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An examination of corporate reporting, environmental management practices and firm performance

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Abstract

Despite the growing interest in environmental management practices (EMPs), research to date has typically analyzed a limited range of these practices and used traditional data sources. In contrast, this paper uses an innovative data source to explore EMPs. We use a more comprehensive set of the practices than prior works in order to test relationships between EMPs and firm performance. The data used in this study comprised environmental and business performance data from 45 corporate reports. Content analysis is used to gather the data and canonical correlation is used for analysis in a two-step process in order to explore the relationships between EMPs and performance measures. Results support previously posited relationships based on traditional data and indicate that EMPs are associated with firm performance.

Keywords: Environmental management; Content analysis; Corporate reports; Multivariate data analysis

1. Introduction

Recently, there has been a great deal of interest in the research literature regarding whether or not environmental management practices (EMPs) can improve firm performance. EMPs are the techniques, policies and procedures a firm uses that are specifically aimed at monitoring and controlling the impact of its operations on the natural environment. The scope of an EMP may be operational, tactical or strategic. According to Rondinelli and Vastag (1996), firms may be reacting to an increasingly difficult regulatory environment or responding to market pressure in adopting EMPs. Regardless of the motivation for employing EMPs, the responses of firms to exogenous pressures have led to EMPs that impact profitability. Currently, firms are trying to understand the benefits of a proactive approach to environmental policies. Firms may become environmentally proactive in anticipation of more efficient utilization of resources and improved corporate image. Despite this intuitive argument, many firms are reluctant to take a more aggressive and proactive approach to EMPs due to a perceived lack of evidence that the benefits exceed the costs of pursuing these initiatives. This attitude is attested to by the relatively

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low number of ISO 14000 certifications that have been issued to US firms (National Institute of Standards and Technology, 1998; Corbett and Kirsch, 2001; International Organization for Standardization, 2002).

It is increasingly important to take note of EMPs for their own benefits. The evidence in both extant literature and anecdotal experiences of firms suggests that EMPs are becoming increasingly popular due to the release of voluntary and international environmental standards. The ISO 14001 standard was released in the fall of 1996 and since then there has been additional pressure on some industry supply chains to address environmental performance through the use of environmental management systems (Zuckerman, 2000; Gordon, 2001). Selecting meaningful and effective tools for measuring environmental performance is also important due to the increasing costs of environmental options, and compliance with regulatory and public pressures (Stern, 1991; Barrett, 1992; Porter and van der Linde, 1995a,b). Other voluntary environmental initiatives, such as the International Chamber of Commerce Business Principles for Sustainable Development have prompted firms to take actions in recent years (Global Envioronmental Management Initiative, 1997). The release of these new standards and voluntary programs presents an impetus for practitioners to better understand the dynamic environment in which they operate and is one reason for researchers to investigate the relationship between EMPs and firm performance (Klassen and McLaughlin, 1996).

Though the research literature has addressed EMPs, most of the research literature has examined a limited set of EMPs. While it is useful to examine the effects that an individual EMP may have on a firm's performance, a more comprehensive discussion is needed in order to explicate the full range of EMPs to practitioners and there is a need to research performance improvement opportunities through EMPs. Thus, the principal objectives of this paper are: (1) to develop and present a more comprehensive set of EMPs; (2) to empirically examine the relationship between EMPs and firm performance; (3) to demonstrate the usefulness of content analysis in operations management research.

The second objective highlights the exploratory and confirmatory aspects of this paper. This paper is exploratory in the sense that a much larger set of EMPs is considered than has been done in previous papers. There is not much if any guidance as to which of the EMPs are most likely to be associated with firm performance, as previous papers typically used a much smaller set of EMPs. A natural implication of this is that new EMP-firm performance relationships may be found. This paper is confirmatory in that it is testing the EMP-firm performance link. Previous studies have examined this link, thought typically with a smaller set of EMPs than will be considered here. In doing so, the results of this study will contribute to the evolving field of environmental management.

The next section reviews literature involving environmental management concepts, EMPs, and effects on the firm. The relevant results of these empirical research studies are presented and corporate environmental reporting is discussed. Section 3 presents how content analysis was performed to collect data from corporate reports. Section 4 presents the results of a canonical correlation analysis. It is followed by Section 5 in which the results concerning the relationship between EMPs and firm performance measures are presented and the implications of the results discussed. Sections 6 and 7 of the paper discuss the limitations of this study and identify potential directions for future research.

2. Literature review

2.1. Link between environmental performance and firm performance

Porter's (1991) "win–win" argument was among the first in the literature to challenge the conventional wisdom that government environmental standards are harmful to the competitiveness of firms. Porter, using anecdotal evidence, argued that the benefits of environmental management are larger than the costs and tighter regulatory standards will in fact lead to innovation. Porter and van der Linde (1995a) continued this line of reasoning by discussing the idea of "innovation offsets". Their argument was that environmental regulations can actually lead to innovations and the resulting benefits may offset the cost of complying with the regulations. They defined two broad categories of innovations. The first consisted of approaches that minimize the cost of pollution after it occurs. The second was improving resource productivity so as to avoid pollution in the first place. The authors present anecdotal evidence to bolster their case. These two articles are particularly important to the environmental management literature stream due to the fact that they elicited a great deal of interest in this topic among researchers. However, it should be recognized that these articles focused on environmental regulation, which is just one impetus for environmental management.

Other authors have argued more broadly for the benefits of proactive environmental management. Berry and Rondinelli (1998) argued for proactive EMPs and

the importance of internal environmental strategies to promote improved performance. They consolidated prior research in order to put forth some conceptual models. They saw multiple mechanisms for a link between environmental performance and firm performance. They argued that environmentally proactive firms will have lower regulatory-related expenses than those firms that are merely aiming for compliance. They also argued that being environmentally proactive will lead to new business opportunities created by increasing demand for both ''clean products and processes'' and participation in voluntary internationals standards.

Using a similar approach, Hanna and Newman (1995), in a conceptual piece, provided a summary of arguments in favor of win–win scenarios. They noted increased customer demand for ''environmentally friendly'' products and services as a potential explanation for linking environmental and firm performance. They also discussed the elimination of waste, which includes emissions and refuse, as a means of lowering cost. Royston (1980), who used anecdotal evidence, Bonifant (1994), and Bonifant and Ratcliffe (1994), who used case studies, anecdotal evidence and some basic industry analysis, offered similar arguments. Sanchez (1997) has also discussed innovation and environmental regulations. The author argued that managers could influence the effect of environmental regulation on their firm's tendency to innovate. Thus, environmental issues and their effects on innovation are seen by many as having positive impacts on firm performance. What is lacking from many of these studies is empirical evidence of a relationship between environmental performance and firm performance.

