# A Case Study of How DuPont Reduced Its Environment Footprint: The Role of Organizational Change in Sustainability

By Scot Holliday

B.A., 1996, Boston University
M.A., 2004, The George Washington University

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David R. Schwandt
Professor of Human and Organizational Learning

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Scot Holliday

Dissertation Research Committee

David R. Schwandt, Professor of Human and Organizational Learning, Dissertation Director

Mark Starik, Professor of Strategic Management and Policy, Committee Member

Susan Swayze, Assistant Professor of Education, Committee Member

## DEDICATION

To my wife, Metri,
for your compassion,
understanding, tireless support,
and always abundant love,
and to our new son, Alex

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## ABSTRACT

A Case Study of How DuPont Reduced Its Environment Footprint:
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This dissertation examines the actions, decisions, interactions, and operations undertaken by DuPont from 1989 to 2008 that enabled it to transform into a sustainable organization. Specifically, this dissertation examines the role of organizational change in sustainability exhibited by DuPont during its change process. The researcher in this single case study uses novel theoretical lenses in order to gain insight into the role of organizational change in sustainability, including sustainability theory, organizational change theory, and organizational diagnosis theory. From 1990 to 2008, E.I. du Pont de Nemours and Company (DuPont) reduced its greenhouse gas emissions by 72% and changed its product composition from 100% chemical based to 70% chemical based (and 30% biological matter based).

Two major findings of this research study were determining some of the conditions in which business strategy and sustainability support one another and the criticality of social responsibility. Once DuPont was able to embed sustainability into its business strategy, sustainability became an integrated part of its operations, products, and services. The data from this study support the conclusion that environmental footprint reduction supports social responsibility. Thus, when designing a strategy for organizational change for sustainability, one needs to first consider the needs of the people affected (e.g., customers, employees, and other stakeholder) and second the inherent role of, and impact on, the environment.

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# CHAPTER 1: INTRODUCTION

*It appears to be an environmental footprint story, but the real transformation going on in DuPont has to do with the societal value of the products and services.*

*~ #1242, personal communication, April 24, 2009*

## Overview

Population growth, rising energy costs, and global warming are megatrends affecting today's organizations (Friedman, 2008; IPCC, 2007; Population Reference Bureau, 2009). These megatrends are interrelated and compound one another. Population growth leads to an increase in energy consumption and energy cost, according to the principle of supply and demand. In 2009, the world population was 6.8 billion people and by 2050 the world population is estimated to increase to 9.4 billion people (Population Reference Bureau, 2009). As the consumption of natural resources increases, the amount of greenhouse gas (GHG) emissions released into the atmosphere also increases. In turn, this increase in GHG emissions worsens the problem of global warming. Global GHG emissions due to human activities have grown since preindustrial times, with an increase of 70% between 1970 and 2004 (IPCC, 2007). The largest growth in GHG emissions during this period has come from energy production, transport, and industry (IPCC, 2007).

The Intergovernmental Panel on Climate Change (2004) identified five keys areas that may be impacted adversely by global warming: ecosystems, water resources, human health, settlements and society, and food security. Because of the complexity of global warming, many world leaders and organizations have previously ignored the phenomenon and failed to take action to alleviate it. Ninety-nine percent of the world's

top 10,000 scientists agree that global warming is a real phenomenon requiring immediate global action (IPCC, 2007). Yet, not enough action is being taken to yield a substantial solution. Unless sufficient action is taken by governments, for-profit organizations, not-for-profit organizations, communities, households, and individuals, global warming will gradually destroy life around the planet. For-profit organizations must have a financial incentive to reduce global warming—that is, the GHG-reducing approaches need to maintain or increase financial profits (UNEP, 2006). Firms may absorb short-term profit losses to increase sustainable practices, but such losses may be recovered in the long term through increased efficiency (i.e., better use of resources) and more positive customer opinion (Willard, 2002).

Creating new business strategies that are both profitable and in harmony with the natural environment can be difficult (Ghoshal, 2005; Hall & Vredenburg, 2003). Organizational change toward sustainability requires organizations to innovate their systems (Bertalanffy, 1955; Morgan, 1996; Schwandt & Szabla, 2007), structures (Giddens, 1984), and processes (Wheatley, 1992). Due to the difficulty in innovating for sustainability, many organizations do not innovate voluntarily. Hoffman (2001, 2007) argues that many organizations leading the way are not just taking action voluntarily; rather, the market forces organizations to react to environmental issues. Forty years ago, emissions from a smokestack may have been a sign of progress, but today they are a sign that cleaner technologies are needed (Hoffman, 2001).

According to Hall and Vredenberg (2003), most managers do not know how to enhance their organization's environmental footprint while increasing profit (Elkington, 1997; Savitz & Weber, 2006). As a result, a growing trend in M.B.A. and other graduate

programs is to offer a concentration or emphasis on sustainability (AOM, 2008; BGP, 2008; Sharma, Starik, & Husted, 2007; Wustenhagen, Hamanschmidt, Sharma, & Starik, 2008). Managers need new mental frameworks and strategies to reduce their organization's environmental footprint, thereby helping to reduce global warming, and one way scholars can contribute to this need is by studying how successful organizations simultaneously reduce their environmental footprint and increase profits.

For this study, the researcher examined how E.I. du Pont de Nemours and Company (DuPont) transformed itself to reduce its GHG emissions and create more bio-based products while simultaneously increasing its profitability. The researcher initially considered the timeframe of 1960 to 2008. However, after the researcher gathered and analyzed the data for this study, the timeframe was narrowed from 1989 to 2008.

In the 1970s through the 1980s, DuPont was one of the largest contributors to global warming because of its world leadership in producing chemicals such as chlorofluorocarbons (CFCs) (Hoffman, 2007a; Kinnane, 2002). CFCs were shown to contribute to global warming by collecting in the ozone layer of the earth's atmosphere (IPCC, 2007). The increase in density of the ozone layer trapped more radiation of the sun in the earth's atmosphere, contributing to global warming (IPCC, 2007). From 1990 to 2008, DuPont reduced its GHG emissions worldwide by 72% (DuPont, 2008b; Esty & Winston, 2006; Hoffman, 2007a). DuPont also changed its product line from 100% chemical based to 70% chemical based (and 30% biological matter based). In 2007, DuPont created a 10-year plan to further reduce its GHG emissions an additional 70% (DuPont, 2008b; Hoffman, 2007a).

Because DuPont is a leading organization at reducing its environmental footprint, studying how DuPont achieved its sustainability transformation goals may provide lessons for other organizations that wish to do the same (Dunphy, Griffiths, & Benn, 2007; Epstein, 2008; Esty & Winston, 2006; Hoffman, 2007a; Senge, Smