EVALUATING CORPORATE ENVIRONMENTAL STRATEGY: A CASE STUDY OF SIX MULTINATIONAL COMPANIES

By

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To make responsible environmental choices, consumers need to make thorough evaluations of environmental strategies used by the companies they patronize. The most comprehensive way to integrate environmental concern into an evaluation of corporate activity is to evaluate the environmental impacts across the lifetime of the product or service being evaluated. Starting with the vision statement, the environmental strategy can then be evaluated from cradle to grave. Chapter 1 addresses the elements that should be included in an evaluation of an environmental management program and develops an evaluation process for the use of consumers.

3M, BASF, General Motors, Volvo, BP, and Shell are evaluated in Chapter 2. The analysis of the six companies serves to demonstrate the application of the evaluation process. Evaluations were completed using only public domain information. Three industries are represented, with two competitors evaluated within each industry. The

evaluation process highlights strengths and weaknesses between the competitors, as well as identifies trends within the industries.

The diversified chemical companies, 3M and BASF, both have strong standardized procedures to help make product development decisions across the diverse product spectra. BASF outperforms 3M in its environmental accounting methods, waste management, and supplier relationships. However, both companies are weak in product stewardship efforts. In the environmental management evaluation, BASF outperforms 3M by including more of the product life cycle in corporate responsibility.

The automotive companies, General Motors and Volvo, are confronting limited market demand and the legislative challenges by focusing on fuel efficient vehicles. Both companies are starting to take responsibility for supplier environmental practices and the end of life of the vehicles, extending environmental responsibility. Volvo outperforms GM in the evaluation by adopting stricter performance standards for suppliers, marketing, waste management, and pollution prevention.

The petrochemical companies, BP and Shell, are confronting environmental challenges by focusing on pollution prevention. The companies are attempting to develop profitable renewable energy businesses. However, BP and Shell pay little attention to the post-purchase impacts of their products, adhering to legislative minimum requirements. In the future, BP and Shell will have to take responsibility for the use of their products to commit to environmental sustainability.

The evaluation process provides information to help consumers and investors make informed decisions with their money. Informed decisions can give consumers and investors a lot of power over business strategy.

CHAPTER 1
CORPROATE ENVIRONMENTAL STRATEGY EVALUATION

Introduction

In a world where the simple query, “Paper or plastic?” is an everyday question, making wise choices on environmental preference is becoming more difficult for consumers. While environmental issues merge into economic activity, consumers emerge as power players. If they choose to use it, consumers have the power to influence the environmental practices of the businesses they patronize. As environmental values become fundamental to social structure, organizations must reexamine how they conduct business to be able to meet consumer expectations (Shrivastava 1996).

If the objective is to make environmentally responsible decisions as a consumer, what criteria can be used to judge whether or not a given enterprise is adhering to consumer expectations? How does one distinguish between an organization that is pursuing responsible environmental management from one that disregards concern for the environment? Even understanding the environmental implications of selecting paper versus plastic shopping bags requires one to process inconclusive science.

To make responsible environmental choices in the market, consumers need to look beyond marketing claims in advertisements and product packaging. From all appearances, the most comprehensive way to integrate environmental concern into an evaluation of corporate activity is to take a cradle to grave approach to the analysis. Such an approach evaluates the environmental impacts across the lifetime of the product, process, material, technology or service being evaluated (Richards et al.1994). Starting

with the vision statement, the organization sets the precedent for its approach to environmental responsibility. The environmental stature can then be evaluated through the organizational culture, leadership practices, raw material extraction, product design, manufacture, product stewardship, and waste management.

An assessment chart has been designed to accompany each component of the evaluation (Figures 1.1 – 1.13). Each chart is divided into four successively comprehensive performance level descriptions. The evaluator determines which performance level description best describes the overall performance of the organization being assessed. Using the performance level descriptions, the evaluator scores the company on a scale of 0 to 4 for each component of the evaluation. The final score for the organization will be the sum of the component scores.

Chapter 1 addresses the elements that should be included in the evaluation of an environmental management program. Incorporating the concepts of industrial ecology, the evaluation will provide a comprehensive approach to inspect how an organization approaches environmental management. Following the development of the evaluation, 3M, BASF, General Motors, Volvo, BP, and Shell were evaluated in Chapter 2. The analysis of the six companies serves to demonstrate the application of the evaluation process.

Vision Statement

An organization's vision statement is fundamental to its commitment to environmental stewardship. (Freeman et al. 2000). If concern for the environment is absent from the vision statement, environmental responsibility likely will be absent from other organizational elements (Shrivastava 1996). A vision statement gives an

organization an identity and a unifying theme, around which all decisions and actions supposedly will be made.

Organizations often stand for something more than profitability (Freeman et al 2000). However, values may go unnoticed unless there is an active attempt to assess the organization's culture. The value assessment can be initiated by asking the question, "What does the organization stand for?" The answer to this question sets forth a statement of the core values of the organization and provides a context in which business decisions can be addressed (Freeman et al. 2000).

Vision statements should result from collaboration between employees and management to achieve common values. Then, the organization can focus on these values, and employees, from executives to mail clerks, begin to believe in them. Employees who believe in values are moved to align behavior with those values (Freeman et al. 2000). To illustrate how a vision affects all aspects of an organization, consider the following statement from AT&T:

> AT&T's vision is to be recognized by customers, employees, suppliers, shareowners, communities and other stakeholders worldwide as an environmentally responsible company which protects human health and the environment by fully integrating lifecycle environmental, health and safety considerations into our business decisions and activities. (AT&T EHS Policy 2003, pg. 1)

Implicit in this view is that AT&T is not simply catching waste at the end-of-the-pipe. The company is implementing an environmental viewpoint at every stage in the corporate process. Such a "green vision" seeks ecological, international, competitive, and ethical sustainability.

The scientists at Merck, a pharmaceutical company, stand for the alleviation of human suffering. The scientists "try to remember that medicine is for the people, not for the profits" (Freeman et al. 2000). Despite the lack of a traditional market, Merck has

developed a drug to alleviate the symptoms of river blindness (Onchocerciasis), a disease that strikes mostly in Africa and South America where victims are poor and disenfranchised. Merck cannot give away all its drugs and the employees know that. The vision statement works to inspire employees to help the company survive in an ethical light.

Each organization is different and the most effective vision statement will be created after evaluating the organization's culture and goals. A simple mission statement does not go far enough and a mere slogan may be too brief. The answer to the question, "what does the organization stand for" must permeate the organization. Where values are authentic and shared, sustainable competitive advantage emerges (Freeman et al. 2000).

Leadership (Figure 1.1 Appendix A)

Once the vision statement has been developed, employees must work to make it operative. Effective leadership is perhaps the single most important element for an operative vision (Piasecki et al. 1999). If top management does not support an environmental commitment with action, change will not occur.

A leader's words and behavior can lift people from their immediate tasks to the wider picture of the organization's future. Every action sends a message of what is and is not important to a manager. Frank Riddick, a DuPont EH&S trainer notes: "What managers do and say with respect to the environment is reflected in the way their people do their jobs. If the first question the boss asks every day is 'How much money did we make last night?' everybody understands that production is important. If he asks 'Did we have a safe night?', 'Did we have any environmental incidents?' he makes safety and environment a routine part of the day-to-day job, just like production, quality, and cost." (DiSimone and Popoff 2000, pg. 91).

The Body Shop provides a good example of how leaders can work to effectively spread an environmental ethic throughout the organization. Anita Roddick, owner of The Body Shop, views business as an engine of social change. She has a progressive social conscience, manifested in her company's diverse social and economic development programs. The employee contract includes an obligation to get involved in social and environmental projects. A high degree of consistent environmental values pervades all aspects of the company and this commitment emerges through the ecocentric values and charismatic leadership of the founder (Shrivastava 1996).

An environmental leader needs an interdisciplinary set of capabilities to be effective, including:

- A strong environmental ethic to battle with the economics of business.
- A clear outlook to prepare the organization for changes in the stakeholder demands.
- Strong organizational skills to maintain and support environmental efforts across the company.
- A business orientation to understand the costs of environmental management as well as the potential benefits.
- A clear vision to direct the organizational attention toward the long-term challenge of sustainability.

"Environmental leaders, then, require an extraordinary range of knowledge, diplomatic and political talent, dispute-resolution abilities, basic business skills, and a humanism in their decision making that reaches beyond the balance sheet." (Piasecki et al. 1999, pg. 3)

Corporate Culture and Employee Participation (Figure 1.2 Appendix A)

Leadership should strike a balance between central direction and local autonomy. If management only uses top-down initiatives, people will wait for things to be done. If there is an exclusive reliance on bottom-up initiatives, projects become fragmented. Environmental leadership should include the idea that those closest to the work know best how to do it. The old command and control style is no longer appropriate. An

organization needs strong leadership and empowerment at the same time (Freeman et al. 2000).

Proponents argue that one of the greatest strengths of the International Standards Organization (ISO) 14000 standard is that it establishes a process that spreads environmental responsibility and participation to every individual within the organization. When all employees become quality conscious and become part of the process, quality improves, especially regarding the environment (Johnson, P. 1997). ISO 14000 training teaches employees the environmental consequences of their individual work, how these impacts can be minimized, what the benefits are for conforming and what the negative consequences can be if responsibilities are ignored.

When management is looking to focus on environmental improvements, hiring the right kind of people is important. As Frank Riddick, a DuPont Environment, Health, and Safety trainer says, "You want your people to do the right thing because it's the right thing, not because somebody is watching them" (DiSimone and Popoff 2000, pg. 101). Employees need to have personal values and beliefs that are aligned with the organization's vision statement and environmental commitment. Employees who believe in the organization's stated values can be motivated to innovate to realize those values (Freeman et al. 2000).

Once the staff is committed to the vision statement, there should be incentives and rewards to encourage innovation. Incentives promote innovation because they tangibly reward people for effort. Incentives need to be inspiring enough for employees to break out of the habitual mode and develop more flexible and responsive modes of work. The

employees who figure out how to comply with regulation better, faster, and cheaper will provide a competitive advantage for the organization (Freeman et al. 2000).

A good way of encouraging employee participation is a suggestion program. Loblaw International Merchants, a grocery retailer in Toronto, Ontario, provides an example of an effective suggestion program (Shrivastava 1996). Loblaw claims that the most important impact of their green strategy has been to give the employees the freedom to initiate environmental projects. Employees have come up with innovative ideas, including recycling programs and an environmental information service for consumers. A store manager came up with the idea of eliminating shopping bags altogether by redesigning the shopping carts. The new system uses shopping carts with removable, returnable recycled plastic boxes. Customers sort groceries directly into these boxes from the shelf, use them to carry the goods home, and return them later. The system was intended to increase margins by 0.5 percent and eliminate grocery bags. The company is experimenting with different versions of the system to find the best arrangement.

Team management is another approach used to increase involvement at all levels. An example is the “green team,” which deals specifically with environmental issues or processes. AT&T uses green teams through its Total Quality Management efforts. The mission of the team is usually to institute environmental programs and increase environmental awareness, and many green teams also have a hand in compliance auditing. Many of the teams are cross-functional, so they deal with issues that cross departmental or functional lines. As such, members come from all the areas or departments involved.

Management has a role in creating an atmosphere where innovation and creativity are rewarded. Many organizations still cling to hierarchical systems that empower few and stifle many bright ideas (Welford 2000). However, it is not only good business to encourage participation and involvement, but it also moves toward sustainability. As employees participate in a changing organization, they feel valued. This credit, in turn, "encourages commitment to the organization, better work practices, and avoids the problems associated with apathy and indifference" (Welford 2000, pg. 163).

Environmental Accounting (Figure 1.3 Appendix A)

Contradictory to traditional business perceptions, environmental management involves everyone in the organization, even accountants. Few people realize that existing accounting systems are a critical barrier to the internalization of environmental costs and considerations by the modern organization. Business decisions are skewed when environmental costs are hidden. In focusing on issues of profit and efficiency, managers ignore social and environmental concerns (Smith 1993).

Accounting provides an image of the organization reflected in a financial mirror. In traditional accounting systems, only those events that can ultimately be defined in financial terms are captured by the system (Todd 1994). Environmental accounting, however, involves selecting and quantifying the inputs and outputs to show the "true cost," or full cost of a product or service. Full cost accounting can show that society pays more for products than the product's market value. Therefore, even expensive alternatives, which are less ecologically damaging, can be economically justified for the economy as a whole (Callenbach, et al. 1993).

Another concept, similar to full cost accounting, is life-cycle costing. The objective is to assign some monetary figure to every effect of the product, from cradle to grave

(Denton 1994). The list can be extensive, including landfill costs, potential legal penalties, degradation of air quality, and more. The life-cycle approach can show that a product with a relatively low purchase price is not always a good value. More emphasis is placed on the operation and maintenance cost, which in turn means a greater emphasis on design, so products and purchases that last longer prove to be more valuable (Denton 1994).

Managers are discovering that an environmental accounting system can help to improve environmental performance and reduce costs. Wastes released to the environment represent inefficient use of costly resources as well as potential liability to the organization (Allenby and Richards 1994). Strategic management decisions such as product design, process design, facility location, input materials, capital investments, cost reduction, waste management, and product pricing require accurate environmental costs (Bhat 1996). Environmental accounting data can offer a large opportunity for cost reduction through strategic management. When a full cost accounting method was used to compute total environmental costs at some DuPont and Amoco Oil plants, these costs were found to constitute as much as 20 percent of the total operating costs (Bhat 1996, Ditz, et al. 1995).

As stakeholders express major reservations about the impact of economic activity on the quality of life, alternative “bottom line” measures to that of purely profit are beginning to get some attention (Smith 1993). Executives have recently begun to experiment with an approach known as the Triple Bottom Line, wherein the organization attempts to satisfy performance measures along economic, environmental, and social dimensions concurrently (Graedel and Allenby 2003). If organizations begin to be

valued on social and environmental bases, as well as economic success, the resulting transformation may be a shift in the definition of the private firm. Economic entities may evolve to assume more social and environmental responsibility.

Design and Prior Assessment (Figure 1.4)

The challenges presented by environmental responsibility will promote innovation in product design and redesign (Lovins et al. 1999). The environment has become an increasingly important aspect of product design and Design for Environment stipulations are starting to be integrated into the design standards of many organizations. By designing environmental and safety performance into their products, designers can reduce environmental liabilities from the start (Shrivastava 1996).

Traditional design approaches use function, cost, and technical efficiency as primary design criteria. Ease of maintenance, availability of materials, and operator convenience are also of primary consideration. Design for Environment emphasizes environmental criteria. Choices are based on environmental and health effects, product disposal, hazard characteristics, risk levels, and safety. Designing for the environment also focuses on the product-human interaction of the product (Shrivastava 1996). In modern industrial operations, design for environment is part of a larger scheme termed "design for X", where X can be any one of a number of characteristics, such as recyclability, disassembly, compliance, manufacturability, energy efficiency, reliability, and serviceability (Manahan 1999, Madu 2001).

Design for recyclability (DfR) means that products and components are planned and made with the objective of ultimately reusing them. There are several key considerations in designing products for recycling, including simplicity, modularity, repairability, minimizing types of materials, and avoiding toxics, coatings, fillers, and

plated metals (Manahan 1999). Design for disassembly (DfD) generally means the simplification of parts and materials to make them easy and inexpensive to snap apart, sort, and recycle. DfD focuses on the ease of disassembly so that the various components can be used again to make other products. BMW was one of the first companies to implement design for disassembly in the design for the Z1 model automobile. The car has an all-plastic skin that can be disassembled from its metal chassis in 20 minutes, and has doors, bumpers, and front, rear and side panels made of recyclable thermoplastic (Buchholtz 1998).

A more proactive stance on product design is to consider a product's fate after use. Asking designers to consider the product's disposal at the moment of its conception can require radically new thinking (Peattie 1995). Designers who have spent years designing products that can withstand the most extreme circumstances are now faced with the challenge of making that same product easy to disassemble for recycling. Repairability, reusability, and recyclabiltiy will become increasingly important criteria for product designers to include into the original product design.

Materials Selection and Acquisition (Figure 1.5 and Figure 1.6 Appendix A)

The first step in the manufacturing portion of the product life-cycle is materials acquisition. This stage is an opportunity for manufacturers to start production on an environmentally responsible foundation. The extraction of raw materials generally involves considerable environmental impact, either from moving and processing large amounts of rock and soil, or from hewing large numbers of trees. Even organizations that are not extracting raw materials make extensive use of natural resources. Land is used

for locating facilities, as landfill space, and for burying toxic wastes; water in production processes; and rivers and oceans as sinks for discharging wastes.