Florida (1996) was among the first to empirically investigate the relationship between EMPs and performance. Using survey methodologies, he developed a link between advanced manufacturing, productivity and environmental performance. His findings suggest that manufacturing process improvement and productivity improvement efforts create substantial opportunity for improved environmental performance. These findings tend to support the ''win–win'' argument of Porter. However, these findings may not be generalizable since they are based on descriptive statistics rather then rigorous hypothesis testing. He also performed a cluster analysis to test the idea of whether or not firms adopt bundles of related environmental manufacturing practices. Florida claimed the most significant finding from the cluster analysis was that a ''significant fraction'' of his sample firms actively pursued a bundle of technological and organizational innovations aimed at improved industrial and environmental performance. His bundle included 10 EMPs, most of which were operational in scope.

More rigorous empirical tests of the relationship between EMPs and firm performance can be found in proprietary archival data used by Klassen and McLaughlin (1996). They used an event study to investigate how the announcement of a third party environmental award affected a firm's stock market return. This research explored ''the orientation of management toward environmental performance''. The authors did not operationalize environmental practices into specific practices from which a firm could choose. Instead, Klassen and McLaughlin used event history analysis to show a positive relationship between environmental performance and firm performance. This was an apparent confirmation of the ''win–win'' argument. They had two categories of mechanisms for explaining the environmental performance-financial performance link. The first was ''market gains'', which included market share gains, experienced based scale economies, certifications and higher margins. The second was ''cost savings'' which included lower cost structure, avoiding environmental fines and liabilities, and greater productivity due to reduced energy and material consumption.

Russo and Fouts (1997) linked environmental performance to economic performance through an analysis of 243 firms using independently developed environmental ratings. These authors posited that this relationship is moderated by the growth of the industry. Their model of the link between environmental performance and profitability was based on the resource-based view of the firm. They tested the idea that improved environmental performance resulted in a competitive advantage, which was reflected in economic benefits. Their results indicated that it ''pays to be green'' and the relationship is reinforced with the existence of industry growth.

Klassen and Whybark (1999) explored the link between an environmental technology portfolio and manufacturing performance using a forced choice survey instrument. The EMPs used in their research focus primarily on manufacturing technologies and operational performance measures. They found that increasing the allocation for proactive pollution prevention technologies correlated with improved manufacturing performance, whereas increasing the allocation for reactive pollution control (i.e., end of pipe) correlated with worsening manufacturing performance.

Orlitzky et al. (2003) performed a meta-analysis of 52 studies of corporate social performance. They meta-analyzed 139 correlation coefficients specific to the relationship between corporate environmental

performance and corporate financial performance. Their analysis revealed a positive relationship between the two. This meta-analysis seems to confirm the argument that Porter started, namely that improving environmental performance will improve overall business performance.

2.2. Measuring environmental performance

Selecting meaningful and effective measures for environmental performance is becoming increasingly important due to the increased costs of environmental operations; market, regulatory, and public pressures; voluntary initiatives, and international standards (Global Envioronmental Management Initiative, 1997). Investigators who rely on financial reporting typically have many standardized sources of data available. Much of this is due to governmental reporting requirements. For environmental performance data the situation is very different. There is a lack of agreement on how to define and measure this aspect of firm performance, though some researchers have identified the corporate environmental report as the key medium for communicating a firm's environmental performance (Jones et al., 1999). Below, we briefly review some of the efforts to achieve a more standardized reporting of environmental performance.

The Measuring the Environmental Performance of Industry (MEPI) project summarized the issue very well, noting that that measuring environmental performance has many difficult challenges, such as (list below quoted from MEPI web site, http://www.environmental-performance.org/approach/index.php):

- Environmental issues are complex and often difficult to quantify.
- Comparing the environmental impacts of firms with different economic activities is problematic.
- There is no universally accepted approach to weighing different environmental impacts against each other, and any overall assessment will produce highly contested results.
- There is no standard approach to environmental reporting and measurement, although a range of guidelines has now been developed.
- The availability and quality of environmental data is often poor.

Their data collection effort was massive, involving seven institutes and research centers and 13 investigators. They collected data from corporate environmental reports, statements by firms registered with the European Union Eco-Management and Auditing Scheme (EMAS), national pollution inventories (in the UK and The Netherlands) and from survey returns. Of these sources, they stated that corporate environmental reports were their principal source of data (Science and Technology Policy Research at the University of Sussex, 2001).

Other efforts involving environmental reporting and performance include the Global Reporting Initiative (GRI) (Global Reporting Initiative, 2004), and the Global Environmental Management Initiative (GEMI) (Global Environmental Management Initiative, 2004). The GRI group is working ''to develop and disseminate globally applicable Sustainability Reporting Guidelines''. It is a non-governmental organization that has an association with the United Nations. Their process of creating the reporting guidelines is similar to the process used by the International Organization for Standardization. A useful feature of the GRI initiative is that it attempts to standardize environmental reporting. Unfortunately, participation in this initiative is voluntary. As of November 2004, only 584 organizations had registered their reports with GRI. Work at GEMI includes a survey of metrics used by 41 participating companies in the mid 1990s. Some of the outcomes of this study include identification of metrics in use, leading verses lagging indicators, and the attributes of environmental performance indices. According to their research, three of the top six reasons for firms measuring environmental performance include public reporting, public relations, and investor demands. The efforts of GEMI and GRI both demonstrate the importance of measuring and reporting environmental management practices and resulting performance.

There appears to be a lack of research literature that uses MEPI, GRI or GEMI data. For MEPI, the output has come from researchers in the project and has been mostly self-published. GRI and GEMI are reporting guidelines rather than data sets. However, it appears there have not been many efforts to analyze data from GRI or GEMI compatible firms. The MEPI, GRI and GEMI efforts can be useful for researchers due to their efforts to offer a third party-like source of data. However, the fact that these data are not being used widely by researchers is an indication that there are difficulties with these data sets. For this reason, in this project we decided to find an alternative source of data.

