the EAC sample is –0.38%, both insignificantly different from zero. Since the results for Days 1–60 are sensitive to the method used, we conclude that there is no consistent evidence of any post-announcement market reaction.

## 6. Implications of the results

Our findings have a number of interesting managerial implications. First, the market is selective in reacting to CEIs. Of the seven different CEI categories considered in our analyses, the stock market reaction is insignificant for the following four categories: environmental business strategies, eco-friendly products, renewable energy, and recycling. Although Walley and Whitehead (1994) contend that most CEIs destroy shareholder value, our results indicate that this is not exactly the case. The evidence suggests that while the majority of CEI types are value-neutral, there are certain CEIs for which the market reaction is positive and certain CEIs for which it is negative. Our results for CEIs are important as managers often face pressures from various stakeholders to give consideration for environmental issues. Managers responding to such pressures can benefit from empirical evidence of what types of CEIs improve or at least do not negatively impact firm value. Beyond the value captured in the stock market reaction, it is plausible that CEIs may create value in other, intangible ways including increased brand loyalty, higher customer and employee satisfaction, and long-term survivability, which are perhaps not fully reflected in the market's reaction to announcements.

Second, environmental philanthropy is viewed positively by the market. Such philanthropy can generate positive publicity and goodwill among various stakeholders, and can also create value through more loyal customers and highly motivated employees. Referring to Fig. 1, environmental philanthropy is likely to improve financial performance via the revenue gains from enhanced reputation. Given that the median value of philanthropic contributions by firms in our sample is \$2.0M, the positive market reaction to environmental philanthropy suggests that such initiatives can yield high returns.

Third, the market reacts negatively to voluntary emission reductions. These results are consistent with earlier results that membership in the EPA Climate Leaders program is associated with negative market reaction (Fisher-Vanden and Thorburn, 2008). Despite the benefit in terms of mitigating future regulatory risks or positively impacting reputation, the market remains concerned about announcements of voluntary emission reductions. Referring to Fig. 1, it is possible that the market negatively values voluntary efforts at reducing emissions because of the visibility of direct, assignable costs, while the revenue impacts of such efforts are highly uncertain. Therefore, announcements of voluntary emission reductions efforts should be accompanied by formal justifications as to why these efforts are being conducted (for example, preparing for future legislation, competitive lobbying, or anticipated carbon trading) and what the expected value from these efforts is likely to be.

Fourth, our results indicate that the market reacts more positively to CEIs that are achievements as opposed to intents. Since achievements may more clearly signal either realized or future cost reductions and/or revenue gains as compared to intents, a greater focus in outward communications on achievements as opposed to intents may be warranted.

Fifth, with respect to EACs, we find that ISO 14001 certifications are associated with positive market reaction. This is a validation of the value in achieving a level of environmental commitment and performance that is based on a widely recognized and accepted international standard, and more so when the standard is sometimes considered as a prerequisite for trade. Thus, our results suggest that managers should use the ISO 14001 framework for developing an EMS.

Finally, the market reaction to environmental awards in our study is different than in Klassen and McLaughlin (1996), who find significant and positive market reaction. Our evidence indicates that LEED certifications and government awards are value-neutral, but non-governmental awards have a negative market reaction. While awards and certifications can serve as catalysts for organizational change and innovative business practices, a key implication for managers seeking to improve shareholder value through awards and certifications is to be judicious in pursuing them. Applying for awards and certifications and going through the evaluation process can use valuable resources and management time. Thus, firms should be careful in charting out their course of environmental efforts if it involves awards and certifications as interim goals.

In summary, it is important for managers to appropriately implement and communicate environmental strategies, as the effects on shareholder value can vary along different dimensions. Focusing on communicating achievements as opposed to intents, incorporating well-established standards (such as ISO 14001) in developing EMS, being judicious in pursuing recognition from award givers, together with the communication of a sound, economic rationale based on cost reductions, revenue gains, or reputational benefits, can positively impact shareholder value.