Product designers have a particularly significant role in influencing choices for raw materials. In many cases, a number of different materials can be chosen for a particular application. However, other things being comparable for a particular application, the designer's objective should be to select materials that have the least significant toxic properties (Graedel and Allenby 2003). With respect to material choices involving toxic materials, the designer should consider the potential for materials substitution in products and the potential for process changes. An additional caution in selecting materials is to attempt to anticipate future restrictions on materials whose use is not currently constrained.

The Volvo Car Company has created a chemical inventory system that attempts to reduce the use of hazardous chemicals and substitute environmentally friendly substances. In 1991, Volvo established a database known as MOTIV, for monitoring chemical inventories. Supervisors monitor chemicals used in each facility and identify the effects on internal and external environments. The analysis and comparison of chemicals used in Volvo allows designers to use benign substitutes for hazardous chemicals (Shrivastava 1996).

Once the product designer has determined the best choice for materials, the organization can attempt to obtain those materials with minimal environmental impact. The first concern should be to minimize impact at the extraction site (Graedel and Allenby 2003). Once the materials have been extracted, they must usually be processed and purified to obtain a usable form. The sequence of steps to process the raw materials

can be highly energy-intensive because high pressures and high temperatures are often used. Using metals as an example, processing and purification are carried out in the molten state so energy consumption is relative to the melting point. The energy required for extracting and processing raw materials presents a good case for considering recycled input sources (Graedel and Allenby 2003).

Post-consumer waste, industrial scrap and unwanted by-products from manufacturers should be considered as resources for productive use rather than automatically disregarded as waste (Allen and Behmanesh 1994). "An efficient recycling operation may be able to provide adequate quantities of a needed material at much lower costs with less environmental impact" (Graedel and Allenby 2003, pg. 124). Many metals are recycled with reasonable efficiency and can generally be refined to the desired purity.

Proctor & Gamble presents a nice example of responsible resource management. The company makes a wide range of products and therefore cannot follow a single materials requirement policy. However, the use of controversial materials is restricted when alternatives are available, and recycled inputs are encouraged (Shrivastava 1996). The company uses large amounts of forest products, but is continually striving to reduce the amount of natural resources used. Until 1990 Proctor & Gamble owned its own forests and practiced sustainable forestry in its harvesting methods. With control over its materials acquisition, P & G could establish and maintain contingencies to guard the status of its forest resources. The company now monitors its lumber suppliers to ensure they adhere to environmentally responsible harvesting practices.

Manufacturers with ample buying power can have the same positive influence on their suppliers. All manufacturers can add an environmental screen to their supplier selection process. As more and more organizations require environmentally sustainable practices from suppliers, more suppliers will change operations to comply, and therefore win contracts.

An appropriate example is provided in the supply chain management at Ben & Jerry's Homemade Ice Creams, Inc. While expensive, fatty, premium ice creams may represent the epitome of social irrelevance, Ben & Jerry's has creatively found a way to integrate its product with social causes (Shrivastava 1996). The company is committed to championing family-owned farms. In support, the company buys all its cream from a dairy cooperative of family farms. Similarly, B & J buys Brazil nuts and cashews grown and harvested by natives of the Amazonian rain forest. By helping them maintain their traditional lifestyle, the company also helps protect the rain forest (Shrivastava 1996).

Consumers are the end users of all natural resources. To avoid resource depletion, consumers need to reassess their own consumption patterns. However, as the main intermediaries that grow, harvest, trade, process, and distribute natural resources, organizations can play an important role in resource conservation (Shrivastava 1996). Organizations also have a large influence in creating consumer demand through marketing. A responsible organization can begin to orient market demand toward products made with environmental consciousness.

Environmental Marketing (Figure 1.7 Appendix A)

The environment emerged as a potent marketing tool in the late 1980s (Bhat 1998). With the rise in environmental awareness sweeping industrialized nations, manufacturers and retailers would be foolish to ignore it. In a survey for *The Wall Street*

Journal in 1991, some 45 percent of Americans felt that they should do something to improve environmental quality through their purchasing patterns (Smith 1993). While this number contrasts with an impressive 82 percent in Germany, the survey result still represents an important shift in the buying behavior of North Americans.

Following cue, many environmentally friendly products have been marketed in a way to stimulate concern for wider environmental issues within consumers. According to the Marketing Intelligence Service, the number of new "green products" grew from 24 in 1985 to 810 in 1991. The number of "green products," as a share of all new products introduced, rose form 0.5 percent in 1985 to 13.4 percent in 1991 Additionally, 68 percent of marketers made packaging changes in 1991 to indicate environmental friendliness (Bhat 1998).

A conscious consumer wants to ensure that products are safe, both to her, and to the environment. Many members of the public believe that the balance of power rests with the manufacturers and retailers because consumers have too little information, education, and experience to make informed decisions when confronted with complicated marketing schemes. The best contribution advertising and marketing can make toward environmental protection is to provide consumers with clear, accurate, and reliable data needed to make informed purchasing decisions. (DiSimone and Popoff 2000).

The main expressions of green marketing, to date, have been in the form of waste reduction through product packaging and recycling potential. Unfortunately, many of these "environmentally friendly" claims cannot be properly tested in terms of environmental degradation due to the complex nature of the pollution problem. In an effort to promote accurate labeling, the ISO 14020 standards address responsible

environmental labeling. ISO 14020 defines environmental labeling as a "claim indicating the environmental attributes of a product or service that may take the form of statements, graphics on product or package labels, product literature, technical bulletins, advertising, publicity, etc." (Kuhre 1996, pg. 3). Before ISO 14020s, there were few worldwide coordinated efforts to bring uniformity and truthfulness to environmental marketing.

"Eco labels" are another form of marketing that can help a consumer evaluate a product's environmental performance. Seals or symbols are placed on a product by an independent evaluation group to convey that the product is environmentally less harmful than other functionally similar products. These labels make it easier for a consumer to recognize environmentally friendly products. The seals also provide incentives to manufacturers to develop environmentally friendly products (Bhat 1998).

There are several benefits of effective environmental marketing, and these should also be considered goals and objectives. First, properly done environmental marketing will help to minimize impacts of human activities on the environment (Kuhre 1996). Second, environmental marketing will provide more accurate information for the consumer concerning environmental impacts or aspects. Third, well-designed environmental marketing will increase market share of demand for the product or service. Fourth, creative environmental marketing will increase the awareness and interest among consumers. Truthful environmental marketing will improve employee relations with the general public, stockholders, and regulators (Kuhre 1996).

Sustainable production and consumption require changes in the usage and consumption patterns of individuals and businesses. Consumers must make tradeoffs between environmental consequences and convenience, health, and economic factors

(Bhat 1996). Organizations will increasingly be challenged to provide product value while convincing consumers that the value is worth any potential sacrifice in convenience (DiSimone and Popoff 2000).

Product Stewardship (Figure 1.8 Appendix A)

An organization can add value to its products by offering extended producer responsibility and product stewardship programs. Extended producer responsibility (EPR) makes the manufacturer responsible for the entire life cycle of the products and packaging they use. First formally introduced by Thomas Lindhqvist in a 1990 report to the Swedish Ministry of the Environment, "Extended Producer Responsibility is an environmental protection strategy to reach an environmental objective of a decreased total environmental impact from a product, by making the manufacturer of the product responsible for the entire life-cycle of the product and especially for the take-back, recycling and final disposal of the product" (Institute for Local Self-Reliance 2001). Some of the tools advocated by the EPR movement are take-back programs, deposit-refund programs, Eco-labeling, design criteria, and product stewardship initiatives (Institute for Local Self-Reliance 2001). The primary trouble with EPR is that it puts all responsibility upon the manufacturer, when other organizations have a stake in the product as well.

A similar concept, product stewardship, is gaining popularity due to the recognition that other parties have roles to play. Product stewardship is a product-centered approach to environmental protection that asks all sectors involved in the product life-cycle – manufacturers, retailers, users, and disposers – to share responsibility for reducing the environmental impacts of products (EPA 2001). Product stewardship is a different perspective on EPR, recognizing that although manufacturers must take on new

responsibilities for their products, real change cannot be made solely by manufacturers. Product stewardship extends beyond the walls of a facility, including contractors, suppliers, distributors, and customers (Bhat 1996). Retailers and the existing waste management infrastructures will also have to be involved for the most effective solution.

In most cases, manufacturers have the most power to reduce the environmental impacts of their products. An organization that has accepted its responsibility also has recognized the competitive advantage in the process. By rethinking products, supplier relationships, and the customer, manufacturers have increased productivity, reduced costs, fostered innovation, and provided customers with more value at less environmental impact. Forward thinking organizations have recognized that corporate citizenship and maximum resource productivity are essential components in creating opportunity (EPA 2001).

Several voluntary agencies have set forth principles to guide companies in reducing the environmental impacts of products during the use and disposal stages. CERES, the Business Charter for Sustainable Development, and the Chemical Manufacturers Association all have principles advocating product stewardship (Bhat 1996). Product Stewardship Programs require strong managerial leadership. Strong leadership pushes the other necessary components for successful programs.

One of the most widely used tools in product stewardship is the Life-Cycle Assessment (LCA). Although the concept is still in infancy, lacking a well-defined approach, the LCA is defined as an attitude by which a manufacturer accepts responsibility for the pollution caused by products from design to disposal. The LCA recognizes that environmental concerns enter into every step of the process with respect

to the manufacture of products, and thus examines the environmental impacts of products at all stages of the product life cycle (Buchholtz 1998). The life-cycle perspective is contrary to the traditional belief that responsibility begins with the raw material acquisition and ends with dispatch of the final products.

ISO 14040 sets the standards for Life-Cycle Assessments. The ISO defines the LCA as a systematic set of procedures for compiling and examining the inputs and outputs of materials and energy and the associated environmental impacts directly attributable to the functioning of a product or service system throughout its life-cycle. The basic objective is to guide decision-makers in selecting actions to minimize environmental impacts (Johnson 1997).

Ultimately, the consumer makes the choice between competing products and who must use and dispose of the products responsibly. Consumers must make responsible choices when buying products. They must use products safely and efficiently, and they must take extra steps to recycle products that they no longer need (EPA 2001). The challenge for the organization is to make its products easy for the consumer to handle responsibly.

Waste Management, Pollution Prevention, and Energy Efficiency (Figure1.9, Figure 1.10 and Figure 1.11 Appendix A)

Even with strong recycling programs and efficient production processes, an organization has a responsibility toward waste management and pollution prevention. Waste is a serious environmental concern for organizations. Both solid and toxic wastes pose management problems and monitoring wastes is an unavoidable business imperative.

Not until 1984 did Congressional subcommittees first force a company to attempt to calculate total pollution emissions. After tallying the numbers, executives at Dow Corning were shocked to discover that the company was releasing ten million pounds of dangerous chemicals into the environment (Peattie 1995). The initial reaction was the introduction of end-of-the-pipe measures, such as filters. Thereafter, more proactive pollution prevention programs have been established.

The Pollution Prevention Act of 1990 was a major milestone in the efforts to reduce pollution in the United States. The act shifted the emphasis from reduction of environmental degradation to prevention of pollution itself (Bhat 1996). The pollution prevention strategy was meant to apply to all pollution generating activities: energy, agriculture, federal, consumer, as well as industrial sectors.

Managers have since recognized the benefits that come with pollution prevention, namely the elimination of waste, profitable innovation, and avoidance of command-control regulation. By preventing pollution, an organization can also save money on disposal costs, waste site clean-ups, and tort liability. Not surprisingly, environmentalists have welcomed the pollution prevention philosophy because it offers a way to incorporate environmental values into the world economy.

There is a growing trend toward waste reduction and pollution prevention that stresses the total system design, as opposed to add-on devices or end-of-the-pipe treatments. The ISO 14000 standard certification requires “commitment to continual improvement and prevention of pollution” (Johnson 1997, pg. 83). Gradual improvement may not only be simpler to accomplish, but may also facilitate the acceptance of environmental management systems and the accompanying goals.

Avoiding the formation of waste in the first place eliminates the need for treatment and disposal, which can reduce costs and environmental. According to Frank McAbee, Senior Vice-President of Environmental and Business Practices for United Technologies, waste reduction is primarily process engineering. Operating processes at peak efficiency can reduce wastes, cut costs, and improve quality and productivity. With good engineering, waste reduction can be used as a competitive advantage (Denton 1994).

Taking waste management to a higher level, the organization of Economic Co-operation and Development (OECD) suggests the Polluter Pays Principle. The principle is defined by OECD as "the polluter should bear the expense of carrying out the measures decided by the public authorities to ensure that the environment is in an acceptable state" (Smith 1993, pg. 80). The principle focuses more attention on the economic instruments for environmental protection, holding with the idea that control by the automatic operation of market forces is more efficient and more flexible than control by regulation (Smith 1993). Ultimately, a unique combination of direct regulation and economic instruments may be required to push economic entities in the right direction.

An excellent waste-management program that can serve as a role model for an organizational effort is the integrated Waste Reduction Always Pays (WRAP) Program at Dow Chemical. The WRAP Program includes 5 basic goals:

1. Reduce waste to the environment through continuous improvement in its manufacturing process so it can in turn reduce emissions and volume of wastes.
2. Recognize excellence at eliminating waste to send a positive message that waste reduction is a top priority.
3. Enhance the waste reduction mentality, because waste reduction is employee driven.
4. Measure and track progress.
5. Reduce long-term costs.

By identifying the WRAP projects that impact the bottom line through fuel, raw material and environmental control costs, the company can create competitive advantage (Denton 1994). Each of Dow's manufacturing divisions is responsible for the development and implementation of the WRAP program within its own operations, allowing flexibility to tailor the program to specific needs. Many methods have been used to implement WRAP including idea-generating contests, quality performance techniques, plant waste reduction reviews, recognition programs, and even the development and communication of the top ten generator lists for waste and emissions at a division (DiSimone and Popoff 2000).

In the end, a "level playing field" among organizations undertaking pollution prevention is indispensable (Anderson 1994). Government's role is to provide that level field. At the same time, government must give industry the freedom to innovate, substitute products, test, market, and allow technology to work toward creating a safer, more environmentally benign economy.

Environmental Audits and Reporting (Figure 1.12 and Figure 1.13 Appendix A)

To add value to environmental management initiatives, organizations will make their achievements public with environmental reporting. Placing the information in the hands of the public is a powerful instrument because it puts pressure on organizational policies to follow through with stated objectives (Cairncross 1995). Stakeholders may use this information in making purchasing decisions, employment decisions, and investment decisions, particularly if they are looking toward socially responsible investing.

To evaluate its impact on the environment, an organization may conduct an environmental audit. Environmental auditing is defined by the International Chamber of Commerce as being "A management tool comprising of a systematic, documented,

periodic, and objective evaluation of how well environmental organization, management, and equipment are performing with the aim of helping to safeguard the environment" (Smith 1993, pg. 60). Ideally, such an audit will incorporate a life-cycle assessment of how an organization's activities impact the environment.

The original purpose of the environmental audit, first developed in the United States, was to allow American organizations to be sure that they were complying with the legislation that governs pollution prevention (Cairncross 1995). With the establishment of the Toxic Release Inventory (TRI) of 1986, American organizations in polluting industries had a legal obligation to publish details of their most air polluting emissions (Cairncross 1995). As a result, a growing number of American organizations now include some kind of environmental information in their financial statement.

Increasingly, audit procedures are becoming accepted by organizations around the world. The development of the ISO 14000 series of voluntary environmental standards is helping the reception (Harrison 1997). The ISO 14000 is particularly effective in demonstrating that the techniques employed by environmental auditors have become increasingly sophisticated over the last 15 years. As with ISO 9000, ISO 14000 is not a single standard but will cover environmental management systems, environmental auditing, environmental labeling, environmental performance evaluation, life-cycle assessments, terms and definitions, and product standards in an attempt to create a level playing field between nations and industries (Harrison 1997).

The information in the audit provides internal discipline, and gives the corporate environmental division a baseline for improvement. Without follow-up action, the information becomes useless. The organizations that will benefit the most from auditing

are those who have introduced integrated environmental management systems that can take the information and make improvements (Welford 2000).

There is arguably an equally, if not more important, need for business organizations to convey audit information to a wider audience via external reporting. Accurate information about the products and the wider social and environmental aspects of processes should be communicated to all stakeholders and particularly customers (Welford 2000). Linda Descano, Vice President of Environmental Affairs for Saloman, Smith, and Barney explained that "Since the perceptions of the capital markets are shaped primarily by information provided by companies, the challenge for the corporate community is to communicate the immediate and long-term financial implications of their progressive environmental practices" (Piasecki 1998, pg 70). A growing number of organizations publish an environmental report, which usually contains information from the audit, filtered and polished for the intended audience.

