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Corproate environmental strategy and practices: Antecedence and consequences

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Corporate environmental strategy and practices: Antecedents and consequences

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ABSTRACT

This study examines the antecedents and consequences to environmental practice and strategy and summarizes what constitutes environmental practices. We conducted a survey to study the environmental strategy among manufacturing firms in Iowa and examined the relationship between factors influencing practices and strategies, environmental practices and strategies and corporate performance, which include operational cost, product, and relations. Findings show that environmental strategy and practices do not lead to the reduction of operational cost of firms while supply chain is significant in product marketing. Top management value and public/community exert strong influence on corporate relationship with its stakeholders.

INTRODUCTION

Environmental protection is receiving more and more attention in corporate strategy. Business and academy have devoted considerable effort to issues related to environmental protection. Firms and organizations have adopted practices that reduce or prevent environmental degradation. These practices are often labeled as “green”.

Extensive research has been conducted on the definition of environmental strategy and approaches (Hart, 1995; Russo & Fouts, 1997; Sharma & Vredenburg, 1998), relations between corporate environmental strategy and stakeholder pressure (Kassinis & Vaffeas, 2006), organizational design (Russo & Harrison, 2005); drivers of environmental strategy and practices (Christmann, 2004; Basal & Roth, 2000). These research analyzes factors that influence drivers of corporate environmental strategy and the relationship between environmental strategy and financial performance.

Previous research fails to identify a fundamental issue: what practices make a company “green”? There is a lack of consensus on the definition of green practice. Although “green” practice or “green” companies has been widely used by entrepreneurs and scholars, there is no official definition of what constitutes “green” practice or what kind of firm or organization could be qualified as “green”. Consumers and the public are confused at the ambiguity of “green” practices and its arbitrary use by organizations, which lead to inappropriate behavior of corporate environmental practice and consumer misconception of environmental protection.

This paper attempts to explore the environmental practices adopted by manufacturing firms in the state of Iowa. In order to identify green practices, we began with a search of influential national and international environmental standards and criteria used or

advocated in business, industry, and political arena. The research compiles a list of environmental practices that are “green” and are acceptable by most of parties concerned. The research also tries to explore the impact of environmental strategies on corporate performance, namely, cost, product, and relation with stakeholder. The research examines whether environmental practices reduce company cost, promote marketing of company product, or improve corporate relations with internal and external stakeholders. The relations between those green practices and drivers and impacts are tested, too.

The structure of the paper is as follows. Section one examines what environmental strategy is. Section two studies factors influencing drivers of environmental strategy. We define eight major categories of green practices. Section three presents the outcomes/impact of the strategy and practices on corporate performance. Section four studies the impact of those practices on corporate performance. Section five proposes research questions and a regression model is developed. The last part is the result of our research and discussion.

LITERATURE REVIEW

Environmental/Green strategy

Corporate environmental strategy refers to “a pattern in action over time” (Mintzberg, 1989) intended to manage the interface between business and the natural environment. Based on previous research, environmental strategy can be categorized into two groups: reactive and proactive (Hart, 1995; Russo & Fouts, 1997; Aragon-Correa & Sharma, 2003).

Reactive environmental strategy is compliance strategy, wherein firms rely on pollution abatement through an "end-of-pipe" approach, often resisting the enactment and enforcement of environmental legislation (Hart, 1995). Proactive environmental strategy is going beyond compliance to a focus on prevention, a systemic approach that emphasizes source reduction and process innovation (Hart, 1995; Russo & Fouts, 1997).

Sharma (2000) argues that a reactive pollution control strategy involves “end-of-pipe” investments in developed technologies and “does not require the firm to develop expertise or skills in managing new environmental technologies or processes” (Russo & Fouts, 1997). On the other hand, a proactive pollution prevention strategy requires the “acquisition and installation of new technologies” (Russo & Fouts, 1997) that involve higher-order learning and may lead to the development of competitively valuable organizational capabilities (Russo & Fouts, 1997; Sharma & Vredenburg, 1998). A proactive environmental policy would involve the redesign of production and service delivery processes. Such a redesign requires addition of new technology.

Hart (1995) distinguished four types of resource-based environmental approaches: (1) the end-of-pipe approach, (2) pollution prevention, (3) product stewardship, and (4)

sustainable development. Reactive environmental strategy includes end-of-pipe approach while proactive environmental strategy consists of pollution prevention, product stewardship, and sustainable development (Hart, 1995; Russo & Fouts, 1997).

There is a need to clarify the definition and technical features of each environmental approach. End-of-pipe protection refers to added technical installation for environmental control of emission. They operate independently from the production process or are identifiable part added on to production facilities (Organization for Economic Co-operation and Development, 1997). Compliance is achieved primarily by the addition of pollution-removing or filtering devices to the existing assets of a firm and does not require the firm to develop expertise or skills in managing new environmental technologies or processes. The technology is essentially self-contained, off-the-shelf hardware. Once such hardware is installed, it does not fundamentally vary production or service delivery processes (Groenewegen & Vergragt, 1991; Kemp, 1993).

Under the Pollution Prevention Act of 1990, “pollution prevention” means “source reduction,” and other practices that reduce or eliminate the creation of pollutants. “Prevention” includes what is commonly called “in-process recycling”, but not “out-of-process recycling” (U. S EPA, 1990).

Product stewardship means that whoever designs, makes, sells or uses a product takes responsibility for minimizing its environmental impact. This responsibility spans the product's life cycle - from selection of raw materials to design and production processes to its use and disposal (The Northwest Product Stewardship Council, 2001).

Product stewardship entails integrating external (stakeholder) perspectives into product design and development processes (Allenby, 1991; Fiksel, 1993). A common

feature is the use of some form of life-cycle assessment (LCA) (Davis, 1993). LCA is used to assess the environmental burden created by a product system from "cradle to grave" (Keoleian & Menerey, 1993).

There is a need to differentiate “green” company and “sustainable” company because the two are not the same. The term “green” focuses on the natural or ecological side of corporate practice, such as water, air, natural environment, while sustainable development covers the social, economic, and environmental aspect of corporate practice. Sustainable development, as defined by the World Commission on Environment and Development (the Brundtland Commission, 1987), is “the capacity to meet the needs of the present without compromising the ability of future generations to meet their own needs.” As sustainable development is concerned with such issues as the labor practice and the development of developing nation, it is not covered in the green construct. For example, Wal-Mart is viewed as a green company. But it is not viewed to be a sustainable company because of its poor labor practice.

Sustainable development implies technology cooperation working with host governments and businesses to build appropriate infrastructure, develop human resources, and nurture competitiveness (Schmidheiny, 1992). Few companies have the capacity or market power to alter unilaterally entire socio-technical systems. So sustainable development is not discussed in this paper.

Influential environmental standards, such as ISO 14001 as well as EPA regulations, prefer proactive strategy to end-of-pipe strategy. The following is a statement from U.S EPA.

> "The congress hereby declare it to be the national policy of the United States that pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner." (U. S. C. 13101—13109)

Under "The Global Compact", the Principle Seven is: "Businesses should support a precautionary approach to environmental challenges". The key element of a precautionary approach, from a business perspective, is the idea of prevention rather than cure (The Global Compact, United Nations, 1999).

Drivers of environmental strategy

Previous studies on organizations and the natural environment have identified four drivers of corporate environmental strategy: legal regulation, stakeholder pressures, economic opportunity, and ethical motives (Bansal and Roth, 2000). Previous literature also indicates that a great deal of environmental pressure emerges from a company's stakeholders. Henriques and Sadorsky (1999) identify four critical stakeholders in corporate environmental commitment: regulatory stakeholders; organizational stakeholders; community stakeholders, and the media. Stakeholders can be divided into two categories, external and internal. External stakeholders include regulators,

public/community, and contractors/suppliers. Internal pressures include shareholders, management, and employees (Henriques & Sadorsky, 1999; Mitchell et al, 1997).