2.3. Use of content analysis in operations management research

Based on an extensive literature search, it appears that the use of content analysis as a means of gathering

data in operations management is quite rare. However, in other business disciplines content analysis has been firmly established as a methodological tool. Bligh et al. (2004) investigated leadership by performing a computerized content analysis on President George W. Bush's speeches. Osborne et al. (2001), in the strategy literature, also used a computerized content analysis to determine cognitive strategic groups. Bhattacherjee and Premkumar (2004) used content analysis as part of their study on user beliefs and attitudes toward information technology. Content analysis has also been used to investigate leadership of self-managed teams (Druskat and Wheeler, 2003) and how beliefs about co-workers affect group performance (Kim, 2003).

Of relevance to this paper is the fact that accounting researchers have often used content analysis on annual reports (see, for example Zeghal and Ahmed (1990) and Hackston and Milne (1996)). Gray et al. (1995) created a large database over many years of corporate social and environmental data based on content analysis of corporate reports. Wilmshurst and Frost (2000) concluded that corporate environmental reports fairly reflect what upper management believes are the important environmental issues to stakeholders.

Also relevant to this paper is the work of Rondinelli and Berry (2000). They performed a content analysis on the environmental reports of 38 firms in order to investigate environmental citizenship. Their paper does not describe the details of the content analysis, nor does it attempt to statistically analyze the data from the content analysis. In this paper, we have attempted to do both.

2.4. Summary of literature review

In general, there has been limited but growing empirical research in the environmental management field. The difficulty in measuring environmental performance is evidenced by the diversity of data used, from anecdotal, case study, survey, to proprietary data sources. This represents a range from the purely perceptual, but potentially broad (surveys), to the highly standardized, but narrow (EPA's Toxic Release Index). Thus, there is an opportunity to incorporate new types of data into research involving environmental management.

The literature that supports the win–win hypothesis tends to take a narrow view of EMPs in that it has tended to focus on a smaller subset of EMPs, with some papers focusing on waste reduction, some on manufacturing technology and remanufacturing techniques, and yet others on product design. In order to further the discussion of the relationship between EMPs and firm performance, it is necessary to test a larger set of EMPs to support or refute the "win–win" hypothesis, and to identify where resources are best allocated in developing EMPs.

The specific mechanisms that have been posited to explain the environmental performance-firm performance link have tended to fall into two categories. The first is cost-based, wherein firms adopting EMPs will lower their cost structure. The second is demand-based. That is, firms use EMPs to exploit business opportunities brought about by stakeholder demands for better environmental performance. In both cases, EMPs are the vehicle through which innovation occurs. For instance, a firm engaging in recycling may re-evaluate the materials it uses in its products. This may result in innovative use of current materials or the inclusion of a new, innovative material.

3. Data collection methodology

3.1. Use of corporate environmental reports for data collection

There were several reasons for using corporate environmental reports rather than other forms of data. As explained in the literature review, comprehensive efforts at measuring environmental performance have been limited and so far have not proven to be widely available to researchers. A survey could have been used, but this study uses a much larger set of EMPs than previous efforts, so the research team was concerned about the efficacy of a survey to get data on all the EMPs. A case study/field interview approach could have been used to overcome this weakness, but the time required to conduct a sufficient amount of such interviews was prohibitive. Given that the research team desired to perform a statistical analysis of the EMP-firm performance relationship, corporate environmental reports are a logical choice as they contain the information needed and are relatively easy to obtain. Content analysis is a suitable approach for converting the information into data needed for our study.

Content analysis has been defined as a systematic, replicable technique for compressing many words of text into fewer content categories based on explicit rules of coding (Berelson, 1952; Krippendorff, 1980; Weber, 1990; U.S. General Accounting Office, 1996). Content analysis enables researchers to filter large amounts of data in a systematic fashion (U.S. General Accounting Office, 1996). It can be argued that this is a useful technique for allowing researchers to discover and describe the focus of individual, group, institutional, or

social attention (Weber, 1990). It also allows inferences to be made which can be corroborated with other methods of data collection. Krippendorff (1980, p. 51) notes that ''content analysis research is motivated by the search for techniques to infer from data what would be too costly, no longer possible, or too obtrusive by the use of other techniques''. The lack of standardization of environmental performance data, as discussed in the literature review, would certainly fit that description.

The unit of analysis in the data collection was the firm. This was chosen as gathering information on all of the EMPs in our set at the plant level would have changed the nature of this study. To date, the authors are unaware of any third party sources of information regarding EMP performance at the plant level. Further, firms typically do not make this information about EMP performance available at the plant level although they might gather it internally. So to get this type of information at the plant level some type of survey methodology would have been required.

The data collection included a variety of US and non-US firms. This leads to the question of whether or not this type of reporting is consistent across international boundaries. Unfortunately, the research literature has had very little to say about this. Hackston and Milne (1996) reviewed a number of studies on corporate social disclosure, which is the rubric that environmental disclosure falls under. Based on this review, they concluded that the amount of corporate social disclosure among US, UK and Australian firms is ''reasonably consistent'' based on average pages per company. This is an indication of consistency across international lines, but not conclusive proof. Investigating the amount and types of differences in voluntary environmental reporting based on country of origin is something that should be done in future research.

The web page version of the reports was chosen over the printed version in order to gather the reports expeditiously. Comparison of hard copy and web reports from a sub-sample of companies revealed no substantive differences in the content of the different versions of the reports. This concurs with one of the few studies to explicitly measure the differences between web-based and printed environmental disclosures, as Cormier and Magnan (2004) found ''extensive overlap'' between the two versions.

3.2. EMP set and matrix

As indicated in the literature review, previous research has examined a limited range of EMPs. Yet this same literature, in combination with the business press, makes it apparent that there is a wide range of EMPs. For the purpose of this study, a set of EMPs was developed. This was based not only on the research literature, but also included anecdotal accounts in the business press, the research team's interactions with managers in industry and previous projects on environmental management in which members of the research team had participated. This set of EMPs was developed with the specific intent of capturing the majority of techniques, options and policies regarding environmental management. Appendix A displays the definitions sheet for the EMPs that was given to the data collection team of raters.

In order to recognize that the EMPs have different scopes and potential impacts, the research team classified the EMPs as operational, tactical or strategic. Operational level environmental management practices are usually internally focused and generally pertain to shop floor operations. Tactical level practices fall somewhere between operational and strategic practices and can be viewed as representing both internal and external foci. Strategic practices are usually externally focused and are typically a set of objectives, plans, and policies established by top managers reflecting the firm's environmental posture to external constituencies and stakeholders (Sroufe et al., 2003).

