

AC 2008-1108: ECO-FRIENDLY BUSINESS PRACTICES CAN CREATE OPPORTUNITIES FOR INNOVATION

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Eco-Friendly Business Practices Can Create Opportunities For Innovation

Abstract

Global warming, along with other ecological concerns have made environmental health a national and global issue in every industry. The social, governmental and economic pressures have created the need for companies to develop eco-friendly business practices while maintaining efficiency. For decades, scientists and environmental groups have been warning industry, consumers and governmental leaders about the drastic effects of pollution and the depletion of natural resources. However, only recently have companies begun to recognize the opportunities created when implementing strategies to address environmental concerns.

Traditionally, business leaders regarded the environment and natural resources as unlimited factors of production that were readily available at little or no cost. Today, the concerns about pollution and the need for the efficient use of resources are forcing companies throughout the world to reevaluate their operations in order to become more ecologically conscious while remaining competitive.

Fortunately, due to creative problem-solving and a greater understanding of eco-friendly business practices, companies are discovering that they can satisfy environmental concerns, while simultaneously cutting energy costs, boosting productivity and promoting innovation. The recognition of eco-friendly business practices as win-win opportunities are encouraging more companies to undertake these initiatives. Conversely, those organizations that aren't eco-friendly and fail to address ecological concerns will forgo the opportunities for positive change and suffer financially in the long run.

As future environmental managers and industry leaders, engineering and technology students need to understand the benefits of eco-friendly business practices. Consequently, it is important for their academic programs to provide students with an understanding of environmental health and related concerns.

This paper will describe how companies can use eco-friendly business practices as opportunities to promote innovation. The paper will identify the benefits to business organizations and the environment when eco-friendly business practices are implemented.

Introduction

In today's complex and competitive global economy, it is important for leaders to be trained to view every situation as an opportunity to engage in creative problem-solving. This will help to minimize the negative effects of problems and allow for the implementations of changes to prevent future concerns¹. Furthermore, a creative problem-solving approach encourages leaders to recognize and take advantage of the opportunities presented with each situation². Rather than simply reacting to problems as they occur, effective leaders can learn to be proactive and identify opportunities for innovation.

Viewing Environmental Issues As Opportunities

A major challenge confronting business and governmental leaders throughout the international community involves environmental issues related to pollution, global warming and the depletion of natural resources. The recent Nobel Peace Prize awarded to former Vice President Al Gore highlights the seriousness of pollution, and the need to protect the environment. Although scientists and environmental groups have been warning about the harmful effects of pollution for years, there has been reluctance on the part of businesses to become eco-friendly. Fortunately, creative leaders are discovering that eco-friendly business practices can create mutual benefits by satisfying environmental concerns, while simultaneously boosting productivity and promoting innovation³. To underscore the above, the paper provides case studies on how environmental concerns can be viewed as opportunities. Additionally, the authors illustrate how case study discussions can be used to help students understand the opportunities created when implementing eco-friendly business practices.

The Creative Problem Solving Process

Creative thinking is often described as a process that involves phases of convergent and divergent thinking⁴. For the purposes of this paper, the two creativity phases that are especially significant when trying to recognize opportunities for innovation are problem definition and idea generation.

Problem definition- The first step in creative problem solving requires that the problem be accurately defined and understood. The creative problem solver believes that every problem presents danger and opportunities. To deal with the first part of problem definition, the danger part, the problem solver needs to collect and analyze relevant information and data about the problem. During the information collection and analysis phase, the problem solver can identify the causes or reasons which created the situation and the negative consequences that will result if the problem is not properly solved.

The second part of problem definition involves identifying trends and opportunities associated with the problem. The creative problem solver needs to engage in holistic thinking and focus on the context of the problem to identify opportunities for positive change and innovation.

Idea Generation- Once the problem is accurately defined, the problem solver can engage in idea generation, where a “quantity” of ideas are brainstormed while deferring judgment about the practicality of those ideas. The ideas generated should include unusual and unorthodox ideas to facilitate the opportunities for innovation that are presented by the situation.

Guidelines For Recognizing Opportunities When Solving Problems

To recognize and capitalize on opportunities presented by a given situation, problem solvers need to be future-oriented and follow certain guidelines. To identify opportunities when defining the problem and generating ideas, the problem solver needs to take the following guidelines into consideration⁴:

Challenge the Status Quo: Opportunities for innovation are increased when the status quo is challenged, even if existing policies, procedures and operations are working well. Creative problem solvers need to avoid complacency by asking questions, taking risks and challenging the status quo. To avoid complacency and obsolescence, “if it’s not broke- improve it” should be the motto used in every organization.