There is a problem with the reference of stakeholders in those researches. The use of stakeholder is arbitrary or even conflicting in some works because stakeholders can refer to "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984). In fact, stakeholders in some papers refer to groups that are not engaged in transactions with the corporation and are not essential for its survival, such as the public, environmental groups, local community, citizens, society, or media. We avoid the use of “stakeholders” as a driver of environmental strategy. Instead, “public/community” and “supply chain” are used.

Altogether, we compile five drivers of corporate environmental strategy: government regulation, economic factor, supply chain, public/community, and top management value.

Government regulation. The importance of legislations and regulations in inducing corporate environmental strategy has been widely recognized (Lampe et al., 1991; Lawrence & Morell, 1995; Post, 1994; Vredenburg & Westley, 1993; Henriques & Sadorsky, 1996). Escalating penalties, fines, and legal costs have punctuated the importance of complying with legislation (Cordano, 1993).

Economic factor. Although economic opportunity has been listed as a driver of corporate environmental strategy (Bansal & Roth, 2000; Cordano, 1993), whether environmental strategy and practice bring economic benefit has not been determined.

In theory, environmental strategy brings economic benefit to firms since firms reduce their environmental impacts while simultaneously lowering the costs of inputs, such as material and energy use, and waste disposal (Cordano, 1993; Lampe et al., 1991; Porter

& Van der Linde, 1995). Revenues can be improved through green marketing, the sale of waste products, and outsourcing a firm's environmental expertise (Cordano, 1993).

There is a strong belief that economic opportunities drive corporate environmental responsiveness. The most widely known is the one voiced by Michael Porter and Van Der Linde (1995). Porter believes that pollution reflects underutilized or wasted resources. He argues that an appropriately designed environmental policy may lead to first mover advantages at the firm level.

On the other hand, Walley and Whitehead (1994) argue that win-win situation is rare. Win-win opportunities become insignificant in the face of the enormous environmental expenditures that will never generate positive financial return. Such investments mostly yield a negative return to shareholders. Hence, they view the minimization of shareholders value destruction as the main goal to be pursued in environmental strategies.

Supply chain. Green supply chain has become an important driver of environmental strategy. The social and political concerns on environmental issues have encouraged manufacturing firms to “green” their supply chains (Walton, Handfield, &Melnyk, 1998; Van Hoek, 1999).

Mentzer et al. (2001) define a supply chain as “a set of three or more entities (organizations or individuals) directly involved in the upstream and downstream flows of products, services, finances, and/or information from source to customer.” A supply chain represents all the stages at which value is added to a manufactured product, including the supply of raw materials and intermediate components, finished-goods manufacture, packaging, transportation, warehousing, and logistics (Hall & Potts, 2003).

Firms come to realize that they need to expand their effort to the whole supply chain in order to reduce the overall pollution in the ecological environment. A Danish study (Georg, Ropke, & Jorgensen, 1992) found that the adoption of pollution prevention was associated with tight linkages and interactions across the chain of production. A survey of British companies (Green, McMeekin, & Irwin, 1994) found that the most important requirements for projects resulting in environmentally friendly products were collaboration with customers and suppliers. A survey research study found that half of survey respondents identified suppliers as key contributors to pollution prevention efforts (Florida, 1996).

Industry has been identified as important source of pressure on corporate environmental conduct (Christmann, 2004). Research has shown that industry associations play an important role in setting industry norms for environmental conduct (King & Lenox, 2000). Industry pressures for environmental responsibility can also result from competitors' actions. Firms aim to enhance their legitimacy by imitating successful competitors (Abrahamson & Rosenkopf, 1993).

Customer pressures are an important determinant of firms' environmental conduct (Arora & Cason, 1995; Henriques & Sadorsky, 1996). Customer demand can help to spur innovation in organization (Quinn, 1985). In the case of contractors/suppliers, a company may be faced with the risks of hazardous waste liability and distributor boycotts.

Public/Community. The public/community can exert significant pressure via their influence on the legislative process and their buying patterns. The modern stakeholder management approach suggests that corporations should broaden their objectives to address the expectations and interests of a wide variety of salient stakeholders (Garrod

and Chadwick, 1996; McGee, 1998). Such objectives may include customer satisfaction, regulatory compliance, good corporate citizenship, and social and environmental responsibility among others.

A great deal of environmental pressure emerges from the public and community (Henriques & Sadorsky, 1996; Mitchell et al, 1997). The public/community can exert significant pressure via their influence on the legislative process and their buying patterns, shutdown of future development, and third party and citizen suits.

Top management value. Personal values can influence a firm's ecological responses (Daft & Weick, 1984). Executives can act both proactively and reactively (Child, 1997), exercising choice in addition to responding to real or perceived external expectations (Hitt & Tyler, 1991).

Executives' characteristics- including their values and commitments- play an important role in affecting organizational actions (Hambrick & Finkelstein, 1987; Hambrick & Mason, 1984). Executives may take a particular stance toward ethics programs because doing so is presumed to enhance or maintain organizational legitimacy and thus contribute to financial performance by securing the support of key institutional actors. But executives' stances toward ethics programs also reflect their own commitment to responsible, ethical behavior as an end in itself (Weaver, Treviño, & Cochran, 1999).

Firm's top managements were responsible for the firms' environemtnal management leadership (Lawrence and and Morell 1995; Basal and Roth, 2000). Bansal and Roth (2000) argued that individual concerns for the environment on the parts of organizational members or owners led to the motivation of ecological responsibility. In their study of 53

UK and Japanese firms, Anderson and Bateman (2000) believed that top management attention to environmental issue and action on it are important indicator of success.

Environmental/green practices

There is a need to clarify what constitutes green practice. The term "green" has been used in a very loose manner. There is an arbitrary use of the term to describe any action, company, product, service, and attitude that might be environmentally friendly (Miller & Szekely, 1995). Consumers might be at a loss as to what really constitutes green practice. This research is the first study that identifies what constitutes "green".

To find out what is green, it is useful to look at the criteria, metrics, and systems for identifying excellent corporate environmental performance on the part of a range of environmental stakeholders across society. There is a tremendous need to analyze what constitutes excellent corporate environmental performance. This analysis attempts to make a significant contribution to business, the environmental community, and society.

To draft an acceptable green construct, we reviewed (see ANSI/ISO/ASQ E14001, 2004; ANSI/ISO/ASQ E14004, 2004; CERES,1990;United Nation's Global Compact) various environmental standards and criteria, such as ISO 14001 and 9000 standard series, Valdez principle, United Nations' Global Compact, Global Reporting Initiative (GRI), OECD work on extended producer responsibility (EPR), selection criteria used by various newspapers or organizations, such as *Independent* and EIRIS ranking of greenest companies, Forest Stewardship Council (FSC) certification. We also studied criteria used by American Chemical Society and EPA regulation on green building, product, purchasing, electronics, and emission. Researchers compiled a list of green practices based on these reviews. Meeting/fulfilling that would suggest that a firm is

environmentally friendly or a firm espouses green philosophy or products. The following five principles are mandatory for a firm to be “green”:

1. Legal/regulatory compliance. The company should be in compliance with environmental regulations and has no environmental lawsuit pending (ISO 14001; US EPA, The Independent and EIRIS ranking; The Forest Stewardship Council; Miller & Szekely, 1995; Veleva & Ellenbecker, 2001)

2. There is an environmental management system (EMS) inside the company (ISO 14001; EPA; Valdez Principles; The Forest Stewardship Council).

3. Proactive environmental strategy. The organization should use proactive environmental strategy rather than end-of-pipe strategy (US EPA; ISO 14001).

4. Life cycle assessment should be used (ISO 14001; The Global Compact).

5. In manufacturing, such as production, packaging, purchasing, the use of materials, energy should be reduced, as well as the emission of GHG, the discharge of toxic substances, and the waste produced. The use of renewable energy and material or biodegradable material is preferred. The company should offer recycling and disposal services in an environmentally friendly way (EPEAT; ISO 14001; Valdez Principles).