The most striking feature of the published environmental reports is diversity. Unlike financial reporting, environmental reporting does not have conventions guiding the format or content of published information. Quite a few organizations simply include a few vague statements about environmental performance in their annual report and accounts. However, an audit is only as useful as the information uncovered (Bhat 1998).

Many executives have found that the mere exercise of auditing their activities has been a spur to better environmental performance. Some executives even see the external report as a way of placing value on the internal audit (Harrison 1997). Furthermore, the role of external reporting can be seen as a vital mechanism for corporate accountability.

A widening group of influential investors increasingly call for more detailed accounts than those provided by vague policy statements (Stone and Washington-Smith 2002).

Pressure for change comes from consumers, employees, domestic legislative developments, regional influence (such as the European Community), influential user groups, as well as corporate self-interest. However, internal pressure may be the most immediate source for change (Smith 1993). Organizational leaders see environmental reporting as a way to demonstrate corporate commitment, gain competitive advantages, position themselves on environmental issues, raise staff awareness, and demonstrate progress against targets (UNCTAD 2000). Rigorous disclosure is not only one of the most potent defenses against corporate critics, but it may also justify higher financial costs on companies for cleaner technology (Smith 1993). A recent study has shown that stock markets will reward good corporate behavior. When organizations win environmental awards, their share prices tend to rise, on average, by 0.82 percent. Similarly, prices will tend to fall by about 1.5 percent after an environmental disaster (UNCTAD 2000)

The environmental report might be seen as a burgeoning partnership between businesses and stakeholders. President and CEO of ARCO Chemical Alan Hirsig notes: "Earning public trust involves a lot more than ad campaigns: it requires performance and openness. The point is that once you establish credibility – that is, that you are honestly trying to do the right thing – you can interact with governments, environmental groups, and community leaders on a more constructive basis" (Piasecki 1998, pg 78). The constructive interaction can add competitive advantage. The stakeholders push the company and the company responds, and the cycle can work to benefit all parties.

Several bodies have attempted to develop guidelines for environmental reports because the lack of a standard is an important obstacle to external reporting. The earliest was published by the Coalition for Environmentally Responsible Economies (CERES). The Public Environmental Reporting Initiative (PERI) is another group of similar companies that has compiled a standard format. The Global Environmental Management Initiative (GEMI) also has a set of standards. The problem with such "recipes" is that individual industries face enormously different environmental problems. Thus, industry councils, such as the CEFIC, are looking at creating their own, industry-specific guidelines (Cairncross 1995).

Leadership

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Management shows public support of the company's environmental commitment.	Management consistently reinforces the environmental commitment through word and deed.	A formal environmental management system is in place.	The environmental management system has met the International Standards Organization 14000 certification criteria.	
	N/A ____	0	1	2	3	4 Score ___

Figure 1.1 Environmental leadership evaluation chart

Corporate Culture

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Effective employee suggestion programs are in place allowing employees to share their ideas.	Employees are empowered to implement new ideas to change company standards.	Employees are encouraged to volunteer and continue their education to encourage new ideas.	There are incentives in place for employees to break from routine and implement new ideas for the company.	
	N/A ____	0	1	2	3	4 Score ___

Figure 1.2 Corporate Culture evaluation chart

Environmental Accounting

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Environmental risks are considered in risk analysis.	Environmental metrics are in place to account for environmental impact.	Environmental accounting or full cost accounting is used in decision making.	Economic, Social, and Environmental data are used as performance metrics.	
	N/A ____	0	1	2	3	4 Score ___

Figure 1.3 Environmental accounting evaluation chart

Design and Prior Assessment

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Management ensures that requirements mandated by regulations are met before new projects are implemented.	A formal system of environmental review is in place to reduce environmental impact from new projects.	Environmental implications of proposed projects are considered in each business unit's strategy formation and budget planning process.	There is a formal system to receive and respond to feedback concerning environmental implications.	
	N/A ____	0	1	2	3	4 Score ___

Figure 1.4 Design and Prior Assessment evaluation chart

Raw Materials Selection and Acquisition

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Informal efforts are in place to reduce resource consumption by encouraging efficient use of raw materials.	A formal system is in place to encourage efficient resource use, reuse, and recycling.	Product, process and service designs integrate a commitment to reduce adverse environmental impacts.	Materials decisions are made using life cycle analyses. Materials that create environmental impacts during extraction, use, and/or disposal are avoided.	
N/A ____	0	1	2	3	4	Score ___

Figure 1.5 Raw Materials Selection and Acquisition evaluation chart

Supplier Relations

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Preference is given to suppliers that comply with environment, health, and safety laws, and to suppliers that match the company's environmental policies.	The environmental policies of potential suppliers are screened for consistency with the company's environmental standards.	Selection methods for suppliers are integrated with environmental priorities to align corporate and supplier environmental performance.	Suppliers are provided information regarding effective environmental management and preference is given to those suppliers who adopt effective environmental policies.	
N/A ____	0	1	2	3	4	Score ___

Figure 1.6 Supplier Relations evaluation chart

Environmental Marketing

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Eco-labels are used to show consumers the environmental features of products.	Publications are made available to provide consumers with reliable environmental information on corporate policy and practices.	Marketing programs address post-purchase product use and maintenance.	The marketing program has met International Standards organization 14020 certification criteria.	
	N/A ____	0	1	2	3	4 Score ___

Figure 1.7 Environmental Marketing evaluation chart

Product Stewardship

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	The company responds to legal requirements for product and service liability.	The company provides consumers with information regarding the proper use and disposal of products, emphasizing the goal of reducing adverse environmental impacts.	Durability is emphasized in the design process and repair services are widely available to lengthen the life of the product.	Services are in place to ensure proper disposal of potentially hazardous products. Product take-back mechanisms are used to recover valuable product components and properly dispose of waste material.	
	N/A ____	0	1	2	3	4 Score ___

Figure 1.8 Product Stewardship evaluation chart

Waste Management

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	The company responds to legal requirements for waste reduction, product content and labeling to ensure proper recycling, reuse, or disposal.	A system is in place to identify major hazards and potential risks from product disposal and barriers to recycling and reuse.	Use of recycled, recyclable and less hazardous material is integrated into business unit product and service design operations.	The company initiates efforts to achieve source reduction, use recyclable products designed for disassembly, and develop protective waste disposal techniques.	
N/A ____	0	1	2	3	4	Score ___

Figure 1.9 Waste Management evaluation chart

Pollution Prevention

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	The company responds to legal requirements.	A system is in place to evaluate environmental impacts of product and service use and delivery and initiate design changes to prevent future impacts.	Existing and potential environmental impacts are incorporated into process, product, and service design, planning and implementation.	Products and services are continually evaluated for new opportunities to avoid environmental impact. Life-cycles are considered in the design process.	
N/A ____	0	1	2	3	4	Score ___

Figure 1.10 Pollution Prevention evaluation chart

Energy Efficiency

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	The company responds to legal pressure or market standards for energy efficiency.	A system is in place to identify products and processes that are large energy users and then initiate changes in design considering cost effectiveness.	Opportunities to improve product of process energy efficiency are integrated into relevant business functions. Goals for energy reduction are set and progress is measured.	The company provides leadership in developing energy efficient products and services. The entire life-cycle of the product and service is considered in evaluating energy use.	
N/A ____	0	1	2	3	4	Score ___

Figure 1.11 Energy Efficiency evaluation chart

Environmental Reporting

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	An annual sustainability report is published and made public.	The environmental reports adhere to standardized guidelines established by a third party (CERES, PERI)	Environmental metrics are used to report the environmental impacts of business practices.	The environmental reporting process serves as an internal driver for performance.	
N/A ____	0	1	2	3	4	Score ___

Figure 1.12 Environmental Reporting evaluation chart

General Environmental Strategy

Performance Level

Elements

Not Applicable	1	2	3	4	Notes
The company has no public information available.	The company has a policy of regulatory compliance. The primary goal of environmental management is to achieve compliance with health, safety, and environmental requirements mandated by law.	Formal environmental management systems are in place to facilitate the company's efforts to reach beyond regulatory compliance, to meet more comprehensive corporate policies. Environmental investment opportunities are considered on a cost and benefit basis.	The company has formal systems to integrate environmental management concerns into management functions on a regular basis. Environmental information and concerns are included in all relevant business planning functions.	Integrated environmental management systems are applied to operations globally, and are continually evaluated for improvement opportunities. The full life-cycle of products, operations, and services is considered, including direct and indirect environmental impacts.	
N/A ____	0	1	2	3	4 Score ___

Figure 1.13 General Environmental Strategy evaluation chart

CHAPTER 2
EVALUATING SIX MULTINATIONAL COMPANIES

Introduction to Corporate Evaluations

An organization can add value to its environmental activities by communicating corporate actions to stakeholders. By providing thorough and reliable information on its environmental activities, an organization builds a foundation of trust with stakeholders. The stakeholders can then use the information provided to make consumer, investment, and employment decisions based on personal values and priorities. The aforementioned evaluation is a comprehensive method for stakeholders to use to appraise an organization's environmental posture. By considering an organization's activities from cradle to grave, the evaluation delves deeper than superficial marketing claims that can misrepresent an organization's true environmental commitment.

The environment emerged as a potent marketing tool in the late 1980s (Smith 1993). Organizations now are using "green" imagery and marketing tactics to persuade stakeholders of the organization's environmental responsibility. The six organizations that will be evaluated have received recent attention for their environmental marketing: 3M, BASF, General Motors, Volvo Group, BP, and the Shell Group. These organizations represent industries that have historically been environmentally harmful, so the recent rise of environmental marketing is a curiosity to environmental action organizations (Earthday Resources 2003).

The six organizations were assessed using the Environmental Management System evaluation that was developed in Chapter 1. Evaluations were completed using only public domain information. Predominantly, the information for these evaluations originates from the organization itself and can be discovered from online corporate publications. Environmental and sustainability reports offer valuable information about the environmental performance and strategies of the organizations. The evaluations of the six companies are shown in Figures 2.1 through 2.13 and summarized in Figure 2.14 in Appendix B to show the differences among the organizations and the spectrum of environmental performance exhibited by the six companies.

3M

The Minnesota Mining and Manufacturing Company, better known as 3M, was founded in 1903 when five businessmen agreed to mine a mineral deposit for grinding wheel abrasives. Finding that the deposits were of little value, the new company adjusted focus to sandpaper products. In the following century, 3M has expanded to a globally diversified manufacturer that sells thousands of products and services. The company is divided into 40 business units, which compete in six markets: industrial; transportation, graphics, and safety; health care; consumer and office; electronics and telecommunications; and specialty materials (Marcus et al. 2002).

3M is widely recognized as environmentally progressive and socially responsible (Marcus et al. 2002, Shrivastava 1996). One of the reasons for this recognition is that 3M started focusing on environmental issues long before most other companies did so. On February 10, 1975, the Board of Directors adopted the first corporate environmental policy for 3M (3M 2003). Today, 3M's sustainability policies and practices are directly linked to its four fundamental corporate values:

- Satisfying customers with superior quality and value.
- Providing investors an attractive return through sustained, high-quality growth.
- Respecting the social and physical environment.
- Being a company that employees are proud to be part of.

In accordance with these values, the company has developed its own sustainability vision statement:

> 3M vigorously affirms its commitment to sustainable development through environmental protection, social responsibility and economic progress. We are committed to helping meet the needs of society today while respecting the ability of future generations to meet their needs - that is what we mean by sustainable development or sustainability. (3M 2004)

The inspiration for the company's environmental ethic came primarily from one man, Dr. Joseph T. Ling. Dr. Ling joined 3M in 1960 as the company's first engineer dedicated to the environment and retired in 1984 as 3M's Vice President for Environmental Engineering and Pollution Control. Ahead of his time, Dr. Ling believed that sustainable development "is the mechanism by which we strive for a desirable quality of life, not only for ourselves, but also for generations" (3M 2003).

Dr. Ling sold his ideas about pollution prevention to 3M's management. As an energetic and visionary leader, Ling was able to show employees that pollution is a form of waste and that pollution prevention could improve 3M's financial performance. By explaining that employees were the key to preventing pollution because they knew the details about 3M's operations, Ling was able to help establish pollution prevention as a managerial priority and an aspect of 3M's corporate identity.

Other 3M leaders, including Livo DeSimone, former Chair and CEO of 3M, have sustained the commitment to environmental stewardship (Figure 2.1). DeSimone is a strong advocate of eco-efficiency and has co-authored a book on the subject with the backing of the World Business Council for Sustainable Development (WCBSD)

(Gundling 2000). Three other 3M executives also sit on the WCBSD: Allen H. Aspengren, Robert P. Bringer, and David A. Stonstegard (DeSimone and Popoff 2000). Under committed leadership, "3M's environmental stance has evolved from regulatory compliance, to proactive efforts at pollution prevention, to a newer philosophy of sustainable growth and development of eco-efficient products" (Gundling 2000, pg. 33). Eighty percent of the company's manufacturing facilities are certified under the ISO 14000 criteria (3M 2004).

The corporate culture at 3M facilitates the company's promotion of environmental stewardship (Figure 2.2). A plaque that hangs in the office of many 3M employees reads "Those … to whom we delegate authority and responsibility, if they are good, are going to have ideas of their own and are going to want to do their job their own way" (Marcus et al. 2002, pg 76). The quote, from William McKnight, a former executive of 3M, epitomized the company's commitment (to) employee empowerment. As new employees are hired, they are taught to look for ways to contribute on their own (Zosel 2003).

The company has been successful in operating on the basis of employee empowerment. The Pollution Prevention Pays (3P) program has spawned more than 4,750 projects worldwide, all of them proposed by employees (Reed 2000). These projects have prevented the generation of 1.7 billion pounds of pollution and reduced costs by $850 million in the first year of implementation. Through the 3P program, 3M has been able to better measure environmental performance and link it to financial performance (Figure 2.10).

From the outset, the 3P program was designed so that teams of employees would submit projects for implementation. If successful, the teams would be publicly

recognized at meetings, special events, and company publications. 3M also uses merit programs to serve as employee and corporate incentives to reduce environmental impact (Zosel 2003). The company includes successful 3P projects, results, and team members in its public environmental reports to further communicate the success of 3M employees (Reed 2000).

Many 3M employees see the company's environmental initiatives as an opportunity to display their ingenuity and problem-solving skill (Marcus, Geffen, and Sexton 2002). Arguably the most innovative company in the world (Gundling 2000), 3M prides itself on its technological innovation to provide solutions before problems are identified. Incentive programs that start with the CEO and permeate through the empowered workforce catalyze innovative solutions that reduce environmental impact (Zosel 2003).

The open communication that facilitates employee involvement at 3M is also extended to consumers so the company can continue to meet the needs of the market. "3M perceives one of its current needs as 'marketing' the environmental attributes of current (and future) products as benefits to the user" (Zosel 2003). The company has provided links on its website through which consumers can ask specific questions about each product 3M sells (Figure 2.7). The company also places information concerning input materials on some of its packages. Providing consumers with a list of potentially harmful inputs that are certified not to be present in its products is expected to be attractive to consumers (Zosel 2003).

3M's sustainability report is prepared using the Global Reporting Initiative's (GRI) June 2000 *Sustainability Reporting Guidelines* (3M 2004). By following a standardized format, the company provides "credible corporate economic, environmental, and social

performance information to enhance responsible decision-making" (3M 2003). 3M also follows the GRI objectives regarding independent verification, adding further credibility to the information that is provided to stakeholders in the sustainability reports (Figure 2.12).

The sustainability reports emphasize environmental, social and economic performance - the three elements of sustainability. "By using a set of effective measures, 3M has dramatically reduced its impact on the environment while creating a competitive advantage in the marketplace" (Piasecki et al. 1999, pg. 54). Percentages and figures are reported to show the reductions in air emissions, water emissions, and solid waste generation (3M 2003). However, the figures do not indicate the level of toxicity on the emissions or detail the types of emissions reduced. More quantitative information would help consumers understand 3M's environmental performance.

Metrics provided in the sustainability report show the company's financial commitment to sustainability. The company invests more than $100 million a year in environmentally related research and development and an estimated $200 million in environmental operations (Gundling 2000). As a result, 3M reported savings from pollution prevention totaling $850 million in the first year (Reed 2002). Although the company does not report how decisions are made using environmental data, the financial savings that accompany environmental improvements clearly show how environmental investments are financially beneficial (Figure 2.3).

