

## **Drivers of Sustainable Innovation: Exploratory Views and Corporate Strategies**

**EUNSANG YOON\***

*University of Massachusetts Lowell  
Massachusetts, U.S.A.*

**STEVEN TELLO\*\***

*University of Massachusetts Lowell  
Massachusetts, U.S.A.*

### **Abstract**

Various forces drive corporate commitment to sustainable innovation including: (a) external stimuli, (b) business opportunities, and (c) a business orientation toward corporate social responsibility. The depth of corporate response to these drivers is shaped by how the managing team of a corporation views the relationship between economic growth and the environment. This paper examines associations between key drivers of sustainable innovation and three alternative views of the economic growth-environment relationship. We also examine three contrasting modes of corporate response (i.e. compliance, commitment and resistance) to those drivers and suggest directions for further research on the corporate practice of sustainable innovation.

Keywords: sustainable innovation, economic growth and the environment, corporate social responsibility, sustainability

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\* Main Author, Professor of Marketing, College of Management, University of Massachusetts Lowell (eunsang\_yoon@uml.edu).

\*\* Coauthor, Assistant Professor of Management and Entrepreneurship, College of Management, University of Massachusetts Lowell (steven\_tello@uml.edu).

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## INTRODUCTION

Corporations commit to sustainable innovation for different reasons and with different expectations (Ginsburg and Bloom 2004; Tello and Yoon 2008). Some respond reactively to comply with government environmental regulations while others respond collaboratively to mitigate the public criticisms of social activists. Increased customer demand for environmentally friendly goods and advances in green technologies also motivate corporations to engage in sustainable product development. More recently, recognition of their own social responsibility has led many corporations to initiate sustainability programs in cooperation with the suppliers and distributors. Globalization of economic activities (Dinda 2004), diffusion of information technologies (Martin and Wheeler 1992; Reppelin-Hill 1999) and diversification of eco systems across industry (Knot 2003) have also contributed to corporate adoption of sustainable business practices.

The manner in which a company responds to these driving forces of sustainable innovation is shaped by how the managing teams of a corporation approach the relationship between economic growth and the environment (Hamann 2007; Porter and Kramer 2006; Sharma 2000). The trade-off view represents a pessimistic perspective, focusing on the situation in which economic growth begets environmental problems due to increases in production and consumption (Hirschhorn 2001). The economic synergy view is based on the argument that economic growth is essential to enable a society to increase resources for environmental and social improvement by pointing to the mutually supportive relationship between economic growth and the environment in the process of industrialization (Fisher and Freudenburg 2001; Mol 1999). The concept of corporate social responsibility (CSR) views corporations as social institutions which must consider public interests by engaging in sustainable business practices (Shaw 2007).

A number of conceptual and empirical studies report that the drivers of sustainable innovation are interactive rather than mutually exclusive (see Dinda 2004 for a comprehensive review). Porter and Kramer (2006) suggest that companies respond to both internal and external forces when pursuing CSR initiatives. The interaction between internal business units and external

customers, suppliers and communities helps shape the level of corporate commitment to sustainability initiatives. Ginsberg and Bloom (2004) postulate that the dominant view held by the managing team of a corporation shapes their environmental strategy and positioning. Sharma (2000) observed that the differences in how companies in the oil and gas industry responded to calls for increased environmental responsibility were based on the management's interpretation of environmental issues as strategic threats or opportunities.

In this paper we examine the associations between the key drivers of sustainable innovation and different corporate views of the relationship between economic growth and the environment for the purpose of explaining different modes of corporate commitment to sustainable innovation. In the following section we review the definitions of sustainable innovation as a basis for our exploratory study and the literature on the sources and roles of the key drivers of corporate commitment to sustainable innovation. Then, we discuss the alternative views on the relationship between economic growth and the environment to link them to the modes of corporate response to the drivers of sustainable innovation. After examining the limits of the drivers and views, we conclude with a summary and discussion of the directions for future research.

## DRIVERS OF SUSTAINABLE INNOVATION

### Defining Sustainable Innovation

The literature to date defining sustainable innovation is limited. Knot's (2003) discussion of sustainable innovation focuses on the ability of a heterogeneous sector or system to support, extend or sustain innovation over a period of time in relation to financial success or business growth, without discussion of sustainability as it relates to ecological or social dimensions. McElroy (2004) suggests three different definitions of sustainable innovation, "*sustainability of innovation artifacts relative to meeting financial or business goals... sustainability of innovation artifacts relative to meeting social and/or environmental goals... and sustainability of innovation processes relative to the validity of their outcomes and their internal authenticity* (p. 12)." His discussion focuses on

the innovation process as it relates to learning, epistemology and policy. Nill and Kemp (2009) discuss policy strategies that support sustainable innovation, without specifically defining the concept but suggesting a clear relationship to sustainability and economic policy and development.