The next three are highly recommended:

6. Top management commitment. The top decision makers view environmental protection as an important part of its mission (ISO 14001; Valdez Principles; Global Compact).

7. Continuous improvement. There is a continuous improvement on environmental quality in the company, including emission, energy and materials used (ISO 14001).

8. The company should require its supply chain to be green (Global Compact; ISO 14001; EPA)

People need to understand that ISO 14001 is not equal to the “green” label. An ISO 14001-certified firm might not comply with all the legal regulations. That has happened to some major automotive companies in the U.S. So these firms are not entitled to the title of “green’ company under the criteria.

There is a need to clarify those green practices mentioned above. Regarding environmental management system (EMS), ISO 14001 specifies the framework for the management system that allows an organization to meet its environmental obligations reliably and consistently. The organization is required to take an inventory of all the environmental “aspects” associated with its activities, products, and services. It determines which are significant and then proceeds to define and implement a management system.

According to ISO 14001, an environmental aspect is any element of an organization’s activities or products or services that can interact with the environment. Depending on the nature of the specific operations, consideration usually is given to the following categories of aspects: raw material; processed materials; recycled materials; reused materials; chemicals; natural resources; energy; packaging.

Continuous improvement is borrowed from the total quality management. This principle refers to an organization's ongoing quest for better work methods and organizational processes. A commitment to continuous improvement is ideally recognizable at the work unit and individual level. It refers to the process of enhancing

the environmental management system to achieve improvements in overall environmental performance in line with the organization's environmental policy.

Life cycle assessment (LCA) is a method for systematically assessing the environmental impact of a product through all of its life-cycle stages. The ISO14040 defines LCA as following: "LCA is a technique for assessing the environmental aspects and potential impacts associated with a product". It consists of four parts: goals and scope definition; inventory analysis; impact assessment; interpretation. It is used to assess the environmental burden created by a product from "cradle to grave": material selection, production, distribution, packaging, consumption, and disposal.

Both ISO 14000 and Global Compact urge firms to extend the environmental protection to the supply chain. A proactive company will thrive only when it acts as a whole system that includes not just executives and workers, but customers, suppliers, and neighbors, and by integrating total quality environmental management (TQEM) into its planning and operations processes (Makower, 1994). This paradigm implies that companies wanting to reap the greatest benefits from their environmental management processes must integrate other members of the supply chain into these processes (Walton, Handfield, & Melnyk, 1998).

Impact on Corporate Performance

The impact of environmental strategy can be found on three aspects of corporate performance - cost, product, and relationships with internal and external stakeholders. That is: whether it leads to cost reduction of the company, better marketing and quality of company product, and better relations with internal and external stakeholders.

There is a need to define “cost” because there is an arbitrary use of “cost” in environmental studies. Some researchers equal it to “manufacturing or operational cost”. But cost could be studied from a broader perspective. It can refer to operational/manufacturing cost, capital cost, and lifecycle cost or total cost (Hart, 1995; Darnall & Edwards, 2006).

Previous researches indicate that the implementation of environmental practices has mixed results on an enterprise’s cost performance. Most of these researches are conducted on operational cost. Porter and Vander Linde (1995) believed that waste represents a kind of unutilized resource. Zhu and Sarkis (2004) found that the existence of internal environmental management programs led to both positive and negative economic performance. They focused on more operational level economic and financial performance measures. In a research on ISO 14001 and corporate performance, Montabon argues that environmental system had not helped to reduce cost (Montabon, Melnyk, Sroufe, & Calantone, 2000).

Sharfman and Fernando (2008) studied the relation between capital cost and environmental risk management. They determined that companies that had better environmental risk management practices had a lower cost of capital and thus gained an advantage over their competition. Studies have also been done on environmental strategy and stock performance. Bansal and Clelland (2004) argue that environmentally legitimate firms incur less unsystematic stock market risk than environmentally illegitimate firms. Shareholders perceive companies with a poor environmental record as riskier to invest in, and may demand a higher risk premium (Henriques and Sadorsky, 1996).

Several studies have shown that higher environmental performance is associated with better financial performance, but these studies often lacked the longitudinal data needed to fully test the relationship between environmental strategy and cost reduction (King & Lenox, 2001).

Carter and Dresner (2001) studied cost from a lifecycle perspective. They found that environmental projects are more likely to succeed when firms consider costs from a life cycle perspective. Christmann (2000), in the study of 88 chemical companies, developed a measure that captured the effect of a business unit's environmental strategy on cost advantage than a standard measure of financial performance. She selected a reference group against which cost advantage was measured to measure the effect of the environmental practices. The results from the research showed that the best practices of environmental management did not lead to cost advantage for all firms.

Proponents of a causal link between environmental and financial performance have argued that pollution reduction provides future cost savings by increasing efficiency, reducing compliance costs, and minimizing future liabilities (Porter and van der Linde 1995; Reinhardt, 1998). Unfortunately, they fail to disentangle the effects of industry choice from the effects of variation in environmental strategies among firms in the same industry.

Regarding impact on product, previous research found strong relationships between improvement of environmental practices and subsequent improvements in product and process quality (Pil and Rothenberg, 2003). Melnyk et al. (2003) determined that firms with formal environmental management systems significantly improved product quality while firms with certified programs fared even better than those without.

Previous research also argued that differentiation advantage can result from environmental management that focuses on product characteristics and product markets (Shrivastava, 1995b). Compared to conventional products, environmental differentiation consists of offering products that provide greater environmental benefit or that impose smaller environmental costs. These products allow firms to command a price premium or capture additional market share (Delme, Russo, & Montes-Sancho, 2007).

Research has also found that green marketing appears to be real and growing (Coddington, 1993; Fierman 1991; Kirkpatrick 1990). Some customers demand environmental-friendly products. Firms have already begun incorporating environmental criteria and/or environmental elements into their marketing strategies to remain competitive in the marketplace (Drumwright, 1994; Kirkpatrick, 1990; Mason, 1993).

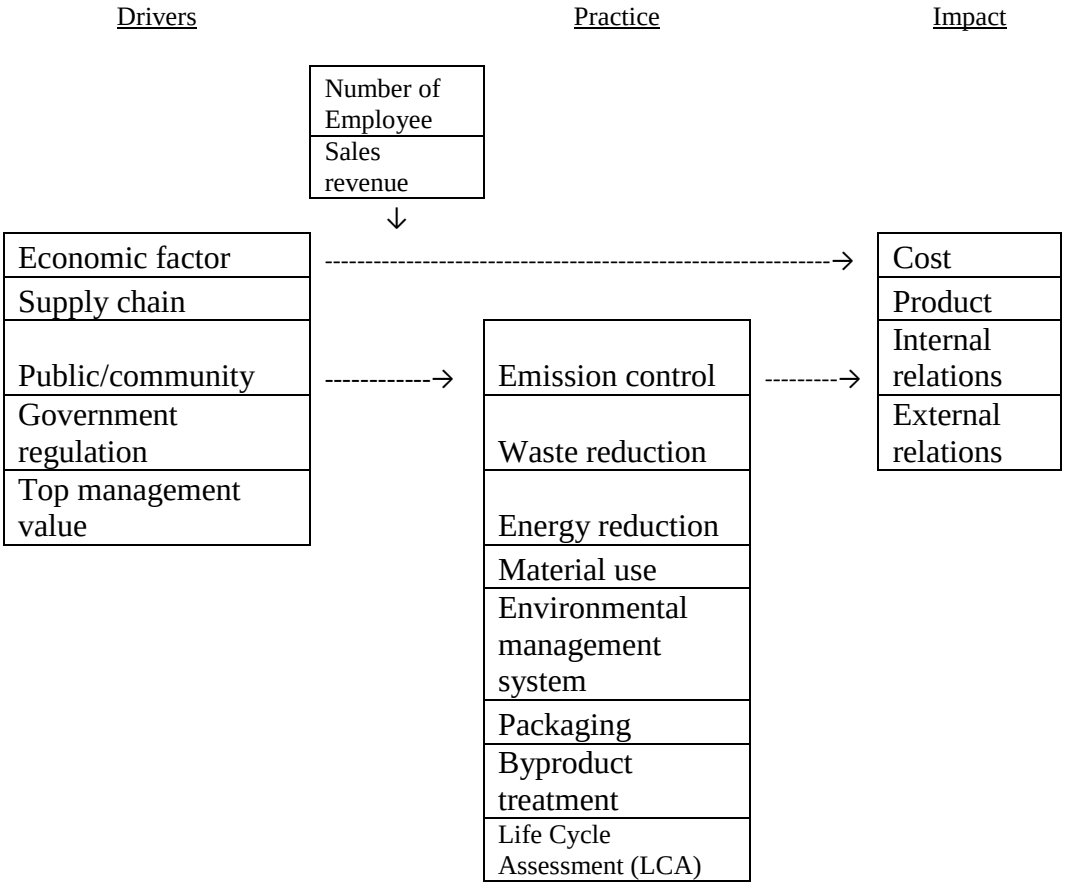
Ginsberg and Bloom (2009) discussed the green marketing strategy. They argued that in order to respond to consumers' varying degrees of environmental concern, marketers can segment the market into different shades of green, true blue greens, greenback greens, sprouts, grousers, and basic browns.