Identify Several Solutions: When solving problems, the creative problem solver should look beyond the obvious solutions and instead, focus on identifying the best solution. By identifying several solutions for a given problem, the problem solver can compare solutions and identify the best solution.

Seek Opportunities in Problem: Creative problem solvers believe that with every problem there are opportunities. By anticipating and planning where the organization should be in the future, leaders can avoid complacency and make the best choices when solving a problem. There is a difference between being open to opportunities and actively hunting for opportunities. Being “open” to opportunities often implies inaction and the tendency to passively wait for opportunities to present themselves. Being a “hunter” for opportunities involves actively searching and pursuing opportunities. By being future oriented, problem solvers can become hunters for opportunities.

Welcome Strange Ideas: Most people are naturally resistant to change or anything new. People tend to prefer the status quo due to its certainty and predictability. Creativity requires that the problem solvers consciously overcome the habitual resistance to new ideas and different ways to do things. To defer negative judgments and overcome resistance to new ideas, problem solvers need to identify the benefits and positive or interesting aspects of new ideas.

The following procedure can help to recognize opportunities and overcome the habitual negative reactions to a new idea:

- (1) First, identify at least 5 current positive aspects about the idea. Establishing a minimum quota of positive aspects about an idea tends to promote innovation.
- (2) Next, identify at least 5 potential future benefits of the ideas if the idea was to be implemented.
- (3) The third step involves identifying concerns about the idea that need to be overcome in order to implement the idea.
- (4) Finally, the problem solver needs to brainstorm ideas to overcome the identified concerns.

Play and Fun: Stress tends to interfere with the creative process. On the other hand, play and fun facilitate creative thinking. Fun ideas can lead to innovative organizational success. The benefits of play and fun include; being uninhibited and less concerned with rules, willingness to engage in risk taking, promotes the use imagination, learning what works and doesn’t work without the fear of penalties, and facilitating the development of creative thinking skills.

Believing in Self: Everyone has creative potential and can learn how to develop that potential. However, to facilitate creative thinking, problem solvers need to believe in themselves and their ideas. Problem solvers need to develop a positive mindset when defining problems and

generating ideas. Conversely, a negative mindset can stifle creative problem solving and the recognition of opportunities.

Simulate Possibilities: Imagination is an essential part of creative thinking. Simulating possibilities, being future oriented and asking questions can help to stimulate the imagination. When dealing with situations, creative problem solvers make a habit of asking “what if” questions. Also, creativity requires that real world constraints be temporarily relaxed, such as; “if money was not an issue or failure could not occur,” how would behavior be impacted? Incubation or taking a “time out” is a way to use the subconscious mind to stimulate the imagination when dealing with problems.

Develop Mental Toughness: Being a risk taker and pursuing new ideas requires mental or psychological toughness in order to overcome rejection, criticism, and self-doubt. Creativity requires the persistence to do what is necessary to turn ideas into reality.

Organizational Benefits Of Pursuing Opportunities

There are major benefits that can be realized from identifying and pursuing the opportunities associated with any problem. Pursuing opportunities connected with perceived problems often promote long term and positive synergetic effects for the organization. Table 1 lists some of the benefits associated with creative problem solving when dealing with environmental concerns⁵.

Table 1: Benefits of creative problem solving when dealing with environmental concerns

- | |
|---|
| <ul style="list-style-type: none">• Correct the current situation• Prevent future related situations from occurring• Create awareness of environmental concerns• Creates awareness of the economic benefits of a situation• Recognition of opportunities for innovation• Increased productivity resulting from new innovations• Fewer future environmental lawsuits• Reduction and mitigation of costs associated with environmental accidents• Fewer company and governmental accident investigations• Fewer future environmental regulations by the government |
|---|

Environmental Case Studies

The ability of business leaders to turn environmental concerns into business related opportunities is well documented with businesses in various industries. Real world applications of the creative problem solving process identified in this paper are presented below. Additionally, the authors illustrate how case study discussions are used to help students understand the opportunities created when implementing eco-friendly business practices.

Identifying the opportunities created when solving various problems is a major learning component of OLS 350, “Applied Creativity in Business and Industry”. In that course, the author frequently teaches creativity using case studies and examples involving current concerns. During

the last two years, environmental issues, including the implementation of eco-friendly business practices, were a topic of discussion.