Rogers (1995: 132) broadly defines innovation as “an idea, practice or object that is perceived as new to an individual or another unit of adoption.” In regard to business processes and economic development, Luecke and Katz (2003: 2) define innovation as “the embodiment, combination or synthesis of knowledge in original, relevant, valued new products, processes or services.” Like Fagerberg (2004), Mckeown (2008) and Rogers (1995), we distinguish invention, the process where new ideas or knowledge are discovered and tested, from innovation, the process where new ideas and knowledge are used to create new products, processes or services. Innovation can be categorized around multiple dimensions including the type of innovation (product, process or service, see Schilling 2008) or the competitive impact that the innovation may have on established companies (disruptive or sustaining, see Christensen 1997). For the purpose of applying the concept of sustainability to the corporate practice of innovation, our discussion focuses on the creation of new and original products, processes and services that add economic value.

By sustainable innovation, we specifically refer to innovation activities that contribute to the triple bottom line of sustainable development: economic, ecological and social benefits (Boersema and Bertels 2000; McNeil 2000; Wheeler and Elkington 2001). Thus, sustainable innovation can reasonably be defined as the development of new products, processes, services and technologies that contribute to the development and well being of human needs and institutions while respecting the worlds’ natural resources and regenerative capacity. This definition is consistent with the general definitions of *sustainable development* that emphasize the integration of ecological, social and economic dimensions along with a sense of responsibility to existing and future generations (Brand 2002; Gerlach 2003).

### **Driving Forces**

A significant body of literature examines the forces contributing

**Table 1. Key Drivers of Sustainable Innovation**

| Driver                  | Role as Driver   | Selected Sources  |
|-------------------------|--|---|
| Consumer Demand         | Purchases environmentally sound goods and services.<br>Leads changes in business practice.   | Ginsburg and Bloom 2004<br>Goldstein 2000; DesJardins 1998                            |
| CSR Initiatives         | Demonstrates corporate commitment to CSR - for internal and external audience.<br>Raises rivalry and competition within and across industries.   | Ginsburg and Bloom 2004<br>Porter and Kramer 2006                                     |
| Government Intervention | Enforces compliance with regulations.<br>Provides incentives to improve environmental impact.<br>Establishes policies to promote technological advance.  | Daly and Portnoy 2004<br>Simpson, Taylor and Barker 2004<br>Carraro and Galeotti 1997 |
| Social Activism         | Raises awareness of environmental and social justice issues.<br>Forces changes in government regulation and business practice.<br>Influences consumer demand.  | Edwards 2005<br>Ginsburg and Bloom 2004<br>Makower 2006                               |
| Technological Advance   | Develops efficient technologies to reduce resource depletion and pollution.<br>Supports new business opportunities.<br>Develops new technologies raising rivalry and competition within and across industries. | Baucus 1994; Henderson 2006<br>Christensen 1997<br>Knot 2003                          |

to corporate adoption of sustainable business practices over the past decade. This body of work suggests that a mix of internal and external drivers guide corporate commitment to, and investment in, sustainable business practices. Internal forces include shareholder and employee pressure (Warhurst 2001), organizational identity (Dutton and Dukerich 1991; Sharma 2000), managerial perspective and discretionary slack (Sharma 2000), company size (Hillary 1997; Schaper 2002) as well as human resources and organizational capabilities (Ashford 1993; Hart 1995; Russo and Fouts 1997). External drivers include consumer demand (Ginsburg and Bloom 2004; Goldstein 2000; DesJardins 1998), government regulation (Daly and Portnoy 2004;

Simpson, Taylor and Barker 2004; Carraro and Galeotti 1997), social activism (Edwards 2005; Makower 2006) and technological advances (Baucus 1994; Costanza et al. 2000; Henderson 2006). CSR initiatives can serve as both internal drivers, encouraging employees to engage in sustainable business practices, and external drivers, raising competitive advantage and threats both within and across industries (Ginsburg and Bloom 2004; Porter and Kramer 2006). Several of the internal drivers mentioned above (i.e. shareholder and employee pressure, organizational identity, managerial perspective and discretionary slack) are directly as well as indirectly associated with CSR initiatives.

For the purpose of examining the association between the drivers of sustainable innovation and views on the economic growth-environment relationship, our research focuses on five drivers: government intervention, social activism, customer demand, technology advance and CSR initiatives. Table 1 lists these drivers along with a brief description of the role each driver plays and sources supporting their validity. These drivers are observable from outside an organization, supporting external review and analysis, and are closely related to corporate response and strategy concerning sustainability (Dinda 2004; Yoon and Park 2005). Other external forces such as global resource depletion and scarcity (Dinda 2004), information accessibility and literacy (Bimonte 2002), and the nature of developing economies (Auty 2003) are not addressed here in the framework since our focus is primarily on corporations in industrialized economies.