In terms of impact on corporate relations with various stakeholders, previous research believes that being environmentally proactive improve a firm's image and enhance the loyalty of such key stakeholders as customers, employees, and government (Hart, 1995; Shrivastava, 1995b). Researchers have suggested that good community relations can help a firm obtain competitive advantage through tax advantages, a decreased regulatory burden, and improvement in the quality of local labor (Waddock & Graves, 1997).

Companies with a reputation for ineffective environmental management may find it harder to attract or retain highly qualified employees, who may themselves have a strong preference for proactive environmental management (Reinhardt, 1998). Studies as well as anecdotal evidence point to improved employee engagement and effectiveness when companies pursue sustainability strategies (Hopkins, 2009).

Previous research has shown that successful environmental projects improved relationships with external stakeholders. Carter and Dresner (2001) argued that successful environmental projects resulted in improved relationships with customers, suppliers, regulatory agencies, and the media. Green consumerism may drive the transition towards more proactive environmental management, particularly in industries that have close contacts with final consumers (Arora and Cason, 1995). The emergence of green consumerism implies that some consumers are willing to pay a premium for environment-friendly products (Vandermerwe and Oliff, 1990). Green suppliers may stop delivering products or service to companies without good environmental records to protect their own reputation (Henriques and Sadorsky, 1999).

Figure 1: Model of Corporate Environmental Strategy and Practice



RESEARCH QUESTIONS

In this section of the paper we explore the relationship between environmental strategy and practices and its impact on corporate performances. One question this study tries to examine is the relations between environmental strategy and corporate cost reduction. Because of the nature of our sample, we confine our study to the relationship between environmental strategy and firms' operational cost.

Question 1a: Do environmental strategy and practice lead to reduction of cost?

"Green" has become a marketing strategy. Previous research shows that environmental strategy could promote the marketing of company product. This study tries to test the relationships between environmental strategy and marketing effectiveness.

Question 1b: Do environmental strategy and practices lead to better marketing performance of company product?

From a stakeholder perspective, environmental strategy meets the needs and desire of some groups of stakeholders that are not engaged in the daily transaction of the firm. Those stakeholders include environmental groups, local community, and the government. A better environmental strategy is supposed to improve the corporate relations with these stakeholders. Suppliers and customers exert influence on corporate performance and practice. Some firms have required their suppliers to be green. Firms who are more environmentally conscious tend to have a better relationship with supplier and customers.

Question 1c: Do environmental strategy and practices improve corporate relations with its stakeholders?

The relations between environmental drivers and environmental practices deserve attention. For example, suppliers and customers may require firms to adopt such practices

as emission control, green packaging, or recycling product, even LCA. The public or community is sensitive to issues like waste reduction, byproduct treatment, emission control, and LCA. This research examines the relations between these factors.

Question 2a: What environmental practices are related to economic factor?

Question 2b: What environmental practices are related to supply chain influence?

Question 2c: What environmental practices are related to public/community influence?

As the paper has discussed earlier, firms who are certified by ISO 14000 are driven by three categories of benefit- legal, commercial and social. Adopting ISO 14000 implies a change in management philosophy of the organization. From research done on LCA (Life Cycle Assessment) companies in four European nations, LCA companies rank legislative pressure, environmental pressure and environmental opportunities significantly higher than non-LCA companies. Swedish LCA companies rank all drivers slightly higher than non-LCA companies, with the only exception of legislative pressure. German firms rank marketing strategy and environmental opportunities significantly higher than non-LCA firms. In Italy, it is worth mentioning the high ranking of legislative pressure and the low ranking of cost reduction by LCA using companies. Environmental legislation is not important, especially in Sweden and Switzerland. However, in Germany environmental legislation is ranked close to the most important drivers (Frankl & Rubik, 2000).

*Question 3***:** Are firms that experience more pressure from environmental groups than economic reason more likely to adopt proactive environmental strategy than firms who do not?

Green firms represent a paradigmatic shift in value. Traditional firms focus on the maximization of profit for its shareholders. Social good, including environmental protection, is secondary to profit creation. Environmental protection has been considered as an added cost by many firms (Walley and Whitehead, 1994). Green firms may not put profit-making as its sole purpose. Green firms may pursue social value as well as monetary benefit.

Investments in end-of-pipe technologies reflect a reactive posture to environmental issues, whereby limited resources are committed to solving environmental problems: product and manufacturing process improvements are made to conform to legal requirements. Pollution prevention implies that firms continually adapt their products and production processes in order to reduce pollution levels below legal requirements. To the extent that prevention at the source allows firms to achieve regulatory compliance at a lower cost and to reduce liabilities, this environmental strategy may be viewed as a cost leadership approach.

Question 4: Do companies that adopt end-of-pipe environmental strategy pay more attention to profit than firms that adopt proactive environmental strategy?

METHODOLOGY

Sample

Manufacturers in the state of Iowa were selected as the research setting for this study. We chose manufacturing firms for several reasons. First, manufacturing firms have more direct impact on environment than service firms. Second, the environmental impact of manufacturing firms is more tangible than service firms, such as material use, new technology use, to name a few. Certain dimensions of environmental impact are not applicable to service firms, such as certain pollution prevention or end-of-pipe technologies. The sample comprises of all manufacturing companies/plants identified by the Center for Industrial Research and Services (CIRAS) at Iowa State University. These firms have contacted CIRAS for technical and managerial assistance.

In terms of research process, surveys were mailed to these companies/plants in three episodes. We created a website where respondents could finish the survey online. We first sent postcard to those companies. On the postcard, we list the website where respondents could finish the survey online. We asked manager/president/owner to be respondents. Two weeks after the mailing, we sent a follow-up letter which contained paper copy of the survey. After another two weeks, we sent firms the last postcard to remind them either to fill in the survey online or finish the paper survey. One question in the survey collected data concerning demographic information. Series of questions assessed firms' environmental practices, forces/pressures influencing the adoption of environmental practices, and certain outcomes of environmental practices.

Surveys were also mailed to 1760 manufacturing firm in Iowa. In total, 179 responses were received, 34 online and 145 in paper mail. The response rate is about 10

percent. Among the respondents, 51 were at the manager's level, such as plant manager, director, facility manager, or general manager. 30 were at departmental manager level, such as environmental manager, director of engineering. 36 company presidents and 16 vice presidents also filled in the survey. Among the respondents are a few engineers and administrators.