This set was next converted into an ''Environmental Practices Matrix'' (see Appendix B) for use in a content analysis. This matrix consists of environmental management practices grouped into three categories: tactical, operational, strategic practices. As can be seen in Appendix B, each EMP has a column for objective measures of the attribute and intensity of use of the attribute. An additional field was used to indicate if the firm noted any measurements of the EMPs (e.g., tons of paper recycled, resources allocated, etc.), how involved the firm was with the EMP, and where in the environmental report the EMP could be found.

3.3. Execution of data collection

Firms from different industries, products, processes and sizes were selected based either on self-selection or outside recognition for being proactive with regard to environmental issues. These firms are more likely to use a wider variety of EMPs than ''laggard'' (Sroufe et al., 2000) firms. The objective of this sampling approach was to construct a sample of firms that would be diverse enough to capture a wide range of EMPs that may be overlooked in a single industry or single product sample.

A list of potential firms was drawn from four sources. The first was a Wall Street Journal advertisement

(Business Roundtable, 1997). In the advertisement, firms asked for additional research into proposed more stringent environmental regulations, while identifying themselves as being environmentally concerned. The second source was a *Fortune* article on most improved environmental performers (Rice, 1993). The third source was "Global Environmental Management Views" (Krut and Drummond, 1997). Lastly, the research team relied upon its knowledge of leading firms in the field of environmental management. This yielded a list of 94 potential firms. The resulting sample contained a mix of US and international firms.

Data were gathered from corporate environmental reports from the web sites of the sample firms. Using "site map" features found on the web pages and a checklist, the research team ensured that the complete environmental report was printed out for each firm. The final sample size resulted in 45 complete corporate environmental reports. The sample size used in this study (45) is consistent with similar studies of this type (Hackston and Milne, 1996). Table 1 lists the firms included. Note that we have not given the web addresses (i.e., Uniform Resource Locators) for these reports, as many of the web links are no longer active for the reports used in this study. This is an example of the internet citation decay effect that has been investigated by communications researchers (e.g., Dimitrova and Bugeja, in press).

The content analysis was performed by four senior-level undergraduate students. The raters attended a training session in which they were briefed on the objectives of the research and trained as to how to fill out the coding sheets used for data collection. The researchers explained the coding process for a sample firm. Raters were given a list of definitions and a coding matrix for each firm studied. See Appendices A and B for the definitions used and the coding matrix. These documents were given to the raters as a guide to what they should look for in rating each firm's involvement with the listed EMPs. Data for each environmental practice was captured on a five point Likert scale, with 1 representing a low intensity of involvement with the practice, and 5 representing a high intensity of involvement. Following the training sessions, raters completed a coding sheet for each firm's corporate environmental report. These were reviewed by the researchers for completeness and the coded data were entered into a database.

The corporate environmental reports were coded over a period of 4 weeks. Raters were asked to re-rate the first few reports a second time, after they analyzed all of the reports. This was done to ensure consistency in their ratings. Inter-rater reliabilities were calculated based on guidelines from Shrout and Fleiss (1979). The reliability as measured by alpha was 0.77 across the four raters, which is within the levels normally considered acceptable (Nunnally, 1978). Also, note that Milne and Adler (1999) found "novice" coders to be sufficiently reliable for this type of analysis. Based on this, the information provided by the coders can be deemed reliable.

The average of the four raters' scores for each EMP at each firm was used during the analysis. Additional information such as return on investment, sales growth (measured as the percentage increase in sales from the previous year), return on assets and operating earnings was gathered independently of the content analysis using Compustat and World Scope databases.

Table 1
Firms in this study

3M	Dupont Co.	Mobil Corp.
ABB	Eastman Chemical Co.	Motorola
American Electric Power Co.	Electrolux Group	Nestle
Amoco Corp.	Exxon	Novartis
ARCO	Ford Motor Company	Raytheon
AT&T	General Motors Corp.	Rockwell
Bang & Olufsen	Georgia-Pacific	Shell Oil Corp.
BASF	Goodyear Tire and Rubber Company	SKF
Bethlehem Steel Corp.	H.B. Fuller	Stat Oil
Bristol Myers Squibb	Hewlett Packard	Texaco Inc.
Chevron Corp.	IBM	Texas Instruments
Compaq	International Paper Co.	Union Camp
Danfoss	ITT Corporation	Union Carbide Corp.
Digital Equipment (Compaq)	Johnson and Johnson Co.	Weyerhaeuser
Dow Chemical Co.	Mead Corp.	Xerox

4. Analysis and results

4.1. Analysis methodology

Grounded on the results of previous research (Starik and Rands, 1995; Russo and Fouts, 1997; Klassen and Whybark, 1999), the principal issue examined in this study is the relationship between EMPs and firm performance. The objective was to test the relationship between two sets of variables with the independent variables corresponding to EMPs and the dependent variables corresponding to performance dimensions. Testing this type of hypothesis can be done via multivariate regression techniques. As two sets (EMPs and firm performance) of variables in a single relationship are being tested, canonical correlation analysis is used (Hair et al., 1998; Andrews et al., 1998). This technique predicts multiple dependent variables from multiple independent variables. As a comparison, multiple regression predicts a single dependent variable from multiple independent variables.

Canonical correlation is also similar to factor analysis in that it creates composites of variables. In particular, this technique develops canonical functions that maximize the correlation between the linear composites. These composites are also known as canonical variates. The canonical functions indicate relationships between the set of independent variables and dependent variables. The maximum number of canonical functions that can be derived is equal to the smallest number of variables in either the dependent or independent variable set. For an excellent primer on canonical correlation, please see Hair et al. (1998).

Hair et al. (1998) advise making sure the specification of the variable sets is based on a strong conceptual foundation. To this end, the researchers condensed the 48 EMPs given to the raters into a smaller set of 20 EMPs. The basis for selection was the a priori association (in the judgment of the researchers) between each variable and the concepts that the literature suggests link environmental performance to financial performance. The first concept was the innovation offset from Porter and van der Linde (1995a). The other concepts were the two mechanisms specified by Klassen and McLaughlin (1996), lowering the cost structure and working to meet new business opportunities.

In the operational practices category, the researchers identified seven practices: recycling, proactive waste reduction, reactive waste reduction, remanufacturing, consume internally, market for waste, and money spent on environment. Eight practices were identified under tactical practices: early supplier involvement, environmental standards for suppliers, environmental audits for suppliers, environmental awards, life cycle analysis, environmental design, specific design target, and environmental risk analysis. There were five strategic practices: corporate policy, environmental mission statement, environmental department, surveillance of market, and strategic alliance.