### **Government Intervention**

Without external intervention, will the environment continue to deteriorate? Daly and Portney (2004) argue that the unregulated market neglects essential needs for public goods, externalizes a significant portion of real production costs and tends to move toward monopoly control over resource allocation. Governments, in their effort to balance protection of the environment and competition in the economy, have exercised both regulations and incentives (Simpson, Taylor, and Barker 2004). Government policies can stimulate environmental R&D, technological innovation and diffusion to provide corporations with the incentives to avoid damaging the environment, while preserving competitiveness in

the market (Carraro and Galeotti 1997).

Global regulations have also been a driver of sustainable innovation. For example, internationally coordinated regulations are required to handle such issues as global warming and ozone depletion. The Montreal Protocol, signed in 1989, regulates member countries not to trade in Protocol-controlled ozone destroying substances, such as chlorofluorocarbons (CFCs), with non-member countries (Sujarittanonta 1998). The REACH directive (Regulation on Registration, Evaluation and Authorization of Chemicals) was enacted by the European Union in June 2007 for the purpose of regulating the manufacturing and trade of chemicals on a global scale (European Chemicals Agency 2007).

### **Social Activism**

Social activism has significantly influenced government and industry response to environmental issues. In 2005, for example, Britain passed legislation that put the “sustainable economy” on the front burner ahead of the usual economic growth platform as environmentalists and lawmakers agreed to find ways to prevent future pollution for the sake of economic prosperity (Edwards 2005). One of the important arguments of many social activist groups has been that human-induced climate changes in the course of economic growth have contributed to natural disasters (e.g. extreme heat and floods in Europe and Hurricane Katrina in the United States in 2005) that ultimately cost billions of dollars in emergency funds.

Social activism not only pressures commercial enterprises to spend additional resources for environmental protection but also influences governments to enact new regulations and raises awareness on such international issues as global climate change, water pollution and greenhouse gases. Non-governmental organizations (NGO’s) have played an important role in addressing world climate changes through international initiatives such as the Kyoto Protocol, where participating countries have committed to reducing greenhouse gas emissions (or limiting emission growth) to 5% below 1990 levels (Aspen Publishers 2005).

### **Customer Attitude and Demand**

As a society becomes increasingly aware of the importance of environmental protection and resource conservation, consumers demand more environmentally accountable behavior on the part of leading corporations (DesJardins 1998). A recent study of U.S. consumers found that 87% of respondents were seriously concerned about the environment while 73% believed the U.S. government should strengthen enforcement of environmental regulations (PR Newswire 2007). Less than one third of respondents (29%) believed industry fulfilled their environmental responsibilities. Over 70% of respondents indicated that a firm's environmental business practices are factored into their individual decisions about where to shop, what products to purchase and where to invest. This represents a significant increase over a 2002 study where only 46% of respondents indicated environmental values influenced their purchasing decisions (Ginsburg and Bloom 2004).

Realizing that protecting the environment promotes profitability and growth, corporations can justify the development of new products and services to meet the demands of green customers (Goldstein 2000). Clearly, not all companies will successfully meet the needs of green consumers. However changes in consumer attitudes and demand definitely drive corporate investment in environmental R&D and technological innovation.

### **Advance of Environmental Technology**

Technological innovation supports the efficient use of natural resources, the ability to mitigate or eliminate various types of pollution and provides new investment and growth opportunities (Baucus 1994). Clean technologies are particularly useful in solving such environmental problems as global warming, the scarcity of natural resources and rising energy costs. Development and application of sustainable technologies also helps corporations improve their images with their financial stakeholders.

Sustainable technology development offers a synergistic impact on the economy, for example, modern information technology facilitates public accounting's shift to a paperless

work environment, improving both business processes and the environment through a reduction in the logging of trees and production of pulp for paper (Johnston and Spencer 2005). Package-flow technology enables United Parcel Service to track the delivery and location of packages, leading to an estimated savings of 14 million gallons of fuel annually (Barnes 2005). And General Electric's Hybrid locomotives, equipped with smaller engines and large battery banks, help the railroad industry reduce fuel consumption and associated pollution (Leahy 2005).

### **Corporate Sustainability Initiatives**

Voluntary initiatives on the part of a corporation supporting sustainable innovation are a proactive mechanism for publicly demonstrating a company's commitment to good corporate citizenship. Corporate citizenship implies not only philanthropy but also accountability, commitment and a management philosophy oriented toward successful sustainable innovation (Epstein and Roy 2003). Bent (2005) reports that accounting practices which include sustainability measures help uncover the full costs associated with environmentally damaging practices while financially illustrating the benefits of changing such practices. He points to a UK chemical company which adopted an environmentally-friendly refrigerant without initially accounting for the emissions savings and the improvement of customer goodwill accompanying such a change of business operation and process.