Table 1: Title of respondents

Manager	51	29.1%
Dep. Manager	30	17.1%
President/CEO/Owner	48	27.4%
VP	16	9.1%
Engineer	6	3.4%
Administrator	5	2.9%

Among the respondents, the biggest industry is fabricated metal products (39), followed by food products (18). The third category is the plastics & Rubber. Table 2 shows the industry of responding firms.

Table 2: Type of industry

	#	Percentage
Furniture & Related Products	11	6.2%
Machinery	11	6.2%
Fabricated metal products	39	22.0%
Motor Vehicle, body, trailer and parts	8	4.5%
Other manufacturing	30	16.9%
Plastics & Rubber	13	7.3%
Primary Metal	5	2.8%
Service	8	4.5%
Animal feed and soyoil production	1	0.6%
Appliance&Electrical equipment	7	4.0%
Automitive	1	0.6%
Casting	1	0.6%
Chemical	6	3.4%
Consumer nondurable	3	1.7%
Corn seed production	1	0.6%
Energy	1	0.6%

Food products	18	10.2%
Nonmetallic mineral products	2	1.1%
Electronic assembly	1	0.6%
Blank	10	5.6%

Among 179 respondents, 141 have environmental staff in their facility and 36 do not; 34 conduct some forms of life cycle assessment in their facility while 144 do not.

176 respondents indicate the number of employees in their facility. 61 have fewer than 50 employees in their facility; 43 firms have employees between 51 to 100. 36 firms have between 101 to 200 employees. Only one firm has more than 3000 employees. Here is the table for number of employees.

Table 3: Number of employee

	#	Percentage
From 7 to 50	61	34.7%
51 - 100	43	24.4%
101 - 200	36	20.5%
201- 250	6	3.4%
251 - 500	15	8.5%
501 - 1000	9	5.1%
1000 - 3000	5	2.8%
Over 3000	1	0.6%

168 respondents indicate their sales revenue. 58 have sales revenue between 20 to 100 million dollars; 49 have sales revenue between 5 to 20 million dollars and 37 have 1 to 5 million dollars. Table 4 indicates the sales revenue. 34 respondents indicated that they conduct life cycle assessment while 134 said they do not.

Table 4: Sales revenue

	#	Percentage
$1 to $5 million	37	20.7%
$5 to $20 million	49	27.4%
$20 to 100 million	56	31.3%
More than $100 million	23	12.8%
Don't know	11	6.1%

Measures

There are missing values in the survey data. To solve the problem, we conducted a sensitivity analysis, which is used to ascertain how a given model output depends upon the input parameters (Saltelli, Chan & Scott, 2000). We replace the missing value with the mean of the data in that industry, rather than the whole sample. By replacing missing value in this way, we try to keep the variance of response as much as possible.
Now the mean was first used but you did not do this in your analyses that you report here. So perhaps you should mention what you ended up doing – use factor scores

Dependent variables. Our analysis focuses on three major impacts of environmental strategy and practices, cost, product, and relationships, both internal and external.

We assess the impact on cost by measuring the impact on the liability cost, material cost, and process/production cost (1, "Significantly decreased," 5, "Significantly increased"). We use product quality, differentiation, marketing to measure impact on product (1, "Significantly decreased," 5, "Significantly increased"). We assess internal relationship by measuring the impact on relationship with employee, supplier, and customer. We assess external relationships by measuring the impact on relationship with local community, regulator, and environmental groups. All the items on relationships were measured using a five-point scale (1, "Significantly negative," 5, "Significantly positive").

The factor analysis resulted in three factors which reflect the impact of environmental strategy on corporate performance. It puts all the items on internal and external relationships into one factor. Table 3 presents the names and cronbach alpha coefficients for those factors.

The cronbach alpha coefficients on all the factors in this section are high, from 0.75 to 0.80. The factor “Cost” includes liability cost, material cost, and process/production cost. The factor “Product” covers product quality, product differentiation, product marketing, and company reputation or goodwill. There is cross-loadings on “Company reputation or goodwill” and “Relationship with customers”. However, the literature review conceptually confirms the result of the factor analysis.

Table 5: Result of factor analysis for Impact of Environmental strategy

	Relation	Product	Cost
Liability costs	-.099	.080	**.663**
Material costs	-.070	.094	**.865**
Process/production costs	-.030	.046	**.868**
Product quality	.090	**.580**	.101
Product differentiation	.098	**.860**	.134
Product marketing	.084	**.841**	.037
Company reputation or goodwill	.510	**.598**	-.032
Relationships with local communities	**.747**	-.016	.017
Relationships with regulators	**.700**	.097	-.110
Relationships with environmental groups	**.743**	.078	-.216
Relationships with employees	**.748**	.165	-.013
Relationships with suppliers	**.582**	.372	-.001
Relationship with customers	**.529**	.471	-.006
Cronbach alpha	0.802	0.773	0.750

Independent variables

Driving influence of environmental strategy. Based on previous research on driving influence of green initiatives (Cordano, 1993; Lampe et al., 1991; Porter & Van der Linde, 1995; Walley and Whitehead, 1994), we develop five measures for drivers of environmental strategy and practices: economic factors, government regulation, supply chain, top management ethics/values, and environmental groups.

Fifteen items regarding forces/pressures influencing firm's adoption of environmental practices were used. A five-point scale is used (1, "no influence," to 5, "significant influence"). Respondents are asked to report how their environmental strategies are influenced by those factors.

We assess top management mandate by measuring top management perspective on environmental issues. Respondents were asked to indicate to what extent environmental issues are emphasized by top management in their companies. Questions cover resource, staffing, social good, and environmental goals. All the items on relationships were measured using a five-point scale (1, "Strongly disagree," 5, "Strongly agree").

A factor analysis was conducted to assess the factors identified in the literature review. The responses for 15 items are factor analyzed to determine statistically independent factors. The analysis identified four separate factors that drive corporate environmental strategy and practices: economic factors, supply chain, top management value, and environmental groups. There is cross-loading on "Competitors' adoption of green practices", "Employee expectations", "The good of society/community". The literature review conceptually confirms the result of the factor analysis. Table 6 presents the names, factor loading, and cronbach alpha coefficients for those factors.

The drivers identified by the factor analysis are consistent with previous researches except that the analysis puts "Economic cost/benefit analysis", "Government regulations", and "Productivity and efficiency goals" into one factor.

Table 6: Result of factor analysis for drivers of environmental strategy

	Top management Value	Environmental groups	Supply chain	Economic factor
Economic cost/benefit analysis	-.067	-.062	.195	**.717**
Government regulations	.219	.188	.196	**.502**
Productivity and efficiency goals	-.042	.111	-.038	**.803**
Final consumer expectations	.121	.128	**.840**	.125
Competitors' adoption of green practices	.129	.425	**.575**	-.054
Immediate customer expectations	.035	.149	**.830**	.238
Employee expectations	.406	**.538**	.390	.199
Environmental groups	.181	**.843**	.131	.004
Local communities	.234	**.777**	.158	.095
Owners/shareholders expectations	.199	**.625**	.235	.324
Sacrificing some profit to achieve environmental goal	**.814**	-.030	.078	.015
Acquiring and using resources for environmental programs	**.805**	.231	.172	.090
Environmental performance primarily	**.784**	.322	.028	-.042
The good of society/community	**.510**	.193	.053	.517
Staffing for advancing environmental agenda	**.724**	.373	.072	.051
Cronbach alpha	0.836	0.809	0.743	0.545

The green supply chain encompasses a broad range of practices from green purchasing to integrated supply chains flowing from suppliers, to manufacturers, to customers, and to the reverse supply chain, which is "closing the loop" (Zhu & Sarkis, 2006; Rao & Holt, 2005). The factor "Supply chain" covers final consumer expectation, competitors' influence, and immediate customer expectation.