Below are two examples of the environmental case studies used during the Fall 2007 semester in OLS 350. In these case studies, the students discussed how these companies successfully capitalized on the opportunities created while addressing environmental concerns^{4, 10}.

Incidentally, the problem solving case studies were one assessment tool the author used to evaluate the course because they involved contemporary, relevant, and real-life problems.

1) Ford Motor Company: Ford Motor Company has initiated a number of eco-friendly practices which have created innovation and financial benefits. The company has been able to reduce its energy consumption and emissions through strategies that include both common sense (switching out the light bulbs) and novel (using wind turbines to power its Dagenham Diesel Centre in Britain). As a result, since 2000, Ford has reduced its global operational energy use by 27% and its carbon dioxide emission by 31%. While in the U.S., the company has saved enough energy to supply 220,000 homes.

Using newly developed technology, called Fumes-to-Fuel, Ford has taken one of the automobile plant's principal energy users, the vehicle paint shop, and redesigned it so that emissions are converted into electricity that help to power the plant. The technology promotes ecological and efficiency needs by reducing CO2 emissions and saving money, since paint fumes no longer have to be collected and incinerated, an expensive process.

Another example of Ford's eco-friendly initiatives that have created innovation and economic benefits, the company is using seat foam made from soy-based material in the 2008 Ford Mustang. That means reduced CO2 emissions compared with petroleum-based materials.

A potentially lucrative and eco-friendly new product category for Ford is the development of plug-in-hybrid electric vehicles (PHEVs). Because electricity is cheaper than gasoline, PHEVs allow for a reduction in fuel costs because batteries can be recharged by plugging the car into an electrical power source, rather than by charging off a combustion engine⁵.

2) Waste Management Corporation: Waste Management Corporation, the leading provider of comprehensive waste and environmental services in North America own tens of thousands of acres of property. Waste Management Corporate began certifying its landfills with the Wildlife Habitat Council to develop habitat management programs on company sites to provide food, land and shelter to wildlife¹⁰.

The benefits of this innovative program have engaged and energized Waste Management Corporation's employees and the communities where the company operates. Employees and people of the local communities come on weekend to work on site programs for various activities such as clearing nature trails, conducting species inventories, and photographing animals. In addition to promoting wildlife and the environment, the company's program has also facilitated employee and community goodwill⁶.

Another example of Waste Management Corporation's ability to recognize and capitalize on opportunities includes its use of providing gas to industry from the company's landfills. The company operates the largest network of landfills in the U.S. Instead of simply flaring or burning the methane gas from landfills, the gas is directed to industrial use for fuel turbine-driven electricity generators⁷.

Waste Management has been using single-stream recycling technology, where all recyclable material can be put into a single bin. With the single-stream process, the recyclable material is placed on a conveyor belt and an assortment of screening and sorting technologies separate the various types of recyclables.

Single-stream recycling has resulted in an increase in recycling rates of up to 30%. The volume of material processed in single-stream facilities has more than doubled in four years. Also, the return on single-stream recycling is expected to be about the same as its return on solid waste⁵.

Other Eco-Friendly Companies:

1) Wal-Mart Stores: Wal-Mart Stores has realized that eco-friendliness is not only good for the environment, but it's good for business. Consumers are using their purchasing power to demand that suppliers provide products that require less energy, in both their manufacture and their use. Consumers are also requiring that products be manufactured from renewable sources that are more environmentally friendly.

Recognizing the concerns of consumers, Wal-Mart is partnering with the Carbon Disclosure Project to measure the amount of energy used and carbon emitted through the supply chain of certain product categories, including milk and DVDs. Wal-Mart will use this information to encourage suppliers to find new ways to be more energy-efficient and show their customers that the products they buy are produced in responsible and sustainable ways⁵.

2) Airbus: Airbus has recognized the benefits of its business practices. Airbus's eco-friendly strategy has become an integral part of its business, including product design, manufacturing, operations and aircraft recycling.

Airbus innovation involves the dismantling of jets by using techniques to raise the level of recyclables and reusable content. Through "Process for Advanced Management of End-of-Life Aircraft" (PAMELA), Airbus is developing innovative and environmentally responsible solutions for decommissioning and dismantling aircraft. PAMELA is expected to demonstrate that up to 95% of an aircraft can be recovered and kept out of landfills⁵.

3) Autodesk: Autodesk, the world leader for 2D and 3D design software, has developed a new generation of computer-aided design or CAD software. This software allows architects and engineers to see how changes to lighting, heating and power systems would impact the energy use of buildings.