Being socially responsible requires the integration of a business culture oriented toward sustainability into a firm's core business strategy and practice (Sage 1999). IBM reports saving \$100 million over eight years through energy conservation efforts while embracing a leadership role in environmental stewardship (Davies 2007). Other major corporations such as Dell and Intel also report saving money through energy conservation programs while decreasing their greenhouse gas emissions (Green 2008). These initiatives help companies reduce costs while improving their brand image among green-minded consumers.

Many corporations demonstrate their commitment to sustainability in CSR reports for their environmentally conscious audience (Amalric and Hauser 2005). While there is some debate regarding the accuracy and impact of self-reporting (Cooper and

Owen 2007; Porter and Kramer 2006), information regarding corporate environmental performance has become increasingly accessible to customers whose purchase and investment decisions are then based on those reports (White 2005).

## **VIEWS ON THE GROWTH-ENVIRONMENT RELATIONSHIP**

In this section we examine three alternative views of the relationship between economic growth and the environment, supporting the roles of the key drivers of sustainable innovation presented above.

### **Trade-off View**

The trade-off view of the relationship between growth and the environment is based on the notion that economic growth is a necessary but not a sufficient condition for improving the overall environment for the benefit of people and nature. As an economy grows, increased production and consumption expands demand for natural resources and also increases pollution. Increased population and urbanization contribute to massive consumption and use of raw materials, natural resources and finished goods. Disposal of the by-products from production and consumed goods has a noticeable negative effect on the environment and well being of the society (Suzuki 2002).

There is a close association between the pattern of economic growth and the environmental problems experienced by a country. For example, the Asia-Pacific region has achieved a 40% growth of industrial production during the past decade, but also faces serious environmental problems including drought, water pollution, air pollution, and spiraling energy consumption, resulting in potentially disastrous, long-term consequences (Surendra 2005). Globalization worsens these growing environmental problems as corporations move their production facilities to developing countries with weaker environmental regulations, shifting the environmental costs of business from one group of stakeholders to another. While this move may serve the immediate bottom-line of a company, resource depletion and pollution may ultimately inhibit long-term economic growth both in the host and client countries.

A trade-off perspective typically leads the management team of a company to view the environmental and social costs as a component of their operating costs required for doing business (Rubenstein 1994). This view suggests that corporations are not very likely to voluntarily respond to emotional appeals for the social good or to public requests to improve their environmental performance through technology or process innovation. Thus, the primary drivers of sustainable innovation from a trade-off perspective are government intervention and social activism.

### **Economic Synergy View**

There have been two primary explanations of how economic growth can enhance sustainability through innovation: ecological modernization theory (Fisher and Freudenburg 2001; Mol 1999) and the Environmental Kuznets Curve (Dinda 2004; Stern, Common, and Barbier 1996). Ecological modernization theory provided theoretical support to the environmental policies of the industrialized nations during the 1980's and 1990's by opposing the so-called limits-to-growth argument (i.e., increasing economic growth leads to deterioration of the environment) while supporting the argument that science and technology continues to find solutions to environmental problems and improves efficiency in business processes (Fisher and Freudenburg 2001; Mol 1999; Revell 2005).

While environmental regulations may initially slow down or inhibit economic growth, corporate investment in environmentally friendly processes and technologies ultimately spurs the creation of new industries and economic growth (Schofer and Granados 2006). One example of empirical evidence for this argument is a study of environmental regulations in Japan in the 1960's and 70's which reports a positive correlation between the pressure exerted by environmental regulations and the level of R&D expenditures and a negative correlation between pollution control expenditures and the average age of capital stock (Hamamoto 2006). Hamamoto suggests a technological modernization of production and processes occurred during this period, improving environmental impact and industrial productivity. A U.S. study found that 9 of the 12 states in the U.S. that were strongest in environmental protection also were strongest in economic growth while 12 of the

14 states that were weakest in environmental protection ranked among the lowest in economic growth (Graham 1998).

The Environmental Kuznets Curve (EKC) hypothesizes an inverted-U-shaped curve between the indicators of pollution and income levels. This hypothesis follows the observation of Kuznets (1955) that environmental degradation increases with growing income up to a threshold level, beyond which environmental quality improves (pollution indicators decrease) with higher income per capita (Coondoo and Dinda 2002). Arrow et al. (1995) describe this relationship as a natural process of economic development from a clean agrarian economy to a polluting industrial economy, and then, to a clean service economy. As economic development accelerates with growth in primary industries, the rate of resource depletion exceeds the rate of resource regeneration. As economic development continues, the growth of information-intensive industries and services is accompanied by increased environmental awareness, enforcement of environmental regulations, better technology, higher environmental expenditures and an increase in per capita income. This, according to EKC theory, ultimately leads to a decrease in environmental degradation (Dinda 2004).