The dependent variables used in the analysis came from the literature. As discussed earlier, Porter and van der Linde (1995a) presented the argument of ‘‘innovation offsets.’’ As measures of innovation, the research team used the two constructs defined below. The raters were asked to look for specific mention of innovations. In particular, innovations that were attributed to environmental efforts were to be scored higher.

Product innovation: This item measures how well the firms have done in introducing product innovations and whether they are actively investigating product innovations.

Process innovation: This item measures how well the firms have done in introducing process innovations and whether they are actively investigating process innovations.

As discussed in the literature review, many studies have analyzed the effect some aspect or technique of environmental management has on financial performance. In order to measure the impact EMPs have on financial measures, the following variables were used:

Return on investment (*ROI*): This is an objective financial performance measure that is a reflection of overall firm financial performance.

Sales growth: This item was measured as the percentage increase in sales from the previous year.

The relationship between the 20 EMPs, comprising the set of independent variables, and the four dependent variables (product innovation, process innovation, ROI and sales growth) was analyzed using canonical correlation analysis. In order to ensure that the results are not sample-specific, a stepwise procedure was used (Thompson, 1984). This stepwise procedure also culls the variables, with the result that the final analysis is closer to the recommended number of observations per variable (Hair et al., 1998). The procedure used was the following:

(1) All 20 independent variables were assumed to be significant and put into a group referred to as ‘‘sig’’.
(2) The independent variables in the group ‘‘sig’’ and the performance (dependent) variables were entered into the canonical correlation analysis.

(3) Those independent variables found to be non-significant were removed from sig group and put into a group labeled ''non-sig''.
(4) Repeat (2) and (3).
(5) The independent variables in group ''non-sig'' and dependent variables are entered into canonical correlation function. Those significant independent variables are removed from ''non-sig'' group and put into ''sig'' group.
(6) Repeat (2)–(5) until there are no membership changes between group ''sig'' and ''non-sig''.

SYSTAT was used to compute all the analyses in this study.

4.2. Data

Hair et al. (1998 p. 448) stated that ''the prevailing guideline'' for multivariate normality ''is to ensure that each variable has univariate normality''. Standard tests of univariate normality indicated no particular problems. The multivariate kurtosis was 1.63, as measured by Mardia's coefficient (Mardia, 1970). This indicates that the data are multivariate normal. Analysis of the Mahalanobis D^2 measure also did not indicate any outlier problems. Hair et al. (1998) recommend examination of scatterplots for both determining homoscedasticity and linearity. Review of such plots revealed no concerns that these assumptions have been violated.

4.3. Results

There were six independent variables left in the ''sig'' group after the final iteration: recycling, proactive waste reduction, remanufacturing, environmental design, specific design target, and surveillance of market.

The results for the canonical functions are shown in Table 2. The p-value for the second function is .057, just over the normal cut-off of .050. This function is very close to the normal cut-off and the Bartlett test has been described as ''conservative'' (Darlington et al., 1973). Note that the lower redundancy indices and the Bartlett test results indicate that the third and fourth functions are lacking in practical significance (Hair et al., 1998).

The Stewart–Love canonical redundancy index (Stewart and Love, 1968) for the overall analysis was .380. As Hair et al. (1998) note, this index is analogous to multiple regression's R^2 statistic. The result is reasonable given the many possible explanatory variables for firm performance; this will be discussed further in Section 6.

To check for small sample size bias, a stability analysis was performed. The results of the stability analysis are shown in Table 3. Canonical loadings are consistent when independent variables are deleted one at a time and this is a good indication of the absence of sample bias (Hair et al., 1998).

Table 2
Canonical correlations and loadings

	First canonical function	Second canonical function	Third canonical function	Fourth canonical function
Canonical correlation	.839	.623	.386	.346
Bartlett test of residual correlations (p-value)	.000	.057	.335	.261
Canoncial loading of independent variables				
Recycling	.599	.280	.300	.106
Proactive waste reduction	.648	−.481	.174	−.390
Remanufacturing	.754	.021	.347	.182
Environmental design	.861	−.081	−.424	.201
Specific design targets	−.053	−.857	−.008	.404
Surveillance of market	.574	-.009	.417	.522
Redundancy indices	.284	.068	.015	.013
Canoncial loading of dependent variables				
Product innovation	.708	−.193	−.423	.531
Process innovation	.745	−.614	−.194	−.171
ROI	−.267	−.672	−.015	.691
Sales growth	.318	−.319	.838	.308
Redundancy indices	.216	.094	.034	.026

Table 3
Stability analysis results for removal of an independent variable

Canonical loadings	Before deletion	After deletion of					
		Recycling	Proactive waste reduction	Remanufacturing	Environmental design	Specific design target	Surveillance of market
Recycling	.599	Omitted	.598	.599	.599	.600	.599
Proactive waste reduction	.648	.648	Omitted	.647	.647	.648	.648
Remanufacturing	.754	.755	.754	Omitted	.754	.754	.754
Environmental design	.861	.861	.861	.860	Omitted	.862	.861
Specific design target	−.053	−.051	−.052	−.053	−.053	Omitted	−.053
Surveillance of market	.574	.574	.574	.574	.574	.574	Omitted
Product innovation	.695	.695	.695	.695	.695	.695	.695
Process innovation	.278	.278	.277	.277	.279	.278	.278
ROI	−.646	−.647	−.646	−.646	−.646	−.647	−.646
Sales growth	.403	.405	.404	.403	.404	.404	.403

5. Discussion

5.1. Identification of significant EMPs

The primary research question was to analyze which, if any, EMPs were associated with firm performance. The analysis pared down those EMPs found to be statistically insignificant until only six EMPs were left. Thus, the first contribution of this research is the identification of these six EMPs. These were:

(1) *Recycling*: This item measures whether firms recycle or not and for how long. Recycling helps with cost savings via more efficient use of materials. Recycling can also improve a firm's image, which may help to improve sales growth. Given how the use of recycling was described in the environmental reports, it appears that the mechanism of reducing the cost structure is perceived to be more important than improving image.
(2) *Proactive waste reduction*: This measures the degree of *proactive* approaches to reducing waste in processes and or the elimination of waste before it is produced. This EMP focuses on cost reduction.
(3) *Remanufacturing*: This item is the degree to which the firm rebuilds a product where some of the parts or components are recovered or replaced. This EMP lowers cost structure.
(4) *Environmental design*: This measure is concerned with the use of environmentally conscious design processes. This is in line with Porter's idea of innovation offsets, as it may be the case that using environmentally sensitive design processes does in fact result in greater product innovation and thus higher firm performance.
(5) *Specific design targets*: If a firm uses specific targets for achieving environmentally conscious designs, it would have scored higher on this measure. Interestingly, this measure could be tied to the three operational measures found to be significant in this study. This is because a firm may choose to set a design goal that a certain percent of product content needs to be remanufactured or recycled. As will be seen below, this particular EMP appeared to have a negative relationship to firm performance.
(6) *Surveillance of the market for environmental issues*: This measure identified those firms that look for opportunities in the future related to environmentally friendly practices. This result would argue for a more proactive approach to environmental issues, which is somewhat in contrast to the prescriptions offered by Rondinelli and Vastag (1996). This EMP is most likely allied with the idea of a demand-based mechanism. In the case of this EMP, the firm is actively seeking out opportunities to fulfill future demand that is based on environmentally friendly products or processes.