Autodesk has developed a process known as "Building Information Modeling" or BIM, which has been incorporated into its Revit platform of software solutions. Revit allows architects and

engineers to incorporate data into their computer-based designs in order to see how using different heating or air-conditioning systems impacts energy use and greenhouse gas emissions⁵.

4) Xerox Corporation: Xerox Corporation has a lengthy history of promoting environmental responsibility and innovation. The company has discovered that by developing technologies to benefit the environment it can also reap competitive benefits. For example, the company has been able to engineer environmental friendly products by enabling customers to dispose of them in an efficient and eco-friendly manner. The company has incorporated a dual purpose approach by demonstrating that waste prevention and management are not only good for the environment but for the company.

Xerox products are designed and built around a modular product architecture which allows for the reuse of its products and reduction of waste. This design process allows for a reduction in the amount of raw materials and energy needed to manufacture brand new parts and at the same time, enables the company to realize financial and environmental benefits.

Each year, customers return millions of ink and toner cartridges, with Xerox picking up the postage. Consequently, billions of pounds of waste are diverted from landfills through the company's return, reuse and recycle programs⁶.

5) Subaru Automotive: Subaru Automotive Corporation has realized the environmental and financial benefits of designing innovative cars that are more fuel efficient and emit fewer emissions. At Subaru, the company's waste management program has become its waste elimination program. In 2004 the Lafayette, Indiana Subaru plant became the first automotive plant in the U.S. to attain "zero-landfill" status by not putting anything into a landfill.

Also, the company's line of partial zero emission vehicles (PZEVs) has demonstrated its commitment to the environment by designing fuel efficient automobiles⁶.

6) Toray Corporation: chemical company, Toray, uses innovation to build prosperity and solve global environmental problems through its environmental technological advances. By being visionary and engaging in holistic thinking the company has translated environmental concerns into products.

For example, Toray has developed carbon fiber reinforced plastics (CFRP) for airplanes. CFRP makes the aircraft lighter; lighter aircraft burn less fuel; less fuel used means fewer greenhouse gas emissions. Also, CFRP allows for a greater freedom of design which has contributed to passenger comfort. For example, the cockpit windows and portholes have been enlarged and the interior humidity can be better controlled.

Also, the manufacturing of automobiles can be made from CFRP and engineering plastics. CFRP has been used to improve fuel economy to counter rising oil prices and mounting environmental concerns⁸.

7) Ricoh Corporation: Ricoh Corporation, an office equipment maker, promotes user and environmental friendliness in its production processes. For example, the company has boasted

environmental efficiency and cuts costs by introducing innovative reforms, including a “zero-waste-to-landfill” policy. Also, at company cafeterias, rice is served in small, medium and large bowls to minimize the amount of food that gets thrown away, thus reducing costs and promoting environmental concerns⁹.

Other examples of companies that are expecting to realize economic results by developing innovative eco-friendly operations include⁵:

DuPont: DuPont Corporation has realized that being eco-friendly create financial benefits. For example, from 2000-2004, DuPont was able to reduce its greenhouse emissions by 72% and avoided costs of over \$3 billion by holding its energy use to 6% below 1990 levels while production increased. Also, DuPont attributes over 5 billion of its 27 billion in revenues to the sales of sustainable products.

IBM: IBM is exploring the economic benefits of eco-friendly business practices. In March 2007, IBM created a new business unit, Big Green Innovation, to help the company initiate waste management, alternative energy options and eco-friendly operations.

GE Energy Financial Services: GE Energy Financial Services is promoting eco-friendly operations to promote innovation and operational efficiency. For example, in May 2007 the company announced that it will double its investments in wind, solar, biomass, and geothermal energy by 2010.

Assessment: Case Studies and Discussions

The authors used several assessment tools to evaluate the case studies and discussions. To assess the case study discussions, the authors developed a list of questions to solicit student feedback. Table 2 lists selected questions for student feedback on those discussions. The average rating on student feedback for the case study discussions in OLS 350 for the Fall 2007 semester was 4.74.

Table 2: Selected questions used to provide student feedback on the case study discussions in OLS 350 (Fall 2007)

Rating Scale: 1 (Strongly Disagree) - 5 (Strongly Agree)
<ul style="list-style-type: none">• This was an effective class assignment for learning about environmental concerns• I clearly understood the goals for this assignment• The class considered my contributions to the case study discussions• I felt free to express my opinions and make a contribution to the discussions• The environmental case studies allowed for balanced discussions on the various issues identified• I was satisfied with this assignment

Table 3 lists the student learning outcomes resulting from the environmental case studies for OLS 350 in the Fall semester of 2007.