A number of studies confirm a statistical relationship between major environmental indicators and national per capita income, supporting the EKC perspective (Grossman and Krueger 1995; Stern, Common, and Barbier 1996; Lifset 2002). Selden and Song (1995) found that concern and value for preservation of the environment increases in a high income society. However, critics of the EKC suggest that the resulting relationship varies based on the industry, type of pollutants measured and the economic indicators used in the study (Azomahou, Lasiney, and Van 2006; Stern, Common, and Barbier 1996). See Dinda (2004) for a comprehensive review of the conceptual, theoretical and empirical studies on the EKC hypothesis.

The economic synergy view of the growth-environment relationship focuses on the production and supply side of the equation, examining how technology can be applied to reduce pollutants and improve manufacturing processes and profitability; as well as the demand side, — whether customers will pay for environmentally-friendly products and processes (Goldstein 2000). Thus, the primary drivers of sustainable innovation from the economic synergy perspective are customer attitude and

demands for sustainable products and the advance of sustainable technologies.

### **Corporate Social Responsibility View**

An emerging view of corporate social responsibility (CSR) is based on stakeholder theory, the premise that commercial enterprises are responsible to a wide range of constituents affected by the enterprise's policies, actions and business activities; including not only the owners, employees, customers and suppliers but also the local community, advocacy groups, government, media and other related constituents (DeGeorge 1986; Weiss 2006). This broad view of CSR sees a corporation as a social institution that must consider the interests of all the groups upon which it has an impact by engaging in sustainable business practices (Shaw 2007). A company with a CSR view embraces its commitment to sustainable innovation by internalizing practices that proactively assess and mitigate economic, environmental and social issues in a manner that minimizes harms and optimizes benefits (Warhurst 2001).

This is a significant departure from the classic view of corporate responsibility, which identifies a corporation's sole responsibility as generating profits for owners of the company (Friedman 1962). It is also distinct from the previously discussed Economic Synergy view in that decisions to invest in the development of sustainable products are based on a commitment to stakeholders, as well as stockholders. While the Economic Synergy view focuses on the ability of the firm to generate profit by matching technological capabilities to customer demand, the CSR view focuses on the role of a firm as integrating the needs and concerns of all stakeholders into decisions regarding the operations and strategic directions of the firm. Porter and Kramer (2006) and Warhurst (2001) argue that such socially responsible behavior can be a source of strategic competitive advantage for such companies.

There is growing evidence that companies are increasingly practicing CSR based on the stakeholder model. As noted earlier, many large corporations such as IBM, Dell and Intel are actively engaged in reducing energy consumption while embracing a leadership role in environmental stewardship (Davies 2007; Green 2008). Demos (2006) reports that in 2006, approximately 10%

(\$2.3 trillion) of all funds under US investment management were invested in companies identified as socially responsible. Hewlett Packard reports that in 2004 it received more than \$6 billion in requests for quotations that required information on their commitment to social and environmental responsibility — an increase of 95% from 2003 or 660% from 2002 (Makower 2006). Further evidence of a growing CSR perspective among today's corporation is reinforced by the popularity of CSR or Sustainability reporting among the world's largest corporations. In 2005, 64% of the 250 largest multi-national corporations published CSR reports either as stand-alone documents or as a component of their annual report (Porter and Kramer 2006). These reports aim to provide the customer and public with the view held by the corporation on the economic growth-environment relationship as well as the direction and level of their CSR efforts.

Corporate sustainability initiatives publicly demonstrate top management's commitment to sustainable innovation programs through strategic resource allocation. These initiatives clearly address triple bottom line issues of economic, ecological and social importance (Boersema and Bertels 2000; McNeil 2000; Wheeler and Elkington 2001) and are used as metrics to measure company progress towards sustainability, for both internal and external stakeholders. Other drivers such as customer demand, social activism and technological advance also contribute to the CSR view on the firm's commitment to sustainable innovation, however corporate sustainability initiatives backed with corporate resources provide a strong incentive promoting sustainable innovation.

## CORPORATE RESPONSE TO THE DRIVERS

Having discussed several drivers of sustainable innovation along with three distinct views of the relationship between economic growth and the environment, we now examine how companies respond to these drivers, specifically three different modes of corporate responses, *commitment*, *compliance* and *resistance* on the basis of the earlier work of Yukl (1994) and Kelman (1958) who examined how work groups respond to influence attempts. If we think of the drivers as an influence attempt, i.e. an effort to change the attitudes, perceptions or behaviors of another party, we

can develop a framework for projecting which drivers a company is most likely to respond to and what the level of commitment is likely to be. Yukl (1994: 194) defines these responses or outcomes as follows:

*Commitment* - An outcome in which the target internally agrees with a decision or request from the agent and makes a great effort to carry out the request or implement the decision; *Compliance* - The target is willing to do what the agent asks but is apathetic rather than enthusiastic about it and will make only minimal effort, and

*Resistance* - the target is opposed to the proposal or request and actively tries to avoid carrying it out.