3M devotes a substantial portion of its research and development budget to reducing the environmental impact of current products (Figure 2.4). Design for the Environment principles are used to reduce environmental impact before the production

process begins. The company also uses a systematic life cycle management program which addresses the environmental and energy impact of each stage of the product life cycle, from development through manufacturing, use and disposal (Figure 2.5) (DeSimone and Popoff 2000). However, the life cycle management (LCM) process is limited in its current application at 3M. The LCM process is only used for new products prior to commercialization. Existing products are supposed be evaluated with the LCM process on a prioritize(d) basis. Priority is given to products that include “materials of public interest,” as defined by corporate staff. As a chemical company, it seems appropriate that 3M address the life cycle impacts of all current products as well as new products. Furthermore, the "potential supplier checklist" on the 3M website does not mention any environmental requirements beyond compliance with federal and state laws (Figure 2.6). The life cycle of a product also includes suppliers, so 3M should extend its LCM process to evaluating potential suppliers.

Waste minimization is 3M's most important strategy for reducing environmental releases (Figure 2.9). However, the company says that "opportunities for reducing solid waste are limited by a deteriorating market for recycled raw materials. 3M's future progress may have to rely primarily on pollution prevention, design changes in products and process, and on internal recycling programs” (3M 2003). However, 3M prides itself on its innovative value creating activities, so perhaps the company can stimulate a market for recycled raw materials. To minimize solid waste, the company conducts limited product recovery activities to use or sell equipment, paper, plastics, solvents, metals and other by-products.

Energy efficiency is another important strategy for 3M (Figure 2.11) Improvements result from employee programs that increase energy efficiency of existing operations, and new equipment and facilities that are designed to be energy efficient. The company considers energy efficiency in its choices of raw materials, product formulations and manufacturing processes. Additionally, 3M is an Energy Star Partner and participates in Green Lights Program, a voluntary program developed by the U.S. Environmental Protection Agency to encourage energy-efficient building operation and upgrades (Energy Star 2003).

3M is weak in environmental product stewardship efforts (Figure 2.8). Once 3M products are sold, the company does not provide any education programs for consumers to learn how to use and dispose of the products responsibly. Medical experts are hired to monitor scientific and medical developments and offer guidance and education to help 3M understand and manage any risks associated with 3M products. A small in-house toxicology lab helps researchers obtain risk-related information on new materials early in the development process as part of Life Cycle Management. However, there are no programs that address post-purchase use of the products. The company will truly be managing the life cycle of its products when product stewardship programs are in place to address the use and disposal of the products.

The 3M environmental management efforts and accomplishments are impressive. Even though the large size, scope, and complexity of the company pose significant challenges to environmental responsibility, 3M has successfully used its core competencies to develop cost-effective green technology (Figure 2.13). However, the focus on product reformulation, process modification, and equipment redesign has made

"the greening of 3M narrowly tied to technological solutions" (Shrivastava 1996). The technology-based approach de-emphasizes larger social and political questions of environmental sustainability. 3M's technological innovations are admirable, but the focus on technological solutions is a limitation to environmental sustainability.

3M might look to improve environmental management activities by broadening its environmental policies to include more of the product life cycle. For instance, the company can begin to screen suppliers and use preference for suppliers that have environmental conduct aligned with 3M's environmental commitments. If diligent, 3M can have significant influence over the activities of its suppliers. 3M also should begin to address post-purchase use of its products by consumers. Providing more information to consumers about responsibly using and disposing of 3M products will make consumers aware of the company's proactive environmental posture. Therefore, while 3M takes more responsibility for the end of its product's life-cycle, it will also enhance its reputation as an environmentally responsible corporate citizen.

BASF

BASF is one of the world's largest chemical companies. With customers in more than 170 countries, BASF is a transnational company with production facilities in 39 countries and 89,389 employees as of December 31, 2002 (BASF 2003). Headquartered in Ludwigshafen, Germany, the company operates the world's largest integrated chemical complex. BASF has four core segments: agricultural chemicals, chemicals, nutrition, and oil and gas (Alperowicz 2003). The company aims to increase corporate value through growth and innovation. BASF management believes this goal can be achieved through sustainable development (BASF 2003).

BASF's leaders have created a vision on which every strategic decision should be based (BASF 2003). The Vision 2010 sets forth the goals that the company wants to achieve. Six values describe the manner in which BASF management wants to reach these goals:

- Sustainable profitable performance.
- Innovation in the service to customers.
- Safety, health, environmental responsibility.
- Intercultural competence.
- Mutual respect and open dialogue.
- Integrity.

BASF literature states that "The notion of sustainability can only be effective if it is firmly integrated into organizational and management systems" (BASF 2003). The company's commitment to sustainability is a core component of the conduct that is binding for all employees. "The Values and Principles form part of the personal target agreements of all senior executives within the BASF Group" (BASF 2003). To support the vision, BASF has structures to promote sustainable business activities, from strategic planning to implementation.

At the highest level, the Sustainability Council draws up strategies for the three aspects of sustainable development: the economy, the environment, and society. The council is chaired by Board member and Industrial Relations Director Eggert Voscherau. Voscherau and seven other division presidents work to ensure that BASF Group policy is in accord with the principle of sustainability (Figure 2.1). To implement strategic decisions, the Sustainability Council has an international steering committee. The ten members, vice presidents from various regions and disciplines, plan and oversee strategy implementation (Figure 2.13).

Several project teams made up of employees from existing operating units coordinate with the Steering Committee. Team tasks include drawing up quantifiable indicators, developing and monitoring environmental and social standards and expanding sustainability reporting. To ensure that all employees keep the corporate values in mind, every employee receives a personal copy of the Corporate Values.

BASF management encourages employees to act independently by fostering teamwork, flexible working time models as well as guided self-study (Figure 2.2). Personal initiative-based training is promoted, and in Germany alone, BASF invested 105.5 million Euros on training in 2002 (BASF 2003). The company also provides employees with a special incentive for creativity and innovative thinking in the form of its annual Innovation Prize.

Innovation is a core competency to BASF's success in the chemical industry. According to Peter Edwards, an analyst at Morgan Stanley (London), "The chemical industry is commoditizing, and technology and capital are no longer barriers to entry, so companies need to innovate to sustain their competitive position and hold on to profitability" (Alperowicz 2003). By capitalizing on their technology platforms in research and development, BASF literature says it will aim to improve profitability by market-driven innovation aimed at greater customer focus (Alperowicz 2003). To do so, the company has trained marketing and sales personnel to improve the understanding of customers' needs in environmental, safety and health concerns.

To align the innovation process with environmental sustainability, BASF engineers developed a proprietary tool called eco-efficiency analysis to evaluate the environmental effects of new and existing products and manufacturing processes to capitalize on those

that are the most environmentally sound and economically efficient (Figure 2.4) (Adhesives and Sealants Industry 2001). The process involves carrying out an overall study of alternative solutions to include a total cost determination and the calculation of ecological impact over the entire product lifecycle (Figure 2.3) (BASF 2003). The environmental effects of a product or process are investigated across six categories: consumption of resources and energy; emissions to air, water and soil; land use; toxicity; and risk potential (Figure 2.5). "On a graph known as an eco-efficiency portfolio, the overall costs are plotted against the product's overall environmental burden, making it easy to compare alternatives" (BASF 2003). The eco-efficiency model has been applied to over 110 products and processes across a variety of areas. The company is also working on incorporating social criteria into the model, so the eco-efficiency analysis would cover the three components of sustainability.

With the data collected for the eco-efficiency analyses, BASF can provide customers, regulatory authorities and members of the general public with detailed information on the effects of the substances they use (Figure 2.8). The company is working on using uniformly structured data records worldwide, perhaps setting the pace for other chemical manufacturers to sign on as well. Furthermore, a Product Stewardship Management System (PSMS) has been followed for many years at BASF as part of Responsible Care. Responsible Care is a voluntary program for the chemical industry to encourage improvements in environmental, health and safety performance beyond levels required by legislation (American Chemistry Council 2000).

Extending BASF's product responsibility beyond the factory walls, BASF managers also routinely do an environmental performance review of its suppliers (Figure

2.6). According to the company, as many as half of the reviewed suppliers have been rejected because their environmental practices were not up to BASF's standards (Butner 1996). Moreover, BASF has extended rigorous standards for distribution safety to distribution partners. The company now mandates key transportation partners to monitor daily practices and their impact on the environment (Adhesives and Sealants Industry 2001). The right form of transport and the right route are selected carefully. Experts also seek the best form of transport in terms of environmental protection (BASF 2003).

To ensure that production plants meet BASF's environmental standards, managers conduct "strict internal audits throughout the world" (BASF 2003). The safety and environment audits monitor the continual improvement of worldwide performance in the sense of Responsible Care. Additionally, BASF's Group companies have set up their own audit systems to ensure that local conditions are taken into account. The company has tested standardized audit systems such as the ISO 14001 at certain BASF sites. However, the BASF literature claims that these management systems offer no additional environmental advantages over their own audit systems. Nonetheless, BASF Corporation, United States, is the first chemical company to be certified according to RC 14001, a new standard combining Responsible Care and ISO 14001 (Sissell 2002).

To communicate BASF's progress towards achieving sustainability, the company publishes a multifaceted environmental report that addresses the major socioeconomic and environmental topics facing the chemical industry (Figure 2.12). Few environmental reports compare with the depth and breadth of BASF's. The company reports the economic, environmental and social aspects of activities through the Annual Report, the Environment, Health & Safety Report and the Social Responsibility Report. Deloitte and

Touche Global Environmental and Sustainability Services provide independent verification of the reports to ensure the validity of the information. BASF's credibility is underscored by the fact that the reports also included negative aspects (BASF 2003).

The BASF Environment, Health, and Safety Report includes data reporting the amounts of air and water emissions, and waste generation from the BASF Group as a whole. Along with metrics, the company sets goals for further improvement. For example, in 2002, emissions of greenhouse gases from BASF's global chemicals operations totaled 18.3 million metric tons (BASF 2002). Although the emission levels are high, the report goes on to show that greenhouse emissions decreased 38 percent in absolute terms between 1999 and 2002. In the same period, production increased by 45 percent, so greenhouse emissions per metric ton of sales product decreased by 61 percent. Furthermore, the company sets reduction goals for specific emissions on a ten year basis.

BASF management aims to boost the efficiency of production processes to maximize the output of the materials to sell or use for further processing (Figure 2.11). The company's leaders view efficiency as using fewer resources and producing less waste when making a product. Production plants are connected through an intricate network of piping that provides an environmentally friendly method of transporting raw materials and energy quickly and safely; by-products from one plant can be used as raw materials elsewhere (Figure 2.9). BASF power plants operate using cogeneration, a process that simultaneously generates electricity as well as steam that can be used in production plants (BASF 2003). At the Ludwigshafen site, BASF started building a further combined heat and power plant in fall 2003. From late 2005 onward, the turbines will produce 3.5 times as much electricity per metric ton of steam as a conventional

power plant. The new plant will be almost 90 percent energy efficient. This technology conserves resources while reducing CO_2 emissions by 500,000 metric tons per year (Figure 2.10).

BASF demonstrates its commitment to sustainability through financial contributions to environmental protection. The cost of operating environmental protection facilities throughout the BASF Group amounted to 697 million Euros in 2002. In the same period, the company also invested 186 million Euros in new and improved environmental protection facilities. These capital expenditures cover both end-of-pipe measures and production-integrated environmental protection measures (BASF 2003).

BASF has won several awards for environmental protection and sustainability from regional associations. BASF's environmental achievements are numerous and multifaceted. The company is on the leading edge of environmental sustainability in the chemical industry. However, as a company that relies on innovation for success, it is my opinion that BASF fundamentally de-emphasizes larger sustainability questions surrounding dematerialization and product reduction. BASF's eco-efficient innovations are impressive, but the focus on industrial solutions may be a limitation to environmental sustainability.

General Motors

General Motors (GM) is the world's largest vehicle manufacturer. The company designs, builds, and markets cars and trucks worldwide and employs approximately 350,000 people globally (GM 2004). Founded in 1908, GM now has assembly, manufacturing, distribution and warehousing operations in more than 53 countries and GM vehicles are sold in approximately 200 countries. In 2002, the company sold more than 8.5 million cars and trucks and realized 15.1% of the world vehicle market.

On March 4, 1991, the General Motors Board of Directors adopted the company's Environmental Principles. The following principles are guidelines for GM employees worldwide, encouraging environmental consciousness in daily conduct and in the planning of future products:

1. "We are committed to actions to restore and preserve the environment.
2. We are committed to reducing waste and pollutants, conserving resources, and recycling materials at every stage of the product life cycle.
3. We will continue to participate actively in educating the public regarding environmental conservation.
4. We will continue to pursue vigorously the development and implementation of technologies for minimizing pollutant emissions.
5. We will continue to work with all governmental entities for the development of technically sound and financially responsible environmental laws and regulations.
6. We will continually assess the impact of our plants and products on the environment and the communities in which we live and operate with a goal of continuous improvement." (GM 2003a)

General Motors wants their employees to conduct day-to-day business using this platform. These core values are outlined in the company's guidebook called "Winning with Integrity - Our Values and Guidelines for Employee Conduct" (GM 2003b). Worldwide, GM is integrating its environmental management systems, based on ISO 14001 specifications (Figure 2.13). These systems include GM's Environmental Performance Criteria (EPC) which assist business units in protecting the environment beyond regulatory compliance.

To manage the company's environmental commitment, the Energy & Environmental Strategy Board (EESB) was created. The EESB is responsible for developing and implementing GM's global energy and environmental strategy and developing operational business processes (GM 2004). Working alongside the EESB is

the Worldwide Facilities Group, which manages the operational aspects of GM's manufacturing functions around the world. Under the coordination of the Worldwide Facilities Group, there are a number of other teams involved in GM's global environmental management, including the Global Environmental Issues Team (GEIT), the Supplier Environmental Advisory Team and the Global Energy Team. These teams allow environmental responsibility to be spread throughout the company, with several operational positions involved in environmental initiatives.

General Motors executives firmly believe that mobility is an important component in the modern world (GM 2004). Social and corporate trends are moving toward global mobility and the company's leaders see GM's large market share as an opportunity to positively influence the future of the automobile industry. In accordance, the company's management conceived and initiated a collaborative project to apply the concept of sustainability to global mobility (Figure 2.1). The Sustainable Mobility Project has become the World Business Council for Sustainable Development's (WBCSD) largest and most comprehensive member-led project, involving some of the world's largest corporations from the energy and automotive industries (GM 2004).

The Sustainable Mobility project has defined sustainable mobility as "the ability to meet society's desires and needs to move freely, gain access, communicate, trade and establish relationships without sacrificing other essential human or ecological values today or in the future" (GM 2004). The objectives of the project are to increase industrial understanding of the complex issues surrounding mobility, to assess the state of mobility today and to project what the situation is likely to be in the future based on current trends.

GM has been actively involved in several other WBCSD projects and is also very active in the Coalition for Environmentally Responsible Economies.

General Motors managers plan to use the company's technological innovations to create positive environmental changes in the automotive industry. General Motors' goal is "to introduce technically feasible, affordable technologies in millions of vehicles each year" (GM 2004). Already, the company is delivering hybrid electric drive power train systems for city buses. The new technology cuts fuel use by 50% and emissions by 80-90% compared with traditional diesel bus engines. Beginning in 2004, GM will sell the industry's first full-size pickups with hybrid electric drive systems. Between 2001 and 2005, GM will introduce a number of other technologies and materials to improve the fuel economy of all GM vehicles, including continuously variable transmissions (CVTs), Displacement on Demand (DOD) engines and lightweight body and chassis components (GM 2004). GM also leads in developing next generation fuel cell systems (PR Newswire 2004).

Many of these technologies emerged from GM's advanced technology R&D. "Research is the brainpower of General Motors, and the focus is on innovation" (GM 2004). Management has developed programs that integrate GM's environmental principles into the innovation process (Figure 2.2). The WE CARE (Waste Elimination and Cost Awareness Reward Everyone) Program is a corporate initiative that formalizes Design for the Environment and Pollution Prevention efforts into a team-oriented approach. The WE CARE Awards competition provides recognition to individuals, teams, and plants that identify and implement ideas in North American locations. Information about the award recipients is shared internally and reported externally to

promote GM's materials and energy reduction initiatives and pollution prevention efforts (GM 2004).

Innovative technologies have been used to improve manufacturing processes and the performance of vehicles. A new hybrid technology called the "Allison Electric Drive System" will be applied to mass transit vehicles to reduce fuel consumption and emissions (Taylor 2003). General Motors also introduced the first gasoline powered car with fuel consumption below 5 liters per 100 kilometers (GM 2002). The Opel Vauxhall Corsa Eco has refined aerodynamics and an extremely efficient "ECOTEC" engine which combine to yield a 4.9/100 km fuel economy. Furthermore, research into hydrogen fuel cells, lightweight vehicle bodies, and continuously variable transmissions show GM's research investment into environmental responsibility. As time passes, the veracity of GM's commitment will be tested as the new technologies begin to be implemented beyond developing stages.