## 7. Summary

This paper analyzes the shareholder value effects of environmental performance by measuring the market reaction associated with announcements of two categories of environmental performance. The first category includes 417 announcements of Corporate Environmental Initiatives (CEIs) that provide information about self-reported corporate efforts to avoid, mitigate, or offset the environmental impacts of the firm's products, services, or processes. Given the numerous mechanisms and extensive discussion in the literature regarding how proactive environmental efforts can increase firm revenues or reduce costs, we hypothesize that the market reacts positively to CEIs. The second category includes 363 announcements of Environmental Awards and Certifications (EACs) that provide information about recognition granted by third-parties specifically for environmental performance. Since awards and certifications are third-party assessments of environmental performance, we hypothesize that the market also reacts positively to EACs. Further, we hypothesize that EACs send a stronger signal of environmental performance than CEIs and therefore result in a more positive market reaction.

Our analyses of CEI and EAC announcements clearly demonstrate the pertinence of operations management in implementing environmental initiatives and improving environmental performance. More than 85% of the announcements in our sample cited one or more operations issues being faced, attesting to the link between operations and environmental management. Thus, through our work, we empirically corroborate the links identified

in the operations management literature between operations decisions and environmental performance.

Although we find that the market does not react to announcements in the aggregate categories of CEIs and EACs, we do find significant market reactions for certain announcement types. Specifically, announcements of philanthropic gifts for environmental causes result in a statistically significant mean (median) abnormal return of 0.46% (0.36%); announcements of voluntary emission reductions result in a statistically significant mean (median) abnormal return of –0.95% (–0.72%); and announcements of ISO 14001 certification result in a statistically significant median abnormal return of 0.77%. The difference between the overall market reactions to the CEI and EAC categories is statistically insignificant.

A limitation of our study is the use of market reaction to announcements as a proxy for changes in firm performance. Although event study methodology is well-established and has been employed to study the financial performance impacts of a variety of phenomena, its application is limited to publicly traded firms and the inherent noisiness of market data can affect the estimates of changes in shareholder value. Alternatively, changes in financial performance may be assessed by employing other measures. As illustrated in Fig. 1, if environmental initiatives indeed improve financial performance, managers can expect to see cost reductions (reflected in decreases in cost of goods sold, or selling, general, and administrative expenses), and/or revenue increases (reflected in increases in measures such as net sales, market share, and asset turnover). An interesting direction for future research would be to use such alternative accounting-based measures of financial performance. This will advance our understanding of the mechanisms by which environmental efforts impact financial performance.

Other avenues for future research include studies of the long-term relationship between environmental performance and market performance. While we observe that the market's reaction to awards is quite different than that reported in the literature a decade ago, statistical evidence across time will inform managers as to the changing nature of the market's assessment of environmental efforts. On a related note, it would also be interesting to further explore why the market reacts somewhat negatively to non-government awards. Another possible limitation of our study is that self-reported announcements of environmental efforts do not imply that the corresponding environmental objectives will indeed be realized. Although challenging, a treatment of the possibility of window dressing or that of ineffectiveness of implemented efforts, will allow for interesting insights into the continuing debate.

Although our study focuses on shareholder value, it is but one measure of value creation. Other measures of value worth exploring in future research include customer loyalty (measured as customer satisfaction, retention rate, or word-of-mouth publicity), employee loyalty (measured as turnover rate, morale, or "pride in work"), and reputation within the community (measured as favorable local opinion arising from such efforts as reducing ambient emissions or generating local employment through environmental initiatives). Estimating the impact of such measures on financial performance can be challenging but very meaningful.

## Acknowledgments

The authors gratefully acknowledge the helpful and constructive comments of the Editor, Associate Editor, and three anonymous reviewers. We thank Robert Klassen for generously providing us with the details of the sample used in Klassen and McLaughlin (1996), which allowed us to compare our sample with

theirs. We also thank Gary Bergmiller, Dan Brooks, Adrian Choo, Sarv Devaraj, Janelle Heineke, Robert Klassen, Richard Lai, Enno Siemsen, Jeff Stratman, and Chris Voss for their suggestions on earlier versions of this paper.

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