Kelman (1958) views the influence process as an interactive social process, involving the motives and perceptions of the target, the actions of the agent and the context in which the influence process occurs. This is consistent with our discussion of sustainable innovation in which the economic growth/environment view of the company reflects the perceptions of the target and the driving forces reflect the agent's actions. Kelman's categories of outcome responses (i.e. instrumental compliance, internalization and identification) differ slightly from Yukl's but they also suggest that certain responses, especially internalization and identification, are more desirable since they can be accompanied by a greater level of commitment on the part of the target.

When anticipating how a company will respond to drivers of sustainable of innovation, it is important to understand the company's view of the economic growth and environment relationship. A company with a trade-off view of the economic growth/environment relationship responds primarily to the government regulation and social activism drivers. The legal ramifications of government regulation lead to compliance, a change in corporate behavior but not necessarily a change in attitude or perspective. As a driver, social activism may result in either resistance or compliance on the part of a company relying on the trade-off view. The coercive nature of social activism places the company in a defensive position where it may attempt to ignore, discredit or placate agents of social activism. A company with an economic synergy view responds primarily to customer demand or advances in technology. This company may incrementally modify their product and marketing strategies (i.e. compliance) or they

can introduce new sustainable product lines, building on advances in technology and growing customer demand (i.e. commitment).

While the primary driver for a company with a social responsibility view are corporate sustainability initiatives, the broader stakeholder perspective accompanying the CSR view and the use of sustainability initiatives as strategic advantage requires consideration of secondary drivers of sustainable innovation. Mandatory or coercive drivers such as government regulation and social activism may solicit either a compliance or commitment response, based on the nature of the regulation or social cause, while customer demand, technological advances and sustainability initiatives, when aligned with corporate strategy are likely to be embraced by a company relying on the CSR view.

Differences between companies in an industry regarding their view of the economic growth-environment relationship and the nature of their response can be a source of competitive advantage within the industry (Ginsberg and Bloom 2004; Porter and Kramer 2006). As an example, consider the actions of Toyota compared to Ford in the U.S. automobile market. Toyota introduced the Prius in the U.S. in 2000, the same year William Clay Ford Jr. announced Ford's commitment to increase fuel efficiency in their SUV and light truck line by 25% in five years through hybrid and crossover vehicles (Morris 2002). However in 2003, Ford abandoned their crossover vehicle program as impractical and pursued the SUV/light truck market which demanded larger, more powerful vehicles with lower fuel economy (Bartirromo 2008). Toyota continued to develop hybrid vehicles and expanded the option into their popular Camry line. In 2008, when gasoline prices crossed the \$4.00 per gallon mark in the US, and the US economy began to weaken, Toyota had come to dominate the energy efficient vehicle market while Ford found an excess inventory of tens of thousands of SUV and light trucks. Toyota demonstrates a company with a CSR view that crafted a long-term business strategy committed to sustainable innovation. Ford demonstrates an economic synergy view, pursuing energy efficient vehicles only when the drivers of customer demand and technological advance were aligned, but abandoning this market when customer demand shifted. Ford's change in business practice reflects short-term compliance to drivers but not the long-term commitment demonstrated by Toyota.

## LIMITS OF THE DRIVERS

Drivers of sustainable innovation face inevitable limits or shortcomings. The most common sources of these limits include: the instability of the driving forces over time, the inconsistency of strategic planning and implementation across organizations, and the influence of self-interest intrinsic to the people involved.

### **Government Regulation**

The two greatest criticisms of government regulation as a driver of sustainable innovation are that they are inconsistent and inefficient. In regard to inconsistency, government regulations change over and across the particular party affiliation in office. Political party identification and ideology is a strong predictor of attitudes to the environment and regulation. Changes of leadership along party lines often mean changes in regulations, funding and enforcement. This is particularly problematic in relation to a global response to environmental issues. For example, during the last decade the U.S. government has rejected numerous global initiatives specifically those dealing with global warming issues (Claeys 2008). It is also difficult to regulate fairly across industries, in these situations government intervention is often inefficient and can even degrade rather than promote the environmental protection (Muldoon 2006).

In regard to inefficiency, government intervention and regulation often lacks flexibility. For example, the EPA's Energy Policy Act of 2005 offered federal tax credits of \$1.80 per square foot on green building projects that meet the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) standards. These incentives were long-term cost savers for many large corporations, but were inaccessible to small or start-up companies due to the high cost associated with employing green technology and building materials. Green taxes on polluting industries often raise the price of their outputs, reducing customer demand for their products. The tradeoff between the efficacy of green taxes as an instrument for environmental protection and the power of raising revenues is also an issue for debate (DeWitt 2008).