General Motors uses design for environment principles in their manufacturing process to reduce environmental impact of production processes. By designing for recyclability, end of life, and disassembly, GM is working to reduce material mass, eliminate scrap materials, avoid the use of hazardous materials, and increase the use of recycled materials (Figure 2.9). In 2002, GM recycled 2.2 million tons of waste and prevented 3000 tons of waste by using new technologies and waste reduction efforts. These efforts reduced carbon dioxide emissions by more than 4.7 million metric tons (PR Newswire 2003).

The company performs Life Cycle Analyses (LCAs) before and during the design process to account for potential environmental impacts before manufacturing begins

(Figure 2.4). The LCA is also used to compare materials for a particular component in the car. Materials are assessed for potential environmental impacts before they are used (GM 2004). The LCAs are accompanied by the Product Material Review process and the Manufacturing Planning Study Process to design environmentally responsible products and processes (Figure 2.5 and Figure 2.10).

GM automobiles are increasingly designed for dismantling and recycling. On its website, GM addresses End-of-Life Vehicles (ELVs) which are vehicles considered to have reached the end of their useful life. In September, the European Parliament approved a directive on ELVs that requires producer responsibility for cost-free take back of ELVs beginning with vehicles produced after 2001. GM says it supports a "free market approach to ELV treatment with extended product responsibility reflecting a shared approach for ELVs among suppliers, OEMs, dismantlers, shredders, recyclers and consumers" (GM 2004). The company also partners with other companies to recycle and take back waste, unfit materials, and discarded materials instead of land filling (Figure 2.8).

To communicate its environmental commitment to stakeholders, GM publishes an annual Corporate Responsibility and Sustainability Report (Figure 2.12). The report follows the Global Reporting Initiative's (GRI) Guidelines, ensuring a comprehensive report on the environmental activities of the company. In fact, GM is a member of the Steering Committee of the GRI to develop a common framework for global corporate reporting that links the economic, environmental and social aspects of sustainability (GM 2004). The company contracts a third-party partner to standardize environmental data

collection and reporting. The third-party involvement allows GM to have accurate data available when making decisions regarding certain processes (GM 2003a).

To assess worldwide environmental performance, GM has a Global Environmental Metrics Team (GEMT), made up of employees from operating units worldwide. In 1999, the GEMT agreed on a common set of metrics for facilities, including energy use, water use, carbon dioxide emissions, and recycled and non-recycled waste. All of these environmental metrics are published in GM's Annual Sustainability Report to guarantee transparency. The company does not leave out potentially harmful information in its sustainability report. The report addresses the regulatory violations and the associated fines for the reporting period. The company also reports any oil and chemical spills and non-routine air emissions above reportable quantities (GM 2003a). The thoroughness with which the environmental metrics are reported is certainly commendable given the size of GM's operations. The global data collection process involves more than 100 facilities in many countries with different cultural and regulatory environments.

Concerned about the environmental impact from their products' life-cycles, GM incorporates environmental responsibility into supply chain management (Figure 2.6). In 1998, GM announced that by the end of 2002, it would require its suppliers to certify the implementation of environmental management systems (EMS) in their operations, in conformance with ISO 14001 (EWire 1999). There is no public evidence of enforcement, but the 2003 GM Sustainability Report still says that GM advises its top 600 vehicle parts suppliers to become certified. The company is heavily involved in the Suppliers Partnership for the Environment Project (SP), which coordinates automobile manufacturers, their suppliers and the EPA (GM 2004). SP has workgroups that focus on

specific tools for suppliers to use to improve their environmental footprints. The tools include Design for the Environment, environmental metrics, and energy optimization.

GM demonstrates its environmental commitment to consumers with the help of eco labels (Figure 2.7). The eco labels, including the Sustainable Business Institute (SBI) Seal, CERES, and Energy Star, show consumers the research and design that has made environmental improvements on GM's products. Unfortunately, GM's marketing efforts do not address post-purchase use of automobiles. Since a considerable amount of the environmental impact from automobiles occurs after purchase, an environmentally responsible company should provide some consumer education on how to minimize environmental impact from daily transportation activities. With a post-purchase effort, GM could work to reduce the life-cycle environmental impact of their automobiles.

Volvo

Founded in 1927, the Volvo Group is one of the world's largest manufacturers of trucks, buses and construction equipment, drive systems for marine and industrial applications, aerospace components and services. The Volvo Group includes Volvo Trucks, Mack, Renault Trucks, Volvo Buses, Volvo Construction Equipment, Volvo Penta, Volvo Aero and Volvo Financial Services (Volvo Group 2003). Volvo today has approximately 72,000 employees, production in 25 countries and operates in more than 185 markets. The Volvo Group's net sales 2002 amounted to 19.3 billion Euros.

In 1999, Volvo Car Corporation became a wholly-owned subsidiary of Ford Motor Company, the second biggest carmaker in the world. Together with Jaguar, Land Rover and Aston Martin, Volvo is part of the Premier Automotive Group (PAG), Ford's premium car division (Volvo Car Corporate Citizenship Report 2002). Volvo Group and Volvo Cars still share the same brand name so a new company, Volvo Trademark

Holding AB, was established to deal with brand matters for the two companies. According to Paul Lienert from Auto Insider, Ford's ownership will not have a significant effect on Volvo's brand image. Lienert asserts that "Volvo continues to shine (albeit perhaps not as brightly as it once did), with a clear and consistent personality linked closely to its long-standing and meticulously crafted reputation as one of the safest vehicles on the road. Indeed, Ford has carefully protected and nurtured that core value at its Swedish subsidiary" (Lienert 2003). The Volvo Group will be evaluated on environmental management because the group is a better comparison for General Motors Corporate than is the Volvo Car Corporation. However, significant differences between Volvo Group and the Volvo Car Corporation will be noted.

As far back as 1972, Volvo's former CEO Pehr Gyllenhammar recognized the conflict between environmental protection and Volvo's products. He declared that "It is in Volvo's best interest that the auto is used in such a way that it does not cause environmental damage" (Rothenberg and Maxwell 1999). A decade later, Volvo adopted a formal environmental policy, being one of the first industrial manufacturing corporations in the world to do so. By creating the new policy, Gyllenhammar sought to add environmental responsibility to Volvo's corporate strategy and image.

Volvo is unique in that the company recognizes the strategic advantage of incorporating environmental issues into operations and business decisions. "Volvo believes that consideration of environmental issues can lead to a competitive advantage" (Resetar et al. 1998). Accordingly, environmental care is included with quality and safety a (not smoothly worded) corporate value for the Volvo Group. The corporation is also unique in that it has a single environmental policy, common to all parts of the Group

(Figure 2.13). This policy is the basis for the environmental management systems, strategies and objectives, audits and activities (Volvo Group 2003). The business units are then free to modify the policy in ways consistent with their unique resources, products, and market pressures (Resetar et al. 1998). Volvo has asserted that no one national or international standard offers a comprehensive environmental management program. So the Volvo environmental management system is structured to incorporate all national and international standards, including ISO 14000, the European Eco-management and Audit Scheme (EMAS), BS 7750, and the International Chamber of Commerce's Business Charter for Sustainable Development (Resetar 1998).

The business units' individual environmental management systems are the tools for controlling the specific environmental impact for each organization (Figure 2.1). As of 2002 80% of all employees in Volvo production units worked in an ISO 14001 certified organization (Volvo Group 2003). Other parts of the value chain, such as product development and marketing, also have environmental management systems in place.

The Volvo Group has a decentralized environmental organization, spreading environmental responsibility to all levels of the corporation (Figure 2.2). Environmental coordinators are responsible for the environmental performance and legal compliance of production plants (Volvo Group 2003). Each business unit has a centrally placed environmental manager who coordinates environmental strategies within the unit. The Group environmental strategies are centrally coordinated by Environmental Affairs at the Volvo Group Headquarters.

The Volvo Group leadership also believes that knowledgeable and dedicated employees are among the most important factors in successful environmental activities

(Volvo Group 2003). By training employees on environmental issues, Volvo hopes to increase individual awareness and support for environmental goals. At Volvo Cars, over 50,000 people have undergone comprehensive environmental training to date (Volvo Car 2004). The training is instrumental in helping designers develop new competencies (Resetar 1998). Designers are better equipped to think about long-term impacts of their decisions. Individual competence is especially important, because new product design is characterized by decentralized decision-making and many design trade-offs.

To focus the efforts and guide the daily work in design and development, Volvo developed several decision tools to be used in the product development process. The tools communicate environmental impacts of material and chemical selection decisions to product and process engineers (Figure 2.4) (Rothenberg and Maxwell 1999). Volvo maintains a "black" and a "grey" list of substances that may not be used in either products or production (Volvo Group 2003). Volvo also decided to adopt a computer database, MOTIV, which holds information on the chemicals used in the company. The system provides designers detailed information on the environmental, health, and safety risks associated with a chemical (Figure 2.5). The database also contains available substitutes for each chemical. The system allows environmental questions to be answered directly in production (Rothenberg and Maxwell 1999).

Another product development tool is the EPS (Environmental Priority Strategies in product design). EPS was created to help designers compare the life-cycle impacts of materials choices. Using EPS, each product can be assigned an Environmental Load Unit (ELU), which is derived from "a weighted evaluation of all aspects of the life cycle and is based on the impact of the product on five 'protection objects': biological diversity,

health, the productive capacity of nature, natural resources, and aesthetic values" (Volvo Group 2003). EPS offers a unique simplicity to the life-cycle analysis which makes it very useful in Volvo's environmental strategy.

With the EPS and MOTIV tools, Volvo engineers are able to integrate design for the environment principles into Volvo's products. The environmental issues are part of around 35 attributes of concern for an automobile (Resetar 1998). Design attributes traditionally include automobile weight, air resistance, and rolling resistance. Attributes that are exclusively environmental in nature are emissions and recycling rates, materials and fuel consumption. However, environmental requirements affect virtually all 35 attributes in some fashion. To account for the materials before production begins, Volvo introduced environmental requirements for suppliers in 1996 (Figure 2.6). The requirements are used as an integral part of the supplier evaluation and follow-up. Environmental training for suppliers is also ongoing, focusing mainly on the implementation of IMDS (International Material Data System).

Volvo asserts that 100% of a car can be recycled if the necessary resources are applied (Volvo Group 2003). Recycling is facilitated by responsible designs at the product development stage. Volvo Cars has developed guidelines for Designing for Recycling (DfR) to integrate recycling into the design stage (Volvo Car Corporation 2004). DfR contains information on the effects of different materials on the car's environmental performance (Figure 2.9). At present, 85% of the material in a car is recycled, including material recycling and energy recovery. Energy recovery from end of life vehicles was found to be highly efficient, so certain materials are processed to recover their energy content. To recover materials, the product must be dismantled and

materials sorted. Volvo Cars has taken steps to develop cars that are easy to dismantle and has developed dismantling manuals for all Volvo models since the 240 series (Volvo Car Corporation 2004). The company is also working to implement consistent marking of components to facilitate recycling and recovery activities (Figure 2.8).

The Volvo Group applies its holistic environmental commitment to production processes as well. To Volvo, "efficient energy utilization means both reducing costs and lowering emissions of atmospheric pollutants, especially of carbon dioxide" (Figure 2.10 and Figure 2.11) (Volvo Environmental Data 2002). To reduce energy consumption, most Volvo production plants are heated by natural gas or liquefied petroleum gas (LPG) (Volvo Group 2003). At certain plants, waste heat from neighboring oil refineries is also used for energy. In 2002, the Volvo Group's energy consumption totaled 2,564 GWh, a slight decrease of 22 GWh compared with 2001 (Volvo Environmental Data 2002). Emissions of carbon dioxide also decreased, from approximately 316,000 tons to approximately 307,000 tons. However, relative to net sales, both energy consumption and CO_2 emissions remained practically unchanged, so Volvo must continue to identify opportunities for improvement.

The Volvo Group's environmental strategy also addresses investment issues (Figure 2.3). To facilitate environmentally sound financial decision making, a set of investment criteria has been developed to balance environmental impacts of decision relative to other investment criteria:

> Prior to making decisions concerning major processes or production changes which result in pollutant emission or other adverse environmental effects, measures shall be taken to enable such decisions to be based on the utilization of the best technology from an environmental viewpoint. Decisions concerning deviations

> from this policy shall be made by top company management. (Rothenberg and Maxwell 1998)

This clause is important because it places the burden of proof on those options that are not as environmentally responsible, regardless of the cost. Furthermore, it encourages managers to look at environmental investments differently than other investments.

Volvo takes the job of communicating environmental activities seriously (Figure 2.12). The group has a long tradition of environmental reporting, having published environmental reports since 1990 (Volvo Group 2003). Additionally, the eco-labeling used by Volvo is in compliance with the ISO 14020 standards (Figure 2.7). Since March of 2002, summarized environmental and social information have been included in the Annual report. The data reporting is based on the global environmental standard for production plants that was introduced in 2000 by Group management (Volvo Environmental Data 2002). The standard focuses on extensive audits in a number of key environmental issues, such as use of chemicals, energy and water consumption, emissions to air and water, waste, and noise. However, the audits are conducted under the direction of the Group's environmental auditor instead of an external party. The Volvo Group may be able to add accountability by hiring a third party to audit and certify the report of Volvo's environmental activities.

BP

BP is one of the world's largest oil and petrochemical groups. The group has operations in over 70 countries, with four business segments: exploration and production; refining and marketing; petrochemicals; and gas power and renewables (BP 2004). The company employs over 100,000 people, serving about 13 million customers in over 100 countries each day. The brands that comprise the BP group are BP, am/pm convenience

stores, Aral fuels and lubricant products, ARCO gasoline, and Castrol automotive lubricants.

BP opens its environmental commitment literature with a simple stated goal – "To do no damage to the environment" (BP 2004). Coming from a petrochemical company, the statement is a serious ambition. After stating the goal, the company goes on to summarize ways it has moved toward accomplishing the goal. The main accomplishment the company celebrates repeatedly is that it achieved a goal set in 1998 to reduce emissions to a level 10% below the company's 1990 baseline (BP 2004). The next step for the company is to address the impact of emissions from customer use of fossil fuel products (Figure 2.8).

BP's business policies focus on five areas – ethical conduct, employees, relationships, health, safety, and environmental performance (HSE), and control and finance. The company issues each employee a policy book titled "What We Stand For" (BP 2002a). The policy clearly states that everyone who works for BP is responsible for getting HSE activities right (Figure 2.2). The goals are simply stated – "no accidents, no harm to people and no damage to the environment" (BP 2004). The policy book is a very general outline of what BP employees should do, including following regulations and ensuring safety. It does not provide any guidance on how employees are to make decisions regarding business and the environment.

An Environmental Management System has been developed to frame the HSE expectations (Figure 2.13). Another booklet, "Getting HSE Right," (BP 2001) is a guide for managers to implement the environmental management system. The requirements include that each business unit will have documented systems in place to meet the

corporate HSE expectations, including justification when certain expectations are not met by the business unit. The guidebook provides a framework in hope to help line managers consistently deliver improved HSE performance. To date, 96 of 104 major operations within BP have achieved ISO 14001 certification (Figure 2.1) (BP 2002b).

On the BP website, the company addresses several key environmental topics. The literature provides basic information on the issues, BP's strategy to address them, stated targets, and how the company plans to achieve the targets. Up front, climate change is addressed. BP states that although the science behind global warming is still emerging, "precautionary action is justified" (BP 2004). To back up the assertion, BP repeats the accomplishment in reducing greenhouse gas emissions to 10% below its 1990 baseline. The new target BP sets is to maintain net emissions at or below the 2001 levels over the next decade (Figure 2.10). To do so, the company will look to avoid hydrocarbon flaring and venting as well as work for greater energy efficiency in operations. Furthermore, the literature says the company will encourage more energy efficiency in society, shift interests into cleaner fuels, and introduce renewable energy (Figure 2.7). BP recognizes "the need to invest in alternative and renewable energy and to minimize the impact of fossil fuels while they remain the dominant energy source" (BP 2004).

BP is challenged to develop a profitable renewable energy business, focusing on solar and wind energy. As a member in the World Resources Institute's Safe Climate, Sound Business Initiative, BP is seeking to build a new energy marketplace in which it can offer a range of products and services designed to reduce the potential climate impacts of energy use (World Resources Institute 1998). BP claims to be on the leading edge of photovoltaic technology, being one of the world's largest manufacturers of solar

electric products and systems (BP 2004). BP Solar is investing over $100 million to build on existing manufacturing and marketing operations. The new facility will be one of the largest solar plants in the world. Within BP Wind, the company is making selective investments on the sites of its petrochemical operations to create clean energy solutions. It will be the first time turbines have been constructed to power an oil refinery anywhere in the world. BP is hoping to build from its successful manufacturing capabilities to focus upon developing a marketplace for BP branded solar and wind products (BP 2004).