Environmental groups are used to assess the pressure from community or society (Kassinis & Vafeas, 2006; Henriques and Sadorsky, 1996).The factor "Environmental groups" includes employee expectation, environmental groups, local communities, and owner/shareholder.

"Top management value" covers top management perspective on such environmental and social issues as whether they are willing to sacrifice some profit for environmental goals, allocate resource or staff for environmental programs, or for the good of society.

Practice variables. Previous research only studied certain aspect of environmental practices, such as purchasing (Min & Galle, 1997), manufacturing (Sarkis & Rasheed, 1995), environmental management system (Montabon et al, 2007). This research tries to study environmental practices from a holistic perspective, which cover major areas of environmental strategy.

In the literature review, we've listed eight categories of practices: waste and emission, energy reduction, material use, packaging, recycling, life cycle assessment (LCA), and environmental management system. These practices cover the major aspects of green practices. All the practices were measured using a five-point scale (1, "no effort", to 5, "significant effort") except LCA. "Life cycle assessment" is a Yes/No question. It has been listed as a practice by influential environmental standard and guidelines such as ISO 14001 and Global Compact of United Nations.

"Emission control" studies the degree of effort firms put forth in pollution/emission control equipment or they reduce emission/waste through use of filtering devices or similar methods (ISO 14001; GRI; Morhardt, Baird, & Freeman, 2002). "Waste reduction" measure whether firms reduce waste at source or "end-of-production" waste (ISO 14001; GRI; EPA; Zotter, 2004). "Energy reduction" studies the effort firm put forth in reducing energy through production change, better maintenance procedure, or retrofitting/replacing equipment. "Packaging" studies how firms introduce packaging from recycled material and eliminate unnecessary packaging (Min & Galle, 1997).

"Material use" covers material reduction led by production change and product design. "Environmental management system" studies the effort firms devote to environmental audits, environmental steward report, and employee training (ISO 14001; GRI; Montabon et al, 2007). The factor analysis also puts the use of renewable energy into this factor.

We did not measure legal compliance because it is the obligation of the firm to follow government regulations. We did not measure continuous improvement because it is very difficult to measure it from survey. Besides, we assume that a firm makes continuous improvement if it has adopted all the green practices listed in our survey. We did not measure green supply chain as a practice because most of respondents in the survey are small- to medium-sized firms and they are not in a position to demand their suppliers or customers to be green.

The factor analysis identified four factors that reflect corporate environmental practices, which is consistent with influential environmental standards, such as ISO 14001 and EPA regulations. The cronbach alpha coefficients on all the factors are at acceptable level. There is crossloading on "Reduce energy use by better maintenance procedures" and "Reduce energy use by retrofitting/replacing equipment". Table 7 presents the names and cronbach alpha coefficients for those factors.

Table 7: Result of factor analysis for Environmental practice

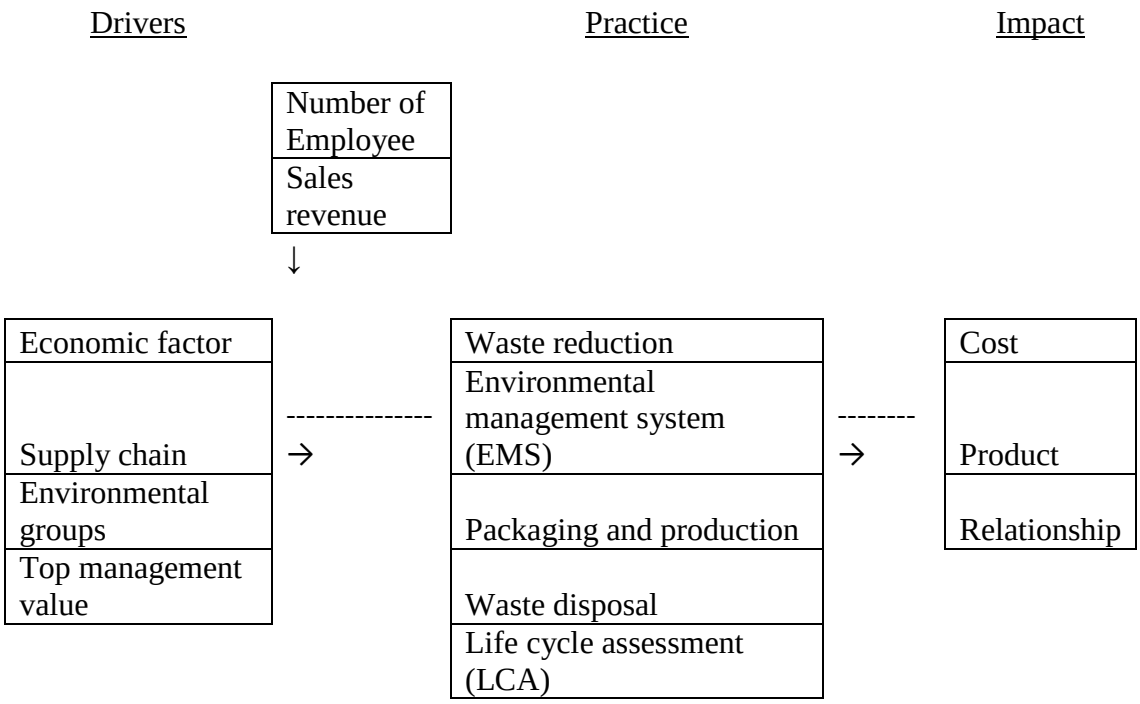
	Waste Reduction	Environmental Management System	Packaging and Production	Waste Disposal
Make production changes to reduce consumption of energy	**.660**	.129	.252	.343
Implement new technology to reduce end-of-production wastes	**.629**	.112	.026	.529
Reduce emissions or waste through use of filtering devices and other similar methods	**.581**	.144	-.088	.160
Make production changes to reduce consumption of energy	**.653**	.264	.209	-.133
Reduce energy use by better maintenance procedures	**.521**	.521	.246	-.095
Reduce energy use by retrofitting/replacing equipment	**.578**	.311	.245	.003
Make production changes to reduce material consumption	**.581**	.038	.498	.006
Introduce packaging made from recycled materials	.022	.218	**.811**	.217
Eliminate unnecessary packaging	.108	.002	**.874**	.061
Change product design to reduce raw material use	.327	-.196	**.499**	.054
Reclaim company products at the end of their useful life	.035	.035	.104	**.817**
Find uses for byproducts of your production process	.361	.343	.208	**.513**
Use renewable energy sources such as solar and wind energy	-.128	**.550**	.157	.385
Conduct comprehensive environmental audits	.376	**.723**	-.170	.080
Produce public environmental stewardship reports	.132	**.786**	.062	.030
Train employees on environmental issues	.396	**.724**	-.054	.150
Cronbach alpha	0.815	0.755	0.695	0.546

Control variable

Firm size influences corporate environmental strategy. Larger firms are more apt to adopt environmental initiatives because of the resource they have. For example, small firms are less likely to go through ISO 14001 certification because of the high certification cost. So we control for number of employees and sales revenue of the firm so we could be more confident about capturing variance accounted for by this factor.

Based on the result of factor analysis, there is some change on the model. Some environmental drivers, practices, and impact are combined in the factor analysis. Table 4 presents the revised model.

Figure 2: Revised Model of Corporate Environmental Strategy and Practice



RESULTS

Descriptive statistics

Mean score and standard deviation have been calculated for each item in the survey. In the "Practice" section, the result shows that "Make production changes to reduce consumption of energy" receives the highest ranking (4.074) while "Use renewable energy sources such as solar and wind energy" receives the lowest ranking (1.452). The survey shows that firms rank high in investment in pollution/emission control equipment, making production change to reduce consumption of energy, reduce energy use by better maintenance procedure or retrofitting/replacing equipment. Compared to other practices, firms are less likely to produce public environmental stewardship reports, reclaim company products at the end of their useful life, and introduce packaging made from recycled materials.