### **Social Activism**

The increasing number and influence of environmental activist groups has raised concerns about their practical intentions and long-term impact. They sometimes lack clarity regarding their long-term goals and objectives, and are often criticized regarding their strategies and tactics (Anderson 1998). Social activist groups are often not well-organized and their commitment easily varies over time or issues since members are typically concerned with a variety of social and political issues. Unorganized movements of activist groups discourage the membership of concerned volunteers. Many have limited financial and legal power to pursue corporations, and thus must rely on the media to generate negative publicity for corporate targets. Corporate response to social activism is often highly localized and situation specific, designed to remove the immediate cause of negative public attention and defuse the issue at hand. Once an incident fades from the headlines, it is difficult to ensure that company practices have really been significantly altered (Makower 2005).

### **Customer Attitude and Demand**

Customers are sometimes skeptical about the tangible benefits that product claims make toward the environment due to a misleading industry practice called “green-washing” — the practice of making an unsubstantiated or misleading claim about the environmental benefits of a product, service or technology. The misrepresentation of the “greenness” of an offering leads to consumer distrust of the corporation’s claims, which in turn discourages commitment to sustainable innovation. (Grankvist, Dahlstrand, and Biel 2004).

Changing the attitude, preference or behavior of consumers may be simple for a small lifestyle adjustment such as replacing a light bulb with a more efficient one or recycling bottles and cans, but can be complex for an extensive lifestyle transition such as buying a compact hybrid car or green house. Inconsistency is often observed when customers compromise between or among comfort, security, reliability, aesthetics, affordability, status and pleasure associated with their buying decision making (Tripsas 2008). The

monetary burden associated with buying a green product also discourages customer demand of, and corporate commitment to, sustainable innovation. Becoming an educated consumer takes time and effort. Consumers often can not tell the differences between the sustainable and regular products and thus, make buying decisions on the basis of their perception about the product rather than the specification provided by the manufacturer. Corporations do not receive the environmental credit they deserve in the eyes of customers when the latter are not willing to be accountable due to significant cost burdens (Werbach 2008).

### **Advance of Environmental Technology**

Advancement of technology as a driver of sustainable innovation requires long-term commitment and support for research, development, testing, application and diffusion. Many sustainable products experience slow diffusion due to adoption costs. Examples are energy-efficient light bulbs as a standard lighting solution for homes and businesses, hydrogen-cells for green car solutions or solar power technology as a sustainable source of energy (Frame and Brown 2008). Newly developed sustainable technology may be incompatible with the existing manufacturing and operational processes, delaying application and diffusion of those technologies across the industry (Sine and David 2003).

The outcome of long-term investment in sustainable technology is not always predictable, nullifying industry and corporate claims regarding the impact of their sustainable innovation. Hall and Vredenburg (2003) argue that DuPont's plan to cut their emissions by two-thirds by 2010 is not achievable since the underlying assumption regarding development of sustainable technology is neither valid nor reliable. Unwanted side effects of new technology also hamper the diffusion of sustainable technologies because of the time-consuming process of testing and verification. Some green technologies may turn out to be detrimental to the environment. For example, hydrogen-fueled vehicles are viewed as being eco-friendly, but the empirical evidence reveals that about 15% of the hydrogen used to fuel automobiles could potentially leak into the atmosphere and even further expand the hole in the ozone above Antarctica (Saco 2008).

### **Corporate Sustainability Initiatives**

Griesel (2008) argues that corporate sustainability initiatives are no longer a way to boost corporate image but require a commitment that extends beyond statutory and compliance obligations to voluntarily improving the quality of life for their employees, local community and society at large. However, an organization's practical commitment to corporate citizenship role is not always clear. Hamann (2007) suggests that the impact of a firm's green initiatives on their profits and/or revenue is the primary obstacle towards their becoming a good corporate citizen. Corporate commitment to sustainability often comes with costs that are passed down in the form of higher prices to consumers, lower wages to employees and smaller dividends to stockholders. An important reason why sustainability initiatives do not necessarily pay off is that the markets for sustainable products are often niche segments, almost all goods and services continue to be purchased on the basis of price, convenience and quality rather than environmental impact.

Corporations trying to launch an effective sustainability initiative can be swamped with rules at many different levels such as corporate laws, antitrust regulations, labor and employment laws, tax systems, environmental laws and consumer protection laws (Gill 2008). When corporations do not provide detailed reports on their sustainability efforts, they run the risk of failing to satisfy public expectations regarding corporate citizenship (Scott and Westervelt 2008). In the utility industry, for example, Georgia Power allowed consumers to purchase renewable power and claimed that this would be "equivalent to planting 125 trees or not driving 2,000 miles." Their green marketing campaign was very successful, with over 4,000 customers enrolling in the company's Green Energy Program. However, consumers later learned that more than 60% of their contributions in the 2Q of 2007 went towards advertising and administration.

### **SUMMARY, LIMITATIONS AND FUTURE RESEARCH**

In this paper, we conducted an exploratory review of the literature on alternative views of the relationship between economic

growth and the environment and key drivers of sustainable innovation in the context of corporate response to those drivers. We also endeavored to explain how the view held by a company shapes or directs strategic business decisions in relation to sustainable innovation. In summary, our review of the literature and industry practice suggests:

(1) Across and within industries, corporations and management teams may have differing views on the relationship between economic growth and the environment (i.e. trade-off view, economic synergy view or CSR view).