During 2002, BP designed a more rigorous and comprehensive approach to energy management. The company asserts that energy efficiency will support the commitment to maintain net emissions at 2001 levels (Figure 2.11). To improve management's understanding of energy use, BP has improved its measurement and benchmarking systems. The company has also encouraged wider application of its energy management systems to develop energy conscious behaviors. During 2002, energy efficiency improved in all of BP's main businesses compared to 2001 (BP 2002b). Future strategies include embedding energy efficiency into plant design and new processes. Additionally, all major products are expected to demonstrate how they plan for optimized energy use.

BP's Green Office initiative aims to reduce the environmental impact that results from business activities in the office. With the practice of eco-efficiency BP can make wise supply choices, use resources and consumables efficiently, and recycle waste (Figure 2.5) (BP 2004). The Green Office initiative has the ability to influence all levels within BP, as each individual has a part to play in setting a good environmental example. BP has established key performance indicators, metrics to chart its environmental impact

within the office space, such as energy and water usage. Metrics are standardized across different sites to enable identification of trends and to facilitate the sharing of best practices. The Green Office initiatives also support BP's objective to reduce waste volumes. Where waste is unavoidable, the company aims to look at ways to reduce, reuse, or recycle (Figure 2.9).

Significant environmental impact can be caused from oil and chemical spills. Appropriately, BP recognizes that these spills remain a significant risk for the company because many products have the potential for accidental releases. To reduce the potential for future incidents, BP aims to continually improve preventative measures and emergency response systems (BP 2004). Included in these preventative measures are standards to assure the integrity of transportation vessels and pipelines. Regular audits are made of third party haulers to ensure these standards are maintained. Although potentially harmful to the BP image, the company fully reports the number of spills that occur during the year. The numbers are reported in a positive light, but BP fully admits that there is still a lot of work to be done. BP asserts that it can influence positive change by sharing its social, ethical, safety and environmental standards in all its business relationships and it seeks to buy from companies whose policies and practices are aligned with its own (Figure 2.6).

As a new addition to environmental policies, BP now recognizes the need to produce and encourage the efficient use of cleaner products. Speaking about the new initiative, BP states that "We use approximately 10% of the fossil fuel we extract to power our operations and supply the remaining 90% to our customers as products. The

potential impacts of these products on global warming and other environmental issues are therefore much more extensive than such impacts from our own operations" (BP 2004).

To follow through with their product commitment, BP is developing cleaner fuels that can be burned with lower emissions (Figure 2.10). The cleaner fuels can reduce the emissions from older vehicles already in use, as well as influence the development of new vehicle technologies. By the end of 2002, BP was marketing clean fuels in 119 cities worldwide (BP 2004). Additionally, more efficient fuel and lubricant packages are being introduced for bus fleets. BP also plans to develop and promote natural gas as a preferred fossil fuel source of energy because it results in lower carbon dioxide emissions than coal or oil. According to the Natural Gas Supply Organization, "the use of natural gas also offers a number of environmental benefits over other sources of energy, particularly other fossil fuels" (Natural Gas Supply Organization 2003). BP believes that natural gas consequently has the ability to meet the large and growing energy requirements of growing economies while reducing the impacts on the environment.

With the BP environmental commitments and targets in mind, managers are challenged to make business decisions that integrate financial security with environmental protection. To help in the task, BP has developed the health, safety, and environmental plan for projects (Figure 2.3 and Figure 2.4) (BP 2004). The plan assists project teams in aligning their HSE activities with the same process that is used to frame business decisions. The company wants to include this approach into the earliest stages of financial planning so that the full life cycle impact of new projects is considered in the overall plan. Environmental impact assessments are used to analyze and describe the

significant environmental effects of a proposed project, but the company does not reveal how the impact statements are used to make financial decisions.

BP tracks and communicates its environmental progress using its own Environmental Reporting Guidelines (Figure 2.12). Currently, the environmental metrics are aggregated for the annual reporting cycle, but BP is looking at changing the reporting procedure to provide more detail on local site performance. The company consults internally and externally to decide on how to report more transparently on BP's impact on local environment. The Environmental and Social Reports are externally verified by Ernst & Young. The auditors assess data management processes, interview BP management, review external media sources, and visit a sample of operational sites (BP 2004). The paper copy of the Environmental and Social Report only provides a selection and summary of the more comprehensive information available online (BP 2004). The website covers environmental topics in good detail and includes a wide range of case studies that illustrate BP's current practices in health, safety, and environmental performance.

BP claims that success is demonstrating that it is possible to achieve "green growth" – economic and social development with environmental gains (BP 2004). The question must be asked, however, if an oil company can truly claim to provide environmental gains. The company's literature provides vivid images of a future-oriented company with grand initiatives to provide for economic, social, and environmental sustainability, but oil is still being harvested around the world. As it attempts to create a new identity as a leader in moving "Beyond Petroleum," BP touts its

$45 million purchase of the largest Solarex solar energy corporation. However, BP will spend $5 billion over five years for oil exploration in Alaska alone (Corpwatch 2001).

BP has, in fact, been targeted by skeptics that question several BP environmental claims. BP is often accused of 'greenwashing,' "the phenomenon of socially and environmentally destructive corporations attempting to preserve and expand their markets by posing as friends of the environment" (Corpwatch 2002). At the 2002 Earth Summit in Johannesburg, BP won a Greenwash Academy Award for their Beyond Petroleum re-branding campaign. The coming decade will reveal whether BP has created an effective strategy to achieve environmental sustainability, or if it simply created a new logo.

Shell

Shell is a global group of energy and petrochemical companies. The group operates in over 145 countries and employs over 115,000 people (Shell 2004). The organization of the Group is divided into five main business segments including Exploration and Production; Gas & Power; Oil Products; Chemicals; and Renewables. Other Shell businesses include Shell Consumer, Shell Hydrogen, and Shell Trading. Royal Dutch Petroleum Company, based in the Netherlands owns 60% of the Group, and the Shell Transport and Trading Company owns 40%.

The Shell Group operates using the core values of honesty, integrity and respect for people (Shell 2004). These cores are embodied in the Shell Business Principles, which have included a commitment to contribute to sustainable development since 1997. In support of the commitment, Shell has created two Group-wide policies: Business Principles and the Health, Safety and Environment (HSE) Policy. The Shell Group is committed to:

- Pursue the goal of no harm to people;
- Protect the environment;
- Use material and energy efficiently to provide our products and services;
- Develop energy resources, products and services consistent with these aims;
- Publicly report on our performance;
- Play a leading role in promoting best practice in our industries;
- Manage HSE matters as any other critical business activity;
- Promote a culture in which all Shell employees share this commitment. (Shell 2004)

Shell expects the world energy demand to double by 2050 and is aiming to meet the growing demand for fossil fuels while reducing the social and environmental impacts. However, the Group first commits to "delivering robust profitability" and "demonstrating competitive edge" (Shell 2004). So Shell has started to integrate the principles of sustainable development into its core processes and management thinking and the Group intends "to set the standard for world-class performance in [the] energy and petrochemicals businesses on this basis" (Shell 2001). The Shell companies have a systematic approach to health, safety, and environmental (HSE) management in order to achieve continuous improvement (Figure 2.13). Shell companies manage HSE activities as any other critical business activity by setting targets for performance, and measure and report performance.

Shell's general strategic direction concerning sustainable development includes continuing to explore for oil and gas, working to develop new gas markets in fast-growing regions, reducing environmental impacts of its operations, and introducing cleaner transport fuels (Shell 2004). Additionally, Shell is working to shift to a low-carbon energy system portfolio by working to reduce the costs of solar power and supporting the development of hydrogen fuel cells and the necessary hydrogen

infrastructure. The Groups efforts in bringing more natural gas to market and expanding its wind power business will also add value to its low-carbon energy business system.

Environmental management systems are in place to continually look for ways to reduce the environmental impact of Shell's operations, products, and services throughout their life (Figure 2.1). The program to certify major installations to the ISO 14001 standards is virtually complete (Shell 2004). The Group is now challenged to implement the environmental management systems into new acquisitions, and they expect to complete the implementation by the end of 2005. Each Shell company is responsible for setting targets for improvement, measuring, appraising and reporting performance.

Shell annually publishes The Shell Report, which is a document that reviews the Group's social, environmental, and economic performance (Figure 2.12) (Shell 2002). The report outlines several social and environmental issues that challenge the Shell Group in their operations, and the way that the Group plans to deal with the challenges. In addressing global warming, Shell aims to reduce emissions from its own operations. The Group says it has already beaten its target to reduce emissions to 10% below its 1990 baseline by 2002. To do so, the Shell Group almost eliminated continuous venting of gas and flaring of gas during oil production. Shell's future target is to manage greenhouse gas emissions so that they are still 5% or more below the 1990 baseline by 2010 (Figure 2.10) (Shell 2004).

The Shell Report also includes energy efficiency issues (Figure 2.11). Shell states that energy efficiency saves money and reduces environmental impact, so it makes business sense to work on using less energy for every ton of product produced. However, over the last five years, Shell has not seen a systematic improvement. New programs are

in motion in the Chemical and Oil businesses to increase energy efficiency (Shell 2002). The two companies have new measures for reporting energy efficiency so corrective actions can be taken promptly. Shell has also created a partnership with Rocky Mountain Institute to integrate energy efficiency design in new plants and retrofits. Shell continues to look for new ways to reduce waste, including turning it into saleable products (Figure 2.5 and Figure 2.9). Shell Chemicals is experimenting with a partnership to recycle used polyethylene terephthalate (PET) soft-drink bottles into building materials (Shell 2004).

The oil and petrochemical business is inherently risky and Shell recognizes the risk associated with its Group. Particularly, the Group recognizes that spills of crude oil, oil products or chemicals can unnecessarily impact the environment, erode stakeholder trust and are a waste of money (Shell 2004). In 2002, Shell's spills were the lowest since they started reporting in 1996, beating the 2002 target and improving significantly on a disappointing performance in 2001. However, the group still reported over 1000 spills. The group's new target is a reduction of more than a third by 2007. To achieve the target, Shell will further upgrade its pipeline systems and will continue to engage with communities to reduce spills from sabotage.

The Shell Report also includes performance information and goals for ozone depleting substances, water use, nitrogen oxides and sulfur oxide, discharges to water, tanker safety, and fines, settlements, compensation payments, and liabilities. The Shell companies recognize their impact on national economies, the environment and individuals (Shell 2002). The Group believes that the open communication initiated by The Shell Report is essential to build sustainable development.

Moving beyond Shell's own operations and business activities, the company has also stated a commitment to help consumers reduce their emissions (Figure 2.8). The Group asserts that "Acting now and encouraging others to do the same is part of being a responsible corporate citizen" (Shell 2004). To encourage others in sustainable development, Shell will promote natural gas as a cleaner alternative for electricity, heating, and transportation, offer renewable energy options, provide lower emission fuels, and advise consumers on how to improve their energy efficiency.

Shell's literature on long-term energy scenarios suggests different possible routes to decarbonization: a direct path to renewables, supported by gas in the medium term, or an indirect path, via a global hydrogen economy that grows out of new developments in fuel cells and other technologies. In 1997, the Shell Group established Shell Renewables with an investment of $500 million (Shell 2004). Shell Renewables, which includes wind, solar, and biomass, is now active in more than 75 countries. Shell reports it will spend up to a further US$500 million on new energies in 2005.

Shell WindEnergy now owns and operates more than 660 megawatts capacity across wind farms in Europe and the United States (Shell WindEnergy 2004). By the end of 2005, the company aims to own or have secured or constructed as much as 2000 megawatts gross capacity. The investments into wind power help diversify the sources of energy available to Shell customers. Shell Solar works with customers to provide domestic, commercial, rural, and urban solar services. To date, Shell Solar has supplied solar cells and modules with a total peak capacity in excess of 300 megawatts - more than any other competitor, and equivalent to approximately one-fifth of the installed capacity worldwide. With the acquisition of Seimens Solar, Shell Solar is now one of the world's

largest solar photovoltaic companies. The Shell Group also recently purchased an equity stake in Iogen Energy Corporation, a world-leading bioethanol technology company. Shell's investment will enable the Canadian-based company to develop the world's first commercial-scale biomass to ethanol plant more rapidly.

As Shell and other energy companies work to make renewable energy economically feasible, the Group is promoting natural gas as a cleaner alternative fuel. Shell's Gas & Power business already serves 35 countries (Shell Gas and Power 2004). The Group expects the demand for natural gas to double over the next two decades as the world searches for cleaner forms of energy. Shell will continue to promote natural gas as a short term solution to environmental impact from fossil fuels. Shell Gas and Power markets natural gas as a low carbon fuel that produces fewer climate change gases than any of the fossil fuels.

Shell Hydrogen is working on a long-term solution to the environmental impact arising from the consumption of fossil fuels (Shell Hydrogen 2004). Shell Hydrogen was established in 1999 as another core business of the Shell Group and is developing business opportunities in hydrogen and hydrogen fuel cells. Shell's literature indicates that the Group believes hydrogen energy has significant potential to play a major role in sustainable development. "Shell Hydrogen is working with governments, other companies, vehicle manufacturers and researchers to develop techniques to generate, use and store hydrogen energy" (Shell Hydrogen 2004). Shell Hydrogen is now working closely with International Fuel Cells (a subsidiary of United Technologies Corporation) in a 50-50 joint venture that plans to develop, manufacture and market a new, commercial

generation of fuel processors designed specifically for the emerging fuel-cell and hydrogen-fuel markets (Shell Hydrogen 2004).

The Shell group adds value to environmental initiatives by reporting its activities to stakeholders with The Shell Report and comprehensive web materials on its commitment to sustainable development. As a charter member of the Global Reporting Initiative (GRI), Shell is supporting the effort to create common guidelines for environmental reporting. The Group also supports the greenhouse gas reporting protocol being developed by the World Business Council for Sustainable Development and the World Resources Institute (World Resources Institute 1998).

In The Shell Report, the financial, environmental, and safety indicators all have quantitative improvement targets (Figure 2.3). The health, safety, and environmental data are reported using Shell's global "HSE Performance Monitoring and Reporting" guideline, but the Group also consults for external assurance (Shell 2004). As a key element of accountability, the published information has been checked for accuracy and completeness by external, independent parties. KPMG and PricewaterhouseCoopers LLP provide assurance over Shell's social, economic and environmental performance data. In addition, Shell's actual performance is checked by independent experts knowledgeable on specific social and environmental topics.

As an atypical example of corporate social responsibility, the Shell Group published the motivation behind adopting social and environmental responsibility. First, the Group claims that looking beyond compliance is a "huge stimulus to innovation" (Shell 2004). Also, the Group reports that stakeholders are beginning to expect businesses to consider impact on people as well as the planet. With the new consumer

expectations and needs, new markets are created to which Shell can cater. As Shell is adopting cleaner technologies, reducing emissions, recycling, reusing, minimizing waste and even turning waste into saleable products, the efficiency reduces costs and even creates new income streams (Shell 2004). Finally, and perhaps most significantly, Shell states that "Providing products and services built on sustainability thinking create customer loyalty and market share" (Shell 2004).

However, Shell has been accused of greenwashing to cover up its activities that perpetuate environmental destruction. The accusation that Shell does not follow its words with action calls the Group's sustainability literature into question. The Group continues to drill for oil in ecologically sensitive areas, such as Peru's rainforests (Third World Traveler 2003). Furthermore, several accusations have surfaced concerning Shell's human rights violations. Since Shell began drilling in Nigeria's Niger Delta, it intensified the environmental impact in the land of the Ogoni (Essential Action 2003). Shell's activities have caused oil spills on farmland and in water sources, and the people of Ogoniland suffer extreme health problems from the air and water pollution. To protest such actions, the head of Shell Nigeria's environmental oversight team quit in the early 1990s (Essential Action 2003). The environmental irresponsibility by Shell and other oil companies is devastating for the health and traditional ways of life.

Above all, Shell announces, profitability is essential to discharging environmentally responsible activities and staying in business (Shell 2004). This said, Shell claims that the criteria for investment decisions are not exclusively economic in nature but also take into account social and environmental considerations. However, the Group does not reveal how the social and environmental considerations weigh against profit

considerations in the decisions. The literature does not include any reference to a standardized procedure that includes social and environmental impacts into business decisions.

In fact, Shell's literature does not include many structured processes that show its commitment to sustainable development. The Group has a lot of goals and aims, but the literature contains very little content to back up the claims. For example, Shell continues to tout its commitment to renewable energy sources, but the Group spends only 0.6% of its annual investments on renewable energy (Corpwatch). For similar actions, Shell was awarded a Greenwashing Academy Award at the Earth Summit in Johannesburg. Shell won first place in lifetime achievement for its greenwashing campaigns over the past decade (Green 2002). The negativity associated with greenwashing campaigns questions the reliability of the Shell Group's public relations programs.

Conclusion

The evaluations of the six companies demonstrate a variety of environmental management strategies that are used in organizations. Although the six evaluations are juxtaposed in this thesis, it is inappropriate to compare all six companies to each other. Different industries face different challenges – commercially, legislatively, and environmentally. For this reason, three industries are represented within the selection of corporate evaluations, with two competitors evaluated within each industry. Facing similar operative structures, the competitors can be qualitatively compared with the evaluation results. 3M and BASF can be directly compared, GM and Volvo can be evaluated against each other, and BP and Shell can be directly contrasted. The evaluation process will highlight strengths and weaknesses between the competitors, as well as identify trends within the industry.

3M and BASF both produce a wide diversity of products. Additionally, the products have diverse end consumers, as both companies serve industry and individual uses. It is appropriate, and perhaps consequential, that both 3M and BASF have strong standardized procedures to help make product development decisions across the diverse product spectra. 3M uses life-cycle assessments and BASF uses eco-efficiency analyses to evaluate the environmental impact of products on the same basis. In manufacturing stages, 3M and BASF work to minimize environmental impact with extensive pollution prevention initiatives. Both companies have found economic benefit resulting from their pollution prevention programs.

BASF outperforms 3M in its environmental accounting methods, waste management, and supplier relationships. BASF's eco-efficiency analysis incorporates environmental accounting into product development decisions. 3M's life cycle management does not include accounting data in the analysis. Additionally, BASF has designed waste minimization criteria into some production facilities, transporting waste from one facility to be raw materials elsewhere. 3M relies primarily on pollution prevention and waste minimization. Finally, BASF screens suppliers to ensure they minimize pollution and use safety standards that comply with Responsible Care (American Chemistry Council 2000), rejecting the partnership if the supplier's environmental practices are not up to the standards. 3M only ensures compliance with federal and state laws. In an environmental management evaluation, BASF outperforms 3M by including more of the product life cycle in corporate responsibility.

However, both 3M and BASF are weak in product stewardship efforts. Neither company addresses post-purchase consumption of products. Although they can provide

the public with detailed information on the effects of the substances they use, they do not attempt to educate consumers on how to minimize environmental impact during the use and disposal of the products. If these two companies are going to promote sustainability as a business priority, they will need to address the latter stages of their products' life cycles through consumer education and product stewardship.

The automotive industry has different challenges. The industry, as a whole, is facing unprecedented competitive pressure because new car sales are constrained. The markets in the U.S., Europe, and Japan are saturated, so manufacturers are looking to cater to emerging markets in China, South America, Southeast Asia, and Eastern Europe (Automotive News 2004). However, inadequate infrastructure and comparatively low consumer spending restrict new sales in those regions (Frost and Sullivan 2004). Increasingly rigorous legislative standards in the U.S. and the European Union also pose a challenge to automotive companies. California's 2003 zero emissions law and the European Unions emission standards are setting the pace for strict emission regulations.

General Motors and Volvo are confronting limited market demand and the legislative challenges by focusing on fuel efficient vehicles (Figure 2.10 and Figure 2.11). General Motors is developing the industry's first full-size pickups with hybrid electric drive systems (GM 2004). Between 2001 and 2005, GM will introduce a number of other technologies and materials to improve the fuel economy of GM vehicles. Fuel efficiency is also a priority for Volvo designers. The Volvo Group implements energy efficiency in production design, using natural gas to heat production units.

Both General Motors and Volvo are confronting the environmental impacts of end of life vehicles (Figure 2.8). General Motors claims to support extending product

responsibility, a shared approach for end of life vehicles among suppliers, dismantlers, shredders, recyclers and consumers, and participates in existing recycling partnerships (GM 2004). Volvo, however, outperforms GM by designing for the end of the life of the vehicle (Figure 2.9). The Volvo Group has developed guidelines for Designing for Recycling (DfR) to integrate recycling into the design stage (Volvo 2003). Since the Volvo Group interacts with the European Union (EU), the EU take-back programs may push Volvo to consider the end of the life of the vehicle more than General Motors. As a result, Volvo is optimizing dismantling procedures and training dismantling personnel.

Supplier relations are important components of GM and Volvo environmental management systems. Suppliers provide a significant portion of automobile components so it is particularly important that these companies include suppliers in environmental management. Although both companies have environmental performance requirements for suppliers (Figure 2.6), Volvo actually provides training for its suppliers, sharing technical expertise.

Automobiles carry a negative environmental image due to energy requirements and the emissions the vehicles generate. General Motors and Volvo face the challenge of embracing sustainable business practices and convincing critics that automobile companies can make significant changes to the environmental impact of vehicles. Although both companies participate in organizations like the World Business Council for Sustainable Development to promote the environmental image of responsible companies, the automobile industry will always face criticism for negative environmental impacts.

Petrochemical companies most likely receive the most condemnation from environmental critics. The industry is responsible for large-scale environmental impacts from harvesting oil and natural gas. Being process intensive, the petrochemical industry faces unique environmental management challenges. While environmental regulations are becoming ever-more stringent, the pattern of mergers within the petrochemical industry adds further complications to the environmental management challenge (Environmental Software Providers 2003).

BP and Shell are confronting the challenges by focusing on pollution prevention (Figure 2.10). Both companies say they have achieved the goal of reducing to a level 10% below each company's 1990 baseline. BP now aims to maintain net emissions at or below the 2001 levels over the next decade. Shell's future target is to manage greenhouse gas emissions so that they are still 5% or more below the 1990 baseline by 2010. Both companies are looking to eliminate continuous venting of gas and flaring of gas during oil production.

BP and Shell are being challenged to develop profitable renewable energy businesses. BP is focusing on solar and wind energy, while Shell Renewables includes wind, solar, and biomass energy production. As the two energy companies work to make renewable energy economically feasible, both are promoting natural gas as a cleaner alternative fuel because it results in lower carbon dioxide emissions than coal or oil.

The environmental reporting practices of BP and Shell are both thorough and honest (Figure 2.12). The companies report potentially implicating statistics regarding energy use, air and water emissions, waste levels, and oil spills. With websites that provide even more information, the transparency practiced by BP and Shell is

commendable. However, the statistics that are reported over time have shown little, if any, improvement. It may be recommended that both companies shift resources from producing glossy publications reporting consistent environmental impacts to programs that will reduce those environmental impacts.

BP and Shell pay little attention to the post-purchase impacts of their products. Both companies stick to legislative minimum requirements for extraction environmental impact assessments (Figure 2.4). After the products are refined for consumer use and transported to delivery stations, the companies put forth minimal effort to ensure the products are used responsibly. Although BP claims it will begin to promote energy efficiency within society, such a claim is questionable coming from a company that profits from selling energy. To truly embrace environmental sustainability, BP and Shell will have to take responsibility for the use of their products. It may be recommended that the companies begin educating consumers about energy efficiency and pollution prevention. With recent downgrades to oil reserves (BP downgraded 2.5% and Shell cut 20% (Cummins, et al. 2004)) BP and Shell will want to push hard to develop efficient renewable energy sources to compete with other petrochemical companies in the future.

The six evaluations within three different industries demonstrate the utility of the environmental evaluation process. The information revealed by the evaluation may be useful to consumers and investors, as well as the companies themselves. Consumers can use the process to make environmentally sound purchase decisions. Investors may use the information to ensure they are entrusting their money with responsible companies. Companies can conduct the evaluation of their own programs to see how well they are

communicating environmental initiatives and how they are perceived from an external viewpoint.

Overall, the environmental evaluation is a tool that stakeholders can use to exercise their power to influence business practices. The evaluation process provides information to help consumers and investors make informed decisions with their money. Informed decisions can give consumers and investors a lot of power over business strategy.

Leadership

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Management shows public support of the company's environmental commitment.	Management consistently reinforces the environmental commitment through word and deed.	A formal environmental management system is in place.	The environmental management system has met the International Standards Organization 14000 certification criteria.	
	N/A ____	0	1	2	3	4 Score ___

3M	Joseph T. Ling provided foresight for 3M to become a leader in pollution prevention. Current leaders, including DeSimone, Aspengren, Bringer, and Sonstegard sit on the World Business Council for Sustainable Development working group on ecoefficiency. More than 78 percent of 3M manufacturing facilities supplying products for international sales are ISO 14001 certified.	**3.5**
BASF	Values and Principles are part of our target agreements for all senior executives. BASF Corporation, United States, is the first chemical company to be certified according to RC 14001 (a new standard combining Responsible Care and ISO 14001).	**3.5**
GM	GM has been actively involved in several WBCSD projects and is currently the co-chair of the WBCSD Sustainable Mobility project. GM was a founding member of the USCIB in 1945. The company is also active in CERES. GM is currently implementing environmental management systems based on the ISO 14000 standards.	**3.5**
Volvo	As of 2002, 80% of all employees in Volvo production units work in a ISO 14001 certified organization. The EMS may be based on the ISO14001 standard and/or the EMAS regulation.	**3.5**
BP	To date, 96 of 104 major operations within BP have achieved ISO 14001 certification (BP 2003).	**3.5**
Shell	The program to certify major installations to the ISO 14001 standards is virtually complete. The Group must then certify major acquisitions.	**3.0**

Figure 2.1 A comparison of six leadership performance evaluations.

Corporate Culture

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Effective employee suggestion programs are in place allowing employees to share their ideas.	Employees are empowered to implement new ideas to change company standards.	Employees are encouraged to volunteer and continue their education to encourage new ideas.	There are incentives in place for employees to break from routine and implement new ideas for the company.	
	N/A ____	0	1	2	3	4 Score ___

3M	3M expects their employees to arrive with creativity because their cornerstone is innovative technologies. Tuition reimbursement is available and there are several awards for employees to continuously move the company toward sustainability.	**3.5**
BASF	BASF encourages employees to act independently by fostering process and team-oriented forms of work and flexible working time models as well as guided self-study. Personal initiative-based training is promoted and in Germany alone, €105.5 million was invested on training in 2002. BASF provides its employees with a special incentive for creativity and innovative thinking in the form of its annual Innovation Prize.	**3.5**
GM	As GM's global research arm, R&D is where ideas are developed and put into action. "Research is the brainpower of General Motors, and the focus is on innovation." In 1997, GM formed General Motors University (GMU) to help employees continuously improve their performance.	**2.0**
Volvo	Management at Volvo is decentralized so that employees at all levels have input. Participation and involvement from everyone is encouraged. Dialogues and clear objectives, with follow-up and feedback, help create the common focus.	**3.0**
BP	Everyone who works for BP is responsible for getting HSE activities right. The "What We Stand For" policy book is a very general outline of what BP employees should do, including following regulations and ensuring safety. The company has internal continuing education programs, but initiatives appear to be predominantly top-down.	**1.0**
Shell	GameChanger is a program that helps Shell capture, nurture and mature great ideas from anyone until they are ready to be picked up in mainstream technology development activities.	**2.0**

Figure 2.2 A comparison of six corporate culture performance evaluations.

Environmental Accounting

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Environmental risks are considered in risk analysis.	Environmental metrics are in place to account for environmental impact.	Environmental accounting or full cost accounting is used in decision making.	Economic, Social, and Environmental data are used as performance metrics.	
	N/A ____	0	1	2	3	4 Score ___

3M	3M's reports emphasize environmental, social and economic performance - the three elements of sustainability. But the company does not address how decisions are made with environmental, social, and economic data.	**2.0**
BASF	The ecoefficiency analysis include economic and environmental data in decision-making. BASF is working to include social criteria in the analysis. The company has used the process to analyze 110 products, current and new.	**3.5**
GM	Life cycle analyses are used before production to avoid mistakes that may cause environmental liability.	**2.5**
Volvo	A smart set of investment criteria was developed to enhanroorm an environmental viewpoint.	**2.5**
BP	BP developed a health, safety, and environmental plan for projects to assist project teams in aligning HSE activities with the same process used to frame business decisions.	**2.5**
Shell	The Shell Report includes quantitative information about Shell's environmental impact using key performance indicators. The group does not address how the numbers are used in decision-making.	**2.0**

Figure 2.3 A comparison of six environmental accounting performance evaluations.

Design and Prior Assessment

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Management ensures that requirements mandated by regulations are met before new projects are implemented.	A formal system of environmental review is in place to reduce environmental impact from new projects.	Environmental implications of proposed projects are considered in each business unit's strategy formation and budget planning process.	There is a formal system to receive and respond to feedback concerning environmental implications.	
	N/A ____	0	1	2	3	4 Score ___

3M	The life cycle management process is used to identify EHS impacts that can occur during the life stages of the product. Priority is given to products that may use "materials of public interest," meaning they may present potential risks to health or the environment if not properly managed.	**3.5**
BASF	Through regular, comprehensive environmental and safety audits, BASF uses high standards to ensure the efficiency of sites with regard to protecting people and the environment. A risk matrix is used as a strategic instrument to manage local, regional and global activities relating to safety and the environment.	**3.5**
GM	GM uses LCA, a Product Material Review Process, and a Manufacturing Planning Study Process before manufacturing starts. The whole company has set goals, and each plant is required to implement its own EMS within 24 months of operating.	**3.5**
Volvo	Life Cycle Assessments are performed during the design stage in order to identify and improve the environmental impacts.	**3.5**
BP	To make business decisions that integrate financial security with environmental protection, BP has developed the health, safety, and environmental plan for projects.	**2.0**
Shell	Shell works with local and international organizations to ensure that its fuels meet legislative requirements.	**1.0**

Figure 2.4 A comparison of six design and prior assessment performance evaluations.

Raw Materials Selection and Acquisition

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Informal efforts are in place to reduce resource consumption by encouraging efficient use of raw materials.	A formal system is in place to encourage efficient resource use, reuse, and recycling.	Product, process and service designs integrate a commitment to reduce adverse environmental impacts.	Materials decisions are made using life cycle analyses. Materials that create environmental impacts during extraction, use, and/or disposal are avoided.	
	N/A ____	0	1	2	3	4 Score ___

3M	3M uses Design for the Environment to reduce environmental impact before production begins. There is no evidence that the LCM process alters design. The preferred environmental hierarchy is source reduction, reuse, recycling, treatment and safe disposal.	**3.0**
BASF	At BASF, the managers believe that product safety begins with the purchase of raw materials. The company classifies every substance using a safety matrix to make decisions about using the material.	**3.0**
GM	GM uses LCA and a Product Material Review Process before manufacturing to assess potential environmental impact of materials and to compare substitutes. There is no public information showing GM to avoid using a material due to its toxicity. 75% of production wastes are recycled.	**3.5**
Volvo	The total lifetime environmental impact of a Volvo car must be calculated, evaluated and improved as part of the product development process. The E-FMEA, EPS, and MOTIV tools are available to help with the assessment.	**3.5**
BP	The Green Office Program is an initiative to make wise supply choices, use resources and consumables efficiently, and recycle waste. But an oil company will always create environmental impact in harvesting fossil fuels.	**2.0**
Shell	Shell looks for new ways to reduce waste, including turning it into saleable products. Shell Chemicals is experimenting with a partnership to recycle used soft-drink bottles into building materials.	**1.5**

Figure 2.5 A comparison of six raw material selection and acquisition performance evaluations.

Supplier Relations

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Preference is given to suppliers that comply with environment, health, and safety laws, and to suppliers that match the company's environmental policies.	The environmental policies of potential suppliers are screened for consistency with the company's environmental standards.	Selection methods for suppliers are integrated with environmental priorities to align corporate and supplier environmental performance.	Suppliers are provided information regarding effective environmental management and preference is given to those suppliers who adopt effective environmental policies.	
	N/A ___	0	1	2	3	4 Score ___

3M	Product responsibility staff work with suppliers to ameliorate environmental effects, but the "potential supplier checklist" does not mention any environmental requirements beyond compliance with federal and state laws.	**1.0**
BASF	Raw Materials Purchasing employees visit suppliers and perform an environmental and safety assessment to ascertain whether they operate effluent treatment plants to minimize pollution and use safety standards that comply with Responsible Care. According to BASF, as many as half of the suppliers which have been reviewed have been rejected because their environmental practices were not up to standards.	**3.5**
GM	GM announced that by the end of 2002, it would require suppliers to implement environmental management systems (EMS), in conformance with ISO 14001. There is no public evidence of enforcement, but GM is still involved with the Suppliers Partnership for the Environmental Program.	**3.5**
Volvo	Environmental requirements for suppliers were introduced in 1996, and are used as an integral part of the supplier evaluation and follow-up. Environmental training for suppliers is also ongoing, focusing mainly on the implementation of IMDS (International Material Data System).	**4.0**
BP	BP asserts that it can influence positive change by sharing its social, ethical, safety and environmental standards in all its business relationships and it seeks to buy from companies whose policies and practices are aligned with our own.	**1.0**
Shell	Shell "actively promotes [its] Principles with joint venture partners, contractors and suppliers" (Shell 2003).	**0.5**

Figure 2.6 A comparison of six supplier relations performance evaluations.

Environmental Marketing

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	Eco-labels are used to show consumers the environmental features of products.	Publications are made available to provide consumers with reliable environmental information on corporate policy and practices.	Marketing programs address post-purchase product use and maintenance.	The marketing program has met International Standards organization 14020 certification criteria.	
	N/A ____	0	1	2	3	4 Score ___

3M	Consumers can contact 3M through the website and ask specific questions about products. Programs are not available to address post-purchase use. Packaging is designed to minimize materials cost and time of assembly, while increasing reuse and recycling.	**1.5**
BASF	BASF provides information, helps train suppliers' employees, provides advice in designing processes and carries out eco-efficiency analyses. They have trained the marketing and sales personnel to improve their understanding of customers' needs in environment, safety and health.	**2.0**
GM	Eco labels include SBI Seal (Sustainable Business Institute), CERES, and Energy Star. Marketing does not address post-purchase use of automobiles.	**2.0**
Volvo	Volvo is in compliance with the ISO 14020 eco-labeling standards.	**4.0**
BP	BP now recognizes the need to produce and encourage the efficient use of cleaner products. BP also plans to develop and promote natural gas as a preferred fossil fuel source of energy.	**2.0**
Shell	The Shell Report addresses environmental issues and how the Shell Group responds. The Group does not yet address post-purchase use of fuels, but it has plans to market cleaner fuels.	**2.0**

Figure 2.7 A comparison of six environmental marketing performance evaluations.

Product Stewardship

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	The company responds to legal requirements for product and service liability.	The company provides consumers with information regarding the proper use and disposal of products, emphasizing the goal of reducing adverse environmental impacts.	Durability is emphasized in the design process and repair services are widely available to lengthen the life of the product.	Services are in place to ensure proper disposal of potentially hazardous products. Product take-back mechanisms are used to recover valuable product components and properly dispose of waste material.	
	N/A ___	0	1	2	3	4 Score ___

3M	Medical experts monitor scientific and medical developments and offer guidance and education to help 3M and customers understand and manage any risks associated with 3M products. A toxicology lab helps researchers obtain risk-related information on new materials early in the development process as part of Life Cycle Management.	**1.5**
BASF	BASF can provide customers, regulatory authorities and members of the general public with detailed information on the effects of the substances they use. The company looks to use uniformly structured data records worldwide. Product Stewardship Management System (PSMS) is based on best practices that have been followed for many years at BASF as part of Responsible Care.	**2.0**
GM	GM supports a free market approach to End-of-Life Vehicle treatment with extended product responsibility sharing responsibility among suppliers, dismantlers, shredders, recyclers and consumers. GM participates in the USCAR Vehicle Recycling Partnership and the EUCAR partnership in Europe.	**3.5**
Volvo	The company complies with European product take back programs and products are designed with disassembly and recyclability in mind. Consumers are not addressed with disposal issues.	**3.0**
BP	BP is starting to take responsibility for the use of its products and says it will begin to promote energy efficiency within society.	**1.5**
Shell	Shell develops fuel policies to support marketing and health, safety and environmental objectives and they work to ensure that new and existing fuels are fit for purpose and cause no harm. Shell has also stated a commitment to help consumers reduce their emissions, but no programs are in place yet.	**1.0**

Figure 2.8 A comparison of six product stewardship performance evaluations.

Waste Management

Performance Level / Elements	Not Applicable	1	2	3	4	Notes
	The company has no public information available.	The company responds to legal requirements for waste reduction, product content and labeling to ensure proper recycling, reuse, or disposal.	A system is in place to identify major hazards and potential risks from product disposal and barriers to recycling and reuse.	Use of recycled, recyclable and less hazardous material is integrated into business unit product and service design operations.	The company initiates efforts to achieve source reduction, use recyclable products designed for disassembly, and develop protective waste disposal techniques.	
	N/A ____	0	1	2	3	4 Score ___
3M	Waste minimization is 3M's most important strategy for reducing environmental releases. The company says that "opportunities for reducing solid waste are limited by a deteriorating market for recycled raw materials. 3M's future progress may have to rely primarily on pollution prevention, design changes in products and process, and on internal recycling programs."					**2.0**
BASF	BASF aims for efficient production processes to maximize the output of the materials to sell or use for further processing. Production plants are connected through an intricate network of piping that provides an environmentally friendly method of transporting raw materials and energy quickly and safely; by-products from one plant can be used as raw materials elsewhere.					**3.5**
GM	75% of industrial waste was recycled in 2002. GM aims to reduce mass through its design programs. The company also partners with other companies to recycle and take back waste, unfit materials, and discarded materials instead of land filling.					**3.0**
Volvo	Volvo is concerned with optimising the level of recycling. Now, 75% of the material in a car is recycled. The company is optimising dismantling procedures, training dismantling personnel and minimising the quantity of hazardous materials which require special handling.					**3.5**
BP	Although BP strives to minimize the amount of waste materials generated, as a consequence of its operational design, it produces a wide range of wastes. It follows the hierarchy of prevention, reduction, reuse, and then recycling, although recycling efforts are minimal.					**1.5**
Shell	In 2002, Shell disposed of 965,000 tons of waste, of which just under half was classified as hazardous. Waste includes all solids, liquids and sludges that must be incinerated or sent to landfill.					**1.0**

Figure 2.9 A comparison of six waste management performance evaluations.

Pollution Prevention

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	The company responds to legal requirements.	A system is in place to evaluate environmental impacts of product and service use and delivery and initiate design changes to prevent future impacts.	Existing and potential environmental impacts are incorporated into process, product, and service design, planning and implementation.	Products and services are continually evaluated for new opportunities to avoid environmental impact. Life-cycles are considered in the design process.	
	N/A ____	0	1	2	3	4 Score ___

3M	From 1975 to 2002, 3M's Pollution Prevention Pays (3P) program has prevented 857,282 tons of pollutants and saved $894 million. 3P seeks to eliminate pollution at the source through product reformulation, process modification, equipment redesign, and recycling of waste materials.	**3.5**
BASF	BASF sees end-of-pipe technologies are essential for effective environmental protection. Filters or wastewater treatment facilities are installed to prevent pollution from production facilities. The risks associated with production processes are considered before production begins.	**3.0**
GM	GM uses a Manufacturing Planning Study Process to continually evaluate potential environmental impacts of products.	**3.5**
Volvo	Volvo's priorities are fuel efficiency and reduction of emissions. Life-cycles are considered in the design process.	**4.0**
BP	BP aims to maintain net emissions at or below the 2001 levels over the next decade. The company will look to avoid hydrocarbon flaring and venting, and work for greater energy efficiency in operations. BP will also encourage more energy efficiency in society, shift its interests into cleaner fuels, and introduce renewable energy.	**3.0**
Shell	Shell has set commendable targets to reduce its emissions over the next decade. Processes are evaluated to improve emission performance to comply with the corporate goals.	**2.5**

Figure 2.10 A comparison of six pollution prevention performance evaluations.

Energy Efficiency

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	The company responds to legal pressure or market standards for energy efficiency.	A system is in place to identify products and processes that are large energy users and then initiate changes in design considering cost effectiveness.	Opportunities to improve product of process energy efficiency are integrated into relevant business functions. Goals for energy reduction are set and progress is measured.	The company provides leadership in developing energy efficient products and services. The entire life-cycle of the product and service is considered in evaluating energy use.	
	N/A ____	0	1	2	3	4 Score ___

3M	Improvements result from employee programs that increase energy efficiency of existing operations, and new equipment and facilities designed to be energy efficient. They consider energy efficiency in their choices of raw materials, product formulations and manufacturing processes. The company participates in the U.S. Environmental Protection Agency's (EPA) Green Lights Program and is an Energy Star Partner.	**3.0**
BASF	Efficient energy generation at production sites is a central element of sustainable enterprise for BASF. In this way, BASF can achieve cost advantages while conserving resources and protecting the environment. Co-generation is used at the major production facility.	**3.0**
GM	GM has initiated energy efficiency programs such as the Green Lights Program, the Green Power Program, the Energy Star Buildings Program, and 2 EPA partnerships. But all these initiatives concern factories and do not address the energy efficiency of GM's products.	**3.0**
Volvo	Fuel efficiency is a priority of the Volvo environmental strategy. As a result, most Volvo Cars production units are heated by natural gas or liquefied petroleum gas (LPG).	**3.0**
BP	As an energy company, BP doesn't just sell energy, but it also consumes large amounts in exploration and refining. In 2002, BP designed a more comprehensive approach to energy management, and energy efficiency improved in all businesses during 2002.	**2.5**
Shell	Shell used a similar amount of energy in 2002 as it did in the previous two years. In the longer-term, they expect to use more energy to meet expanding global energy demand, but they have energy efficiency projects to evaluate and improve energy use.	**2.0**

Figure 2.11 A comparison of six energy efficiency performance evaluations.

Environmental Reporting

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	An annual sustainability report is published and made public.	The environmental reports adhere to standardized guidelines established by a third party (CERES, PERI)	Environmental metrics are used to report the environmental impacts of business practices.	The environmental reporting process serves as an internal driver for performance.	
	N/A ___	0	1	2	3	4 Score ___

3M	The environmental report is prepared using the Global Reporting Initiative Guidelines. Each business unit sets goals and evaluates performance, but there is no evidence that the report is an internal driver of performance.	**3.0**
BASF	BASF reports the economic, environmental and social aspects of activities in the Annual Report, the Environment, Health & Safety Report and the Social Responsibility Report. The independent verification of the reports ensures the validity of the information. There is no evidence that the report drives performance.	**3.0**
GM	GM's environmental report has been available online since 1996, providing thorough audits of business activity. The reports follow the GRI guidelines.	**3.0**
Volvo	Volvo has published environmental reports since 1990. From March 2002 the company has included summarized environmental and social information in the Annual report.	**3.0**
BP	BP tracks and communicates its environmental progress using its own Environmental Reporting Guidelines, externally verified by Ernst & Young. The website is more comprehensive than the environmental report.	**2.5**
Shell	The Shell Group is a charter member of the Global Reporting Initiative (GRI) and is supporting the effort to create common guidelines for environmental reporting.	**3.0**

Figure 2.12 A comparison of six environmental reporting performance evaluations.

General Environmental Strategy

Performance Level	Not Applicable	1	2	3	4	Notes
Elements	The company has no public information available.	The company has a policy of regulatory compliance. The primary goal of environmental management is to achieve compliance with health, safety, and environmental requirements mandated by law.	Formal environmental management systems are in place to facilitate the company's efforts to reach beyond regulatory compliance, to meet more comprehensive corporate policies. Environmental investment opportunities are considered on a cost and benefit basis.	The company has formal systems to integrate environmental management concerns into management functions on a regular basis. Environmental information and concerns are included in all relevant business planning functions.	Integrated environmental management systems are applied to operations globally and are continually evaluated for improvement opportunities. The full life-cycle of products, operations and services is considered, including direct and indirect environmental impacts.	
N/A ____	0	1	2	3	4	Score ___

3M	EHS Management System is integrated throughout the company. Each business unit must develop action plans and measure results. Life-Cycle Management process is required for new products, but it is qualitative instead of quantitative. The management system could improve by including retrospective LCA of existing products.	**3.5**
BASF	BASF has introduced a global Compliance Program in connection with its Values and Principles. The Chief Compliance Officer is in charge of a continuous advancement of the Compliance Program and of coordinating the network of the regional compliance coordinators. Life cycle analyses are not used.	**3.0**
GM	Worldwide, GM is integrating its environmental management systems, based on ISO 14001 specifications. These systems include GM's Environmental Performance Criteria (EPC) which assist business units in protecting human health and the environment beyond compliance. LCAs are used for products.	**3.5**
Volvo	The Volvo Group has a single environmental policy, common to all parts of the Group. This policy is the basis for environmental management systems, strategies and objectives, audits and activities. LCAs are used, but only for products.	**3.5**
BP	A BP Environmental Management System has been developed to frame the HSE expectations. Each business unit will have documented systems in place to meet the corporate HSE expectations.	**3.0**
Shell	The Shell companies have a systematic approach to health, safety, and environmental (HSE) management to achieve continuous improvement. The companies set targets for performance, and measure and report performance.	**2.0**

Figure 2.13 A comparison of six environmental strategy performance evaluations.

Company	Cumulative Evaluation Score
3M	34.5
BASF	40.0
GM	40.0
Volvo	44.0
BP	28.0
Shell	23.5

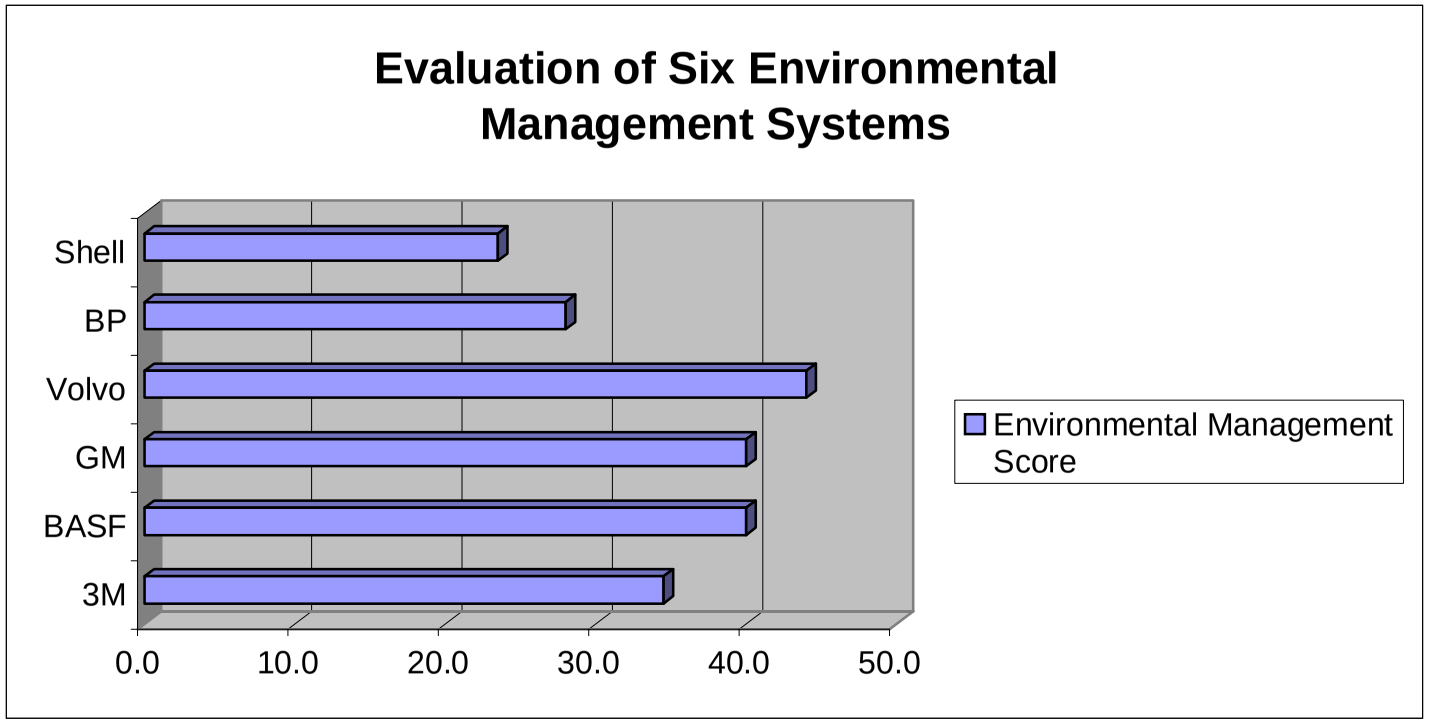

Figure 2.14 **A comparison of six environmental management system performance evaluations.**

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BIOGRAPHICAL SKETCH

The thesis serves to complete my graduate education at the University of Florida. I followed my undergraduate studies in environmental science with a Master of Science in interdisciplinary ecology. Concurrently, I pursued a Master of Science in management degree to learn the essentials of business operations and ideology.

My research in the interdisciplinary ecology program focused on creating course material for a class on industrial ecology and corporate environmental strategy. I am interested in the role that industrial ecology can play in the implementation of sustainable business practices. The most challenging aspect of my educational track has been the dichotomy between my two graduate degrees. There are few opportunities to integrate my business program projects with my ecology schoolwork. Yet my career goals include working to harmonize the two areas in order to create environmental solutions.