As a whole, firms pay most attention to reduction of energy consumption while pay least attention to renewable energy and the use of recycled material.

Table 8: Practice	Mean	Std
Make process modifications to reduce waste at source	4.07	0.97
Make production changes to reduce material consumption	3.74	1.06
Make production changes to reduce consumption of energy	3.70	1.04
Reduce emissions or waste through use of filtering devices and other similar methods	3.57	1.19
Reduce energy use by better maintenance procedures	3.53	1.08
Reduce energy use by retrofitting/replacing equipment	3.52	1.12
Implement new technology to reduce end-of-production wastes	3.49	1.14
Eliminate unnecessary packaging	3.25	1.24
Change product design to reduce raw material use	3.23	1.33
Find uses for byproducts of your production process	3.16	1.36
Train employees on environmental issues	3.14	1.30
Conduct comprehensive environmental audits	2.95	1.45
Introduce packaging made from recycled materials	2.83	1.33
Reclaim company products at the end of their useful life	2.72	1.45
Produce public environmental stewardship reports	1.96	1.22
Use renewable energy sources such as solar and wind energy	1.45	0.81

In the “Driver” section, “Production and efficiency goal” (4.133) and “government regulation” (4.026) receive the highest ranking while “Environmental groups” receives the lowest ranking (2.221). The result shows that firms emphasize the good of society/community (3.876) and the economic cost/benefit analysis of environmental strategies/practices (3.712). Compared to other drivers, such drivers as environmental groups, employee expectations, and staffing for advancing environmental agenda receive less attention when firms are formulating their environmental strategies.

As a whole, government regulation and economic goals play the most important role in formulating environmental strategies while environmental groups and employees play the least important role.

Table 9: Driver	Mean	Std
Production and efficiency goal	4.13	0.76
Government regulations	4.03	1.11
The good of society/community	3.88	0.77
Economic cost/benefit analysis	3.71	1.06
Acquiring and using resources for environmental programs	3.51	0.94
Owners/shareholders expectations	3.36	1.27
Sacrificing some profit to achieve environmental goal	3.32	0.96
Final consumer expectations	3.20	1.23
Environmental performance primarily	3.12	0.98
Immediate customer expectations	3.09	1.24
Staffing for advancing environmental agenda	2.95	1.03
Local communities	2.86	1.14
Employee expectations	2.75	1.05
Competitors’ adoption of green practices	2.67	1.14
Environmental groups	2.22	1.13

In the “Impact” section, “Relationship with employees” (3.729) and “Relationship with government” (3.706) are perceived as the most significant impact of environmental strategies on corporate performance. “Material cost” receives the lowest ranking (2.693). As a whole, items related to cost do not receive high ranking while items related to company reputation and relationship with stakeholders receive pretty high ranking. The result shows that the biggest impact of environmental strategy on corporate performance is on its relation with stakeholders.

Table 10: Impact	Mean	Std
Relationships with employees	3.73	0.66
Relationships with regulators	3.71	0.69
Company reputation or goodwill	3.63	0.72
Relationship with customers	3.60	0.80
Relationships with local communities	3.51	0.66
Relationships with environmental groups	3.41	0.60
Relationships with suppliers	3.33	0.62
Product marketing	3.31	0.64
Product differentiation	3.21	0.62
Product quality	3.17	0.69
Liability costs	2.88	0.72
Process/production costs	2.80	1.41
Material costs	2.69	0.91

Regression analysis

Hierarchical regression and ordinary least square regression analysis are used in the analysis. Three regressions are run to analyze the relationship between driver, practice and impact, which consists of cost, product, and relation. We first enter control variables and driver variables and run the regression analysis. Then we add practice variables and run the regression analysis again. Table 11 reports the means, standard deviations, and correlations among all variables. Results for the regression analysis of variables are presented in table2.

The result answers the question 1, which asks the impact of environmental strategy on cost, product, and relations of the company. As a block, drivers and control variables (number of employees and sales revenue) explain less than half percent of the variance in the impact of “cost”. When combined with practice variables, they explain 9.4 percent of variance in the impact of cost. The result shows that none of the individual drivers has any statistically significant impact on cost.

Drivers and control variables explain 14.3 percent of variance in the impact of “product”. When practice variables are added, the model explains 15.8 percent of variance. The result shows that supply chain driver is significantly related to product. That is, supply chain drivers are correlated with product marketing, differentiation, and reputation of the firm.

Drivers and control variables explain 40.7 percent of variance in the impact of “relation” (here it refers to corporate relations with internal and external stakeholders). When combined with practice variables, the model explains 44.5 percent of variance. The result shows that environmental group, top management value, and environmental management system are significantly related to impact of relation. Sales revenue and life cycle assessment are marginally correlated to relations. All the significant variables are positively correlated to relation. The results show that the influence of environmental group, top management value, and environmental management system significantly improves corporate relations with internal and external stakeholders, such as regulators, local community, environmental groups, employees, suppliers, and customers.

Among practice variables, only “packaging and production” is significantly related to cost. “Packaging and production” is negatively associated with cost. The result shows

that design change and new packaging materials increase cost. Our inference is that green packaging and design usually are very expensive. It often increases cost.

Life cycle assessment (LCA) is marginally related to relation. One reason may be that respondents are not familiar with LCA. Some respondents wrote on the survey that they did not know what LCA is. LCA is an important part of ISO 14001. Generally speaking, large firms are more likely to go through ISO 14001certification. Since most of the respondents in the survey are small- to medium-sized firms, they are less likely to go through ISO 14001certification. Thus, they are less likely to embrace or understand LCA than large firms.

Table 11:
Result of Path Analysis on Impact of Corporate Environmental Strategy[a]

	Cost			Product			Relationships		
Variable[b]	Step 1	Step 2		Step 1	Step 2		Step 1	Step 2	
	Sig.	Sig.	T	Sig.	Sig.	t	Sig.	Sig.	t
Employee #	0.67	0.75	-0.32	0.84	0.72	0.36	0.18	0.33	0.98
Sales	0.47	0.38	0.88	0.67	0.22	1.23	0.14	0.09	**1.73**
Econ.fac	0.44	0.64	-0.46	0.84	0.96	-0.05	0.96	0.97	-0.04
SCM	0.75	0.33	0.99	0.007	0.005	**2.85**	0.31	0.31	1.02
Env.grp	0.88	0.66	0.44	0.34	0.23	1.21	0.000	0.000	**3.63**
MG.value	0.87	0.45	0.76	0.66	0.27	1.11	0.000	0.002	**3.23**
W,Reduct		0.77	-0.30		0.99	-0.01		0.31	-1.03
EMS		0.35	-0.94		0.60	-0.52		0.005	**2.85**
PackPro		**0.001**	**-3.25**		0.72	-0.36		0.26	1.13
Disposal		0.58	-0.55		0.49	-0.69		0.82	-0.23
LCA[c]		0.52	0.65		0.36	-0.92		**0.08**	**-1.79**
R^2	0.007	0.004		0.11	0.14		0.37	0.41	
		0.09			0.16			0.45	
R^2 change		0.09			0.10			0.04	
F	0.20	1.39		3.36	2.52		15.40	11.02	
df	161			159			162		

[a] n=179
[b] All regressions included an intercept, which was omitted from this table.

[c] Yes = 1, No= 0

We conduct an ordinary least square analysis to examine the correlation between environmental drivers and practices except the one involving LCA. As LCA is a dichotomous variable, logistic regression is used to examine the correlation between LCA and drivers. Table 3 shows the result of the analysis. The result does not show any significant correlation between economic factor and any practice. Supply chain is significantly and positively related to packaging. Environmental group is significantly and positively related to waste reduction and environmental management system and is marginally correlated to product disposal. Top management value exerts strong impact on waste reduction, environmental management system, product disposal, and life cycle assessment. Sales revenue is significantly related to waste reduction and marginally related to environmental management system. The results shows that top management value is the most important driver in determining corporate environmental practices.