Table 2 shows the four functions. Only the first two are considered here, as the lower redundancy indices and the Bartlett test results indicate a lack of practical significance for the third and fourth functions. Hair et al. (1998) stated that since the functions in canonical correlation are optimized for prediction, not interpretation, the identification of relationships is more difficult. Thus, we approach this discussion from an exploratory point of view. This is in line with the previous discussion of the lack of a priori linkages from the literature.

5.2. Canonical functions

The canonical correlation determines what, if any, relationships exist between sets of variables. Multiple regression examines many-to-one relationships and allows the user to examine how much each variable contributes to the relationship. In contrast, canonical correlation examines many-to-many relationships; however it still allows the user to examine the contribution of individual variables. Each canonical function represents a many to many relationship and the contribution of each individual variable to a function is measured by the canonical loading.

In the first function, the independent variables environmental design, remanufacturing, proactive waste reduction, recycling and surveillance of the market exhibit high loadings. Only specific design targets exhibits a low loading, which is in fact small and negative. For the dependent variables, the first function has very high loadings for product innovation and process innovation. This first function thus appears to confirm the win–win hypothesis in that EMPs are positively associated with product and process innovation. These results are consistent with Porter and van der Linde (1995a) argument for innovation offsets. Note that Porter and van der Linde did not empirically test this argument.

The two other dependent variables in the first canonical function present an interesting situation. Sales growth's loading was relatively low (.318) and ROI had a negative loading (−.267). The inclusion of ROI was meant to capture a more traditional measure of firm performance. However, a problem with using ROI is that so many factors (independent variables) affect it. That is, it is very likely that there are many other variables not used by this study which determine ROI. It is easier to draw a connection between product innovation and process innovation, and sales growth. The loading exhibited may be large enough to convince researchers that the ''win–win'' hypothesis holds. It is conceivable that the effect of the innovation offsets on sales growth is lagged by some period of time. (By extension, this lagged effect may be the case for ROI as well.) Unfortunately, the current research literature offers little guidance on the length of this lag. On possible lens for viewing this might be the reputation literature, in that a firm which consistently demonstrates product innovation and process innovation may eventually be rewarded by higher sales.

The second function exhibits mostly small and negative loadings for the independent variables with one exception. Specific design targets, the one variable that loaded very lowly on the first variate, exhibits a large and negative loading on the second variate. It appears that the specific design targets variable stands apart from the other independent variables. This is an unusual result. However, Bartlett test for the second variate is .057, just past the normal cut-off of .05. Further, the redundancy indices of the second function are poor. Thus, the practical significance of this function is quite low. The primary lesson from the second function is that the use of specific design targets may not be as useful as some firms would like.

The primary managerial implication of these results is that if a firm wants to see measurable effects on their firm performance via EMPs, recycling, waste reduction, remanufacturing, environmental design and surveillance of the markets appear to be the EMPs that are likely to have the greatest impact. Note that this result differs from previous studies, which typically only tested one EMP.

The fact that six EMPs were shown to be significantly related to firm performance also has theoretical implications. Our results indicate that it is possible for more than one EMP to have a significant relationship with firm performance. The EMP set that was developed and the results show the importance of testing more than one EMP. Previous research had not tested such a large group of EMPs. Our study fills this gap in the literature and lays the foundation for future research. In particular, the canonical loadings, as shown in Table 2, indicate that environmental design, remanufacturing, and proactive waste reduction are key predictors of the outcome variable.

Interestingly, of the six EMPs that appear to have a statistically significant relationship to firm performance, specific design targets do not appear to play an important role based on the canonical loadings. This is an unexpected result, given the importance of environmental design (Sroufe et al., 2000). Future research should investigate this result further.

There were also 14 independent variables that did not make it into the final analysis. It would be premature to conclude that these EMPs are not effective in improving firm performance. Future research that tests large sets of EMPs on a larger sample of firms would be needed to confirm this finding. Similarly, concluding that these 14 EMPs do not matter or can be ignored by managers would be inappropriate. These EMPs were being used, though the data from the raters indicated that these 14 practices tended to be used less often than the others. It is likely that the usage of particular EMPs will rise and fall as new management techniques are developed. Tracking how the changing use of EMPs affects firm performance would be a useful future study.

This analysis used a set of EMPs much larger than what the research literature had previously considered. The canonical correlation analysis identified remanufacturing, environmental design, design goals, and surveillance of the market for environmental innovation as being associated with firm performance. Further, the analysis in this study reveals that there are potential innovation offsets. Earlier, this was referred to as the ''win–win'' hypothesis. Our results provide confirmation of this hypothesis. As this study used an innovative data source, it can be argued that we have provided a type of triangulation for testing this hypothesis. The results of this study should be of interest to firms considering whether or not environmental programs or investments should be pursued. To answer Kleiner (1991) question, ''What does it mean to be green?'' the results indicate that certain EMPs are positively associated with firm performance.

6. Limitations of this study

One of the primary limitations of this research is the lack of standards for environmental reporting. Though many of the reports used in this study followed a similar format, there is no standard way of releasing this information, which is in direct contrast to the financial reporting required by the Securities and Exchange Commission and the Financial Accounting Standards Board. As previously discussed, there have been efforts to standardize these reports, such as GRI and GEMI. However, a continuing weakness of these efforts is a rather low level of participation. Thus an intuitive direction for future research would be to use standardized measures of EMPs. Currently, there is a lack of such measures for many of the EMPs defined in this study.