Table 3: Student learning outcomes resulting from the environmental case studies in OLS 350 (Fall 2007)

Student Learning Outcomes From Environmental Case Studies
(1) Understand that eco-friendly business practices can satisfy environment concerns while simultaneously boosting organizational productivity
(2) Awareness that most problems contain both danger and opportunities
(3) Awareness of the philosophy, “if it’s not broke- improve it”
(4) Understand that for any given problem there are multiple solutions
(5) Awareness that being open to opportunities is not the same as actively hunting for opportunities
(6) Recognize how play and fun can facilitate creative thinking
(7) Understand that creativity is not a personal characteristic that only a select few possess
(8) Awareness that “what if” questions can be used to stimulate the imagination
(9) Understand that eco-friendly business practices can satisfy environment concerns while simultaneously promoting innovation

Pre and Post Test

Before discussing environmental concerns and to assess learning, students were given a pretest before beginning the topic and posttest after discussing the case studies. The questions asked on both test were the same and reflect a sample of the various creative thinking and environmental issues covered in the case study discussions. Table 4 lists the results from last semester’s environmental pretest and posttest, and Table 5 lists selected questions asked on the pretest and posttest. Incidentally, the results from last semester’s pretest and posttest were consistent with those of previous semesters.

Table 4: Results from the environmental pretest and posttest for OLS 350 (Fall 2007)

Pretest:	Posttest:
Number of students: 20	Number of students: 18
Average Percent of Correct Answers: 52.5%	Average Percent of Correct Answers: 78%

Table 5: Selected questions asked on the environmental pretest and posttest for OLS 350 (Fall 2007)

True/False Questions
(1) Eco-friendly business practices can satisfy environment concerns while simultaneously boosting organizational productivity
(2) Most problems contain both danger and opportunities
(3) Creative problem solvers believe in the philosophy, “if it’s not broke- don’t fix it”
(4) Creative people believe that for any given problem there is one solution

- (5) Being open to opportunities is the same as actively hunting for opportunities
- (6) Play and fun should not be a part of creative thinking
- (7) Creativity is a personal characteristic that only a select few possess
- (8) “What if” questions are an effective way to stimulate the imagination
- (9) Most people tend to have positive reactions to new ideas
- (10) Eco-friendly business practices can satisfy environment concerns while simultaneously promoting innovation

Course Assessment

Continuous improvement is the nomenclature used in academia and industry for the process of evaluation and improvement. Each semester, several assessment tools are used to evaluate the relevance and effectiveness of OLS 350, including the environmental case studies. Listed below are some of the assessment tools frequently used to evaluate OLS 350.

Course Evaluations

The effectiveness of the creative thinking education provided in OLS 350 is evaluated using student evaluations which consist of between 16-20 questions about the course. Table 6 lists the average ratings from student evaluations for 2006- 2007 and Table 7 lists selected questions asked on student evaluations.

Table 6: Average rating from student evaluations for OLS 350 (2006-2007)

Rating Scale: (5) Strongly Agree, (4) Agree, (3) Undecided, (2) Disagree, (1) Strongly Disagree.				
Year:	2006	2006	2007	2007
Semester:	Spring	Fall	Spring	Fall
Students:	16	22	23	18
Avg. Rating:	4.78	4.70	4.76	4.79

Table 7: Selected questions asked on student evaluations for OLS 350

No.	Questions
4	Assignments are clearly explained
38	Conceptual understanding is emphasized
68	I feel free to express & explain my views in class
70	I feel free to ask questions in class
81	The course has clearly stated objectives
88	Lecture information is highly relevant to the course objectives
92	I can apply the information/skills learned in this course
117	Exams stress important points of the lecture/text/assignments
C03	Assignments are relevant, interesting and well-integrated

C04 The course has stimulated my thinking C07 Overall, I feel I have learned a great deal in this course

Conclusion

The continual pressure of governmental and environmental leaders is forcing companies to become eco-friendly. Therefore, companies in every industry are reevaluating their operations in order to become more ecologically conscious while remaining competitive. In the paper, the authors have identified examples of businesses that have successfully recognized and capitalized on opportunities created when implementing strategies to address environmental concerns. The creative problem-solving process will allow companies to discover that they can satisfy environmental concerns, while promoting efficiency and innovation. Additionally, the authors illustrate how case study discussions are used to help students understand the opportunities created when implementing eco-friendly business practices

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