Table 12:

Result of Path Analysis on Practice of Corporate Environmental Strategy[a] (standardized coefficients with t-ratio)

Variable[b]	Waste reduction		EMS		Packaging		Disposal		LCA[c]	
	t	Sig.	t	Sig.	t	Sig.	t	Sig.	Sig.	Exp (b)
Employee #	0.44	0.66	2.97	0.00	-0.02	0.99	-0.53	0.60	0.18	1.00
Sales	***2.45***	***0.02***	***1.90***	***0.06***	0.09	0.93	-0.16	0.88	0.96	1.01
Econ.fac	0.32	0.75	1.28	0.20	0.32	0.75	-1.32	0.19	0.23	1.53
SCM	0.40	0.69	0.05	0.96	***2.00***	***0.05***	-0.69	0.49	0.90	1.04
Env.grp	***2.56***	***0.01***	***2.12***	***0.04***	0.42	0.67	***1.78***	***0.08***	0.92	0.97
Mg.value	***4.41***	***0.00***	***5.27***	***0.00***	1.48	0.14	***2.74***	***0.01***	***0.02***	***2.42***

[a] n=179

[b] All regressions included an intercept, which was omitted from this table.

[c] Yes = 1, No= 0

Question 3 asks what factor, economic factor, environmental group, supply chain, or top management value, is more important in pushing firms to adopt proactive environmental strategy. To answer the question, we conduct a Pearson correlation analysis among these variables.

We selected both reactive and proactive practices to answer the question. In this study, EMS and "green packaging and production" are proactive environmental practices. We also chose the item that contains end-of-pipe practice and used them as dependent variables. We used same drivers as independent variables and conducted Pearson correlation analysis.

The result shows that top management value exerts a much more significant impact on environmental management system. Environmental groups exert stronger impact on EMS than economic factors and supply chain. The results show that, as a whole, top management exerts a more significant role in driving firms to adopt proactive practices than economic factor and supply chain.

Table 13

	End-of-pipe (II4)		EMS		Packaging&Production	
	Std. Coeff.	Sig.	Std. Coeff.	Sig.	Std. Coeff.	Sig.
Econ.fac	0.04	0.64	0.09	0.20	0.03	0.75
SCM	-0.09	0.30	0.00	0.96	0.18	***0.05***
Env.grp	0.18	***0.07***	0.18	***0.04***	0.04	0.67
MG.value	0.22	***0.02***	0.39	***0.00***	0.13	0.14

Question 4 asks whether companies that adopt end-of-pipe environmental strategy pay more attention to profit than firms that adopt proactive environmental strategy. The analysis in Table 14 show that top management value and environmental groups exert a strong influence on both end-of-pipe and proactive strategy. So we can't answer this question.

Table 14:

	Proactive practice		End-of-pipe practice	
	t	Sig.	T	Sig.
Econ.fac	1.21	0.23	0.47	0.64
SCM	1.68	0.10	-0.15	0.88
Env.grp	***2.43***	***0.02***	***2.82***	***0.01***
MG.value	***5.85***	***0.00***	***3.82***	***0.00***
Cronbach alpha	0.81		0.58	

DISCUSSION

The study examines the antecedence and consequence to environmental strategy and practice and the relations between factors influencing corporate environmental initiatives, practices and impact on cost reduction, product marketing, and corporate relations with stakeholders.

The finding on relations between environmental strategy and cost supports the argument of Walley and Whitehead (1994), who argue that win-win opportunities become insignificant in the face of the enormous environmental expenditures that will never generate positive financial return. It is also consistent with what we heard from the industry.

Previous research has shown a positive relationship between environmental strategy and product and process quality (Pil and Rothenberg, 2003) as well as green consumerism (Coddington, 1993) and differentiation advantage (Shrivastava, 1995a). This research shows that supply chain exerts significant and positive influence on corporate product performance. The research also reveals that public/community does not have strong influence on product performance.

The most interesting finding is on the impact of corporate relations with various stakeholders. The research shows that a number of drivers and practices exert significant influence on corporate relations, such as public/community, top management value, as well as environmental management system and LCA. The finding is consistent with previous research, which believes that being environmentally proactive improve a firm's image and enhance the loyalty of such key stakeholders. Melnyk (2003) found that

environmental management system improves product quality. But our results did not support this. Rather, we found EMS improves corporate relationships with stakeholders.

The research shows that life cycle assessment (LCA) does not lead to cost reduction. This is consistent with our prediction because LCA includes a number of costs that used to be excluded in accounting practice, such as disposal cost, pollution cost, risk cost. Our research shows that LCA marginally improves corporate relations with stakeholders.

Conclusions

The major contribution of our research is that we clarify the definition of environmental strategy and provide a comprehensive guideline on environmental practices. None of the previous research has defined what constitutes “green” practice. Our research is the first attempt in the academic world that delineates the scope and content of “green” practice and company. Besides, we contribute to the environmental research by clarifying the definition of “cost” in environmental studies.

Another major contribution of our research is that we conducted a comprehensive research on the impact of environmental drivers and practices on corporate performance, such as operational cost, product, and corporate relations. Previous research has conflicting result on these issues and we managed to clarify those issues at least within our research context. Our data reveal that environmental drivers do not lead to a reduction of operational cost. But it shows that packaging decreases cost. Supply chain improves product marketing or differentiation. Top management value and environmental groups exert strong influence on corporate relations with its internal and external stakeholders.

The research suggests that top management value is the most important factor in determining whether firms will adopt proactive environmental strategy. The data show that top management value is more significantly correlated to practices than public/community or economic factors.

The significance of our research is that it provides firms with a guideline of environmental operation. Resource is limited. And there is unmanaged risk associated with environmental strategy. Firms will know how to use their resource more effectively to achieve the best result and control the risk.

Our research provides significance to policymakers. From the returned survey, we found that managers in smaller firms are perhaps less sophisticated in terms of environmental strategy. There is a need to educate business owners/managers regarding the efficacy of green protection.

Limitations and Future Research

One limitation with the research is the sample location and sample size. We confine our sample within manufacturing firms in Iowa. Most of Iowan manufacturers are small- to medium-sized company. Smaller firms are in a weaker position to invest in green initiatives than larger firms. Besides, manufacturing firms might have different environmental initiatives than service firms. Future research can be extended to other states, other nations, or other industry, such as service industry or agriculture.

Another limitation is that we did not attempt to measure continuous improvement of corporate environmental performance. It is very difficult to measure this practice on a paper survey. A field study and longitudinal plant trip might be required for future research.

Despite the limitations discussed above, the research adds to the environmental literature by clarifying the green construct and examining relations between factors influencing corporate environmental strategy, practices and impact on performance.

Future research can be done on the lifecycle assessment of environmental strategies, such as its impact on cost, design, purchasing, production, disposal. Research has been conducted in engineering field. But no research has been done in the business field.

The research studies the impact of environmental strategy on cost, product, and relations. Future research could study the relations between environmental strategy and financial measures, such as stock price, market share, to name a few.

Government is requiring firms to be green by offering more opportunities to firms who are green, such as USDA's BioPreferred Program. Firms need to meet environmental standards in order to get government contract. Research can be done on the relationship between environmental strategy and market performance.

Future research can also been done on the organizational structure and environmental strategy and risk. Environmental strategy carries risk. Firms might not be familiar with the timing and magnitude of environmental impact. Firms might adopt decentralized structure to cope with the environmental risk (Aragon-Correa & Sharma, 2003). Research can be done on how corporate structure changes with environmental risk.

Environmental strategy might bring systemic change. For example, electric car requires a new technological system than conventional car. A new business model is required. Johnson and Suskewicz (2009) argue that the key is to shift the focus from developing individual technologies to creating whole new systems. Future research can study how firms make the systemic change.

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