We must also recognize that this is a cross-sectional analysis. As with all such analyses, there is a question of the time lag between implementation of an EMP and its effect on firm performance. If the efforts of groups such as GRI and GEMI become more prevalent, in the future researchers will be able to avail themselves of multiple years of standardized environmental reports. Alternatively, future researchers could attempt to replicate this study using multiple years of environmental reports. The authors would suggest that these researchers gather the hard-copy version of the reports as the internet citation decay effect (Dimitrova and Bugeja, in press) makes gathering the online version of these reports for multiple years difficult.

As discussed in Section 4, it must be recognized that there are many possible determinants of firm performance. This study analyzed those specific to environmental management practices. In order to increase the understanding of the links between environmental performance and firm performance, future studies should use more detailed environmental performance data. Of course, as was discussed in the literature review, this type of data is difficult to obtain.

The sample size must be recognized as a limitation. Our sample size is below Hair et al. (1998) recommendation of 10 observations per variable for canonical correlation analysis. This may obscure some relationships among the variables. Content analysis is perhaps not as efficient as surveys for gathering data. However, given the difficulties of obtaining information on all the EMPs used in this research, content analysis was a logical choice for data gathering.

As stated previously, firms that were seen as leaders in EMP use were targeted. This was done in partial recognition of the fact that these firms were more likely to have environmental reports. However, it can be argued that the purposive sample used in this study does place some limitations on the generalizability of the results.

7. Conclusions

This study contributes to the operations management field through the identification, development, and testing of environmental management practices using an innovative data source. The results of this study demonstrate significant and positive relationships between EMPs and measures of performance. An additional contribution of this study is a test of the ''win–win'' hypothesis using an innovative data source. The results regarding the usage of EMPs demonstrate that the range of EMPs available to the firm is much larger than that implied by previous research. Results presented in this paper concur with arguments from the literature, such as Hanna and Newman (1995), Royston (1980), Bonifant (1994), and Bonifant and Ratcliffe (1994). In particular, this study empirically examined the relationship between environmental management practices and firm performance in order to see if Porter and van der Linde (1995a) ''win–win'' argument can be supported. Using corporate environmental information, content analysis, and multivariate data analysis, the results support Porter and van der Linde's arguments for innovation offsets. Additionally, the results show that firms in the study use a wide range of EMPs and that these practices are positively associated with multiple firm performance measures.

From a practitioner's standpoint, this study demonstrates the spread of environmental management practices; for researchers, it highlights the need for examining a more comprehensive set of environmental management practices, rather than a limited set of techniques. Future research should examine a wider range of EMPs with an eye towards examining how and why the relationship between EMPs and performance develops. Further, future research would be well served by examining the specific mechanisms behind the significant relationships found in this paper.

For researchers, this study also highlights the use of a data collection methodology, content analysis, which has not seen much use in operations management. To the extent that there are concerns about the ability to gather data via traditional methods in operations management (Frohlich, 2002), the use of innovative data sources will have to become more prominent in the field. This study has shown that content analysis can be used in operations management.

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Appendix A. Environment practices definition sheet for raters

A.1. Research project

A.1.1. Environmental practices

Please remember that there are no right or wrong answers to the report evaluations. We simply need your evaluation of the intensity of involvement by a firm in the following activities and practices.

Key words are in *italics*—1: not doing it, 2: eludes to doing it, ...5: quantitative measures, categories, and targets.

Operational practices

1. *Recycling*: are they doing it? (yes/no) How long (number of years) have they been doing it? Scope of recycling (office paper (low) vs. production process (high))
2. *Waste reduction (proactive)*: *Pollution prevention*, *proactive* Talk in terms of proactive approaches to pollution prevention. Elimination of waste before it is produced. More specific to pollution prevention
3. *Waste reduction (reactive)*: *Emissions*, *Reduction*, Talk in terms of ''reactive'' approaches to reducing waste, i.e., scrubbers, and incinerators, and treatment of waste
4. *Remanufacturing*: *Remanufacturing* Rebuilding a product where some of the parts or components are recovered or replaced
5. *Substitution*: *Substitution* Replacing a material that can cause environmental problems with another material which is not problematic
6. *Consume internally*: consume waste, or scrap internally. Sometimes done for the generation of electricity, recycle waste into other products
7. *Packaging: Returnable packaging*, *reduced packaging, recyclable packaging, environmentally responsible packaging* using packaging and pallets that can be returned after they are finished being used. New alternative to packaging
8. *Spreading risk*: shifting responsibility for environmental problems to a third party or expert better able to deal with issues
9. Creating a market for waste products: treating waste as an input to another product that can be made and sold at a profit
10. *Energy: energy conservation, efficiency*, *recovery, fuel recovery* capturing energy that was a previous emission in the form of steam, or heat. Installing energy efficient equipment, or equipment that can capture previously released energy. Could also include proactive approaches to reduce fuel consumption for logistics activities
11. *Money spent on environmental initiatives*: *Resource Allocation*, Any statistics or numbers given on resources allocated to environmental activities, or projects?
12. *Environmental information*: *Cost accounting, tracking, capturing* This would include accounting for environmental costs, attempting to put a cost on environmental programs and projects
13. Rewards as incentive for environmental project: do they have employee, or supplier incentive programs that reward ideas for environmental improvement?

Tactical

14. *Supply chain management: Suppliers* When making sourcing decisions is there criteria that include or exclude suppliers based on environmental dimensions? How specific is description of evaluation procedure?
15. *Early supplier involvement*: *Suppliers* are suppliers involved in new product design? (yes/no)
16. *Environmental standards for suppliers*: *Suppliers* (yes/no)
17. *Environmental audits of suppliers*: *suppliers, Audit* (yes/no) are suppliers audited on environmental dimensions?
18. *Environmental awards/recognition: Awards corporate citizen* recognition by government bodies (Fed, State, and local), magazines, and environmental groups for environmental achievement

Appendix A (*Continued*)