(2) A combination of external and internal drivers contributes to corporate commitment to sustainable innovation. The key drivers examined in this paper include government regulation, social activism, customer demand, advancements in technology and corporate sustainability initiatives.

(3) A firm's view of the relationship between economic growth and the environment determines which drivers exert the primary and secondary influence on the firm's behavior vis-à-vis sustainable innovation,

(4) A firm's view of the relationship between economic growth and the environment shapes the firm's response to specific drivers, for example, commitment, compliance or resistance, and,

(5) Differences in how firms view the relationship between economic growth and the environment along with differences in their response to drivers of sustainable innovation can provide strategic and competitive advantages within an industry.

As discussed above, the tradeoff view responds to two primary, external drivers of sustainable innovation: government intervention and social activism. The economic synergy view responds to two primary drivers: customer demand for environmentally friendly goods and the advance of environmental technologies. The CSR view supports a primary driver, the initiation of comprehensive sustainability programs as well as secondary drivers such as customer demand, social activism and technology advance. Since the CSR view is based on a stakeholder perspective, a broader range of concerns and factors contribute to decisions within the firm regarding the pursuit of sustainable innovation. However,

sustainability initiatives as a response to the needs of stakeholders become a dominant driving force for sustainable innovation to a firm relying on the CSR view.

Our discussion in this paper has several limitations in the scope of research topics and method of strategy derivation. First, there are other views on economic growth and the environment, such as the cultural-social evolution view of human society (Janson and Smith 2003; Trigger 1998) or the adaptive cycle view of ecological systems (Able, Cumming, and Anderies 2006; Holling 1987; Walker et al. 2006), omitted here because of their limited relevance to the main focus of this paper, i.e. deriving implications for corporate strategy decisions.

Second, some of the other drivers of sustainable innovation — the compatibility of production and consumption process (Briceno and Stagla 2006; Maxwell, Sheate, and van der Vorst 2006), diffusion of new business practice through benchmarking (Yasin 2002; Zairi 1998) — were not discussed because of their low importance as a driving force of sustainable innovation.

Third, the drivers of sustainable innovation discussed in this paper do not act in isolation; some drivers may reinforce or promote other drivers, along with the sustainable practices of a firm or within an industry (Sharma 2000). For example, government intervention is sometimes reinforced by the pressure of social activism, while social activism may stimulate customer demand for sustainable products. Technology innovation may create new market opportunities for corporations, who then launch sustainability initiatives that raise customer awareness and product demand. These interactions are intuitively consistent with industry practice but further conceptual and empirical research is required to test the direction and significance of these interactions. Despite presumed interaction between drivers, however, we suggest that the manner in which a company responds to these drivers is predicated by the company's view of the economic growth-environment relationship.

Fourth, our discussion did not cover the literature in the fields of sociology, administration, ecology and others because of our narrow focus on corporate management and strategic marketing. Last, our discussion of possible corporate responses to the drivers did not include other modes of corporate response (e.g. ignoring the pressure of external drivers, delaying responses until the inevitable moment) because they are not considered as appropriate responses

from a constructive management perspective.

Additional research is needed to confirm our discussion of the link between corporate views of the economic growth-environment relationship and response to specific drivers of sustainable innovation. Note that the framework of our discussion is based on a review of sustainability, corporate social responsibility and marketing literature. Survey research examining dominant views across major corporations and industries could help to confirm or deny our proposed categories and relationships. A survey of industry practice might uncover additional or refined views that affect firm susceptibility to the drivers of sustainable innovation.

The manner in which a firm responds to drivers of sustainable innovation is also a subject for further research. Contrast the reaction of Toyota and Ford to the consumer demand and advance of technology drivers in relation to higher fuel economy vehicles. Why do two automobile industry giants respond so differently? Porter and Kramer (2006) suggest that this is a choice of strategy, Ginsburg and Bloom (2004) report that it is a choice of customer and market orientation while Christensen suggests that it is the firm's dominant position and orientation toward innovation (1997). Case study research analyzing and comparing corporate decision-making and investment processes would help better illustrate and understand how companies respond to different drivers of sustainable innovation.

We have outlined a conceptual framework for examining how companies respond to the key drivers of sustainable innovation and suggested that the manner of response is related to a firm's view of the relationship between economic growth and the environment. Further empirical examination and testing of this framework may help better understand why some companies demonstrate greater commitment toward sustainable innovation than others. It may also suggest strategies for inducing commitment to sustainable innovation from companies and industries which have been slow to commit to sustainability. We hope our efforts would encourage research that identifies strategies and techniques that improve the adoption of sustainable business practices across more industries.

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