19. *Environmental participation*: *ISO 14000*, *Eco-Management and Audit Scheme* (*EMAS*), *EPA 33/50, Green Lights, Green Seal, Waste Wise* participation in OSHA Voluntary Protection Programs (VPP), EPA voluntary programs, ISO 14000. This refers to participation in these types of programs and NOT that the firm has received certification
20. Use of life cycle analysis or design for environment: *Life Cycle* (*LCA*) (yes/no)
21. *Product development and innovation*: *Research, Technology Transfer*, *Products and Services*, *Integrate*, *New Product Design* Is the company investing in environmental R&D? # of new products or the extent of product modifications driven by environmental considerations. Environmental factors drive innovation
22. *Design*: *Eco Efficient Products, Eco Design*, *Process Improvement* Do they mention the stages in which environmental checks are performed. Percentage of products that use environmentally sensitive design processes
23. *Specific design targets*: *Goals %* improvements, do they quantify environmental design goals?
24. *Environmental risk analysis*: *Risk*, *Audit*, *Prior Assessment* Do they assess the risks of materials to the environment, to people
25. *Environmental management systems (EMS)*: also called Environmental Management Information Systems (EMIS) If the company is ISO 14000 certified they will have an EMS. Do they Talk about an EMS, or EMIS?
26. *Communication*: Communications with stakeholders (stockholders, employees, customers, supplier, and community) as to the environmental impacts of the firm and or the environmental efforts and activities of the firm. How well do they get the word out

Strategic

27. *Integration with long-term business strategy*: *Long-term*, *10 year plan*, *20 year plan*, *Sustainable Development, Emergency Preparedness*, *Compliance and Reporting, Focused*
28. *Corporate policies and procedures*: *Integrated Management*, *Precautionary Approaches* extent? Level of detail, extent of involvement throughout the organization. Compliance, commitment to exceed compliance
29. *Environmental mission statement*: *Corporate priority*, *Strategic*, *Leadership* Mission/Vision Statement
30. *Employee programs*: *Education, Employee Programs, Training, Hours of Training* Do they mention training programs, suggestion programs and the benefits of the programs? Vague (1) ... or specific terms (5)? (e.g., X hours of employee training per year, or the number of employees w/environmental training)
31. *Environmental department/teams (existence/extent of formal organizational structure)*: *Environmental Team* How high is it in corporate hierarchy? How large of a budget does it have? Where do they report to? Number of people
32. *Surveillance of the market for environmental issues*: CFC or PVC free cars ... Do they look for opportunities in the future for environmentally friendly opportunities
33. *Strategic alliances*: *Alliances* Alliances with other firms to jointly work on environmental projects

Performance measures

34. *Reduction in significant environmental incidents*: *Impact* Reduce/prevent the number of spills, or accidents
35. *Environmental certification*: ISO 14000, EMAS, Green Seal. The firm has specifically received certification. Participation or attempts to achieve certification should not be scored here
36. *Continuous improvement*: *Continuous Improvement* The firms talks about continuously setting new goals and meeting these goals
37. *Recycling performance*: *Recycling*, recycling performance in term of goals met, % reductions in recycling of materials (solid, liquid, and gas)
38. *Customer and shareholder perception of environmental performance*: *Customer Advise* Do they collect and use feedback from the surrounding community and interest groups?
39. *Independent audits of environmental performance*: How extensive is it? Independent assessment of performance (outcomes) Who receives the report? (Board, government) How extensively is report published?
40. *Waste reduction*: categories of waste reduction (solids, liquids, gaseous ...) (1) not in compliance and (5) exceeding compliance. Numbers given for emission reductions, output measures. How well are they doing relative to goals?
41. *Resource consumption (water, energy, steam, solids, fuel)*: Usually discuss the reduction in resources consumed for manufacturing practices
42. *Cost savings for environmental projects and activities*: Objective numbers given for the amount of money saved due to proactive environmental activities
43. Return on assets
44. Return on investments
45. Operating earnings
46. Sales growth
47. *Innovation performance (products)*: Overall, how well have they done in introducing innovations and are they constantly looking for innovations? Are there specific mentions of innovations? Innovations attributed to environmental efforts should be scored higher
48. *Innovation performance (process)*: Overall, how well have they done in introducing innovations and are they constantly looking for innovations? Are there specific mentions of innovations? Innovations attributed to environmental efforts should be scored higher

Appendix B. Environmental pratices matrix

= amount of $ spent or saved

If an environmental practice is not mentioned, it should be rated as a 1 in the matrix.

Firm: _____

Rater: _____

Question	Attribute	Yes/no	Objective measures	Low	Intensity Scale			High	Notes, page numbers
Operational practices									
1	Recycling			1	2	3	4	5	
2	Waste reduction (Pro)			1	2	3	4	5	
3	Waste reduction (Rea)			1	2	3	4	5	
4	Remanufacturing			1	2	3	4	5	
5	Substitution			1	2	3	4	5	
6	Consume internally			1	2	3	4	5	
7	Packaging			1	2	3	4	5	
8	Spreading risk			1	2	3	4	5	
9	Market for waste			1	2	3	4	5	
10	Energy			1	2	3	4	5	
11	Money spent on Env.		#	1	2	3	4	5	
12	Environmental information			1	2	3	4	5	
13	Rewards/incentives			1	2	3	4	5	
Tactical									
14	SCM			1	2	3	4	5	
15	Early supplier involve			1	2	3	4	5	
16	Enviromental standard for suppliers			1	2	3	4	5	
17	Enviromental audits suppliers			1	2	3	4	5	
18	Enviromental awards			1	2	3	4	5	
19	Enviromental participation			1	2	3	4	5	
20	Life cycle analysis			1	2	3	4	5	
21	Product dvlp. innovate			1	2	3	4	5	
22	Design			1	2	3	4	5	
23	Design targets/goals			1	2	3	4	5	
24	Enviromental risk analysis			1	2	3	4	5	
25	Enviromental management systems			1	2	3	4	5	
26	Communication			1	2	3	4	5	
Strategic									
27	Int. long-term			1	2	3	4	5	
28	Corp. policy/procedure			1	2	3	4	5	
29	Environmental mission statement			1	2	3	4	5	
30	Employee programs			1	2	3	4	5	
31	Environmental department			1	2	3	4	5	
32	Surveillance of Market			1	2	3	4	5	
33	Strategic alliance			1	2	3	4	5	

Environmental/financial/market performance						
34	Reduction in incident	1	2	3	4	5
35	Environmental certification	1	2	3	4	5
36	Continuous improvement	1	2	3	4	5
37	Recycling performance	1	2	3	4	5
38	Customer perception	1	2	3	4	5
39	Independent audits	1	2	3	4	5
40	Waste reduction	1	2	3	4	5
41	Resource consumption	1	2	3	4	5
42	Cost savings	1	2	3	4	5
43	Return on assets	1	2	3	4	5
44	Return on investment	1	2	3	4	5
45	Operating earnings	1	2	3	4	5
46	Sales growth	1	2	3	4	5
47	Innovation product	1	2	3	4	5
48	Innovation process	1	2	3	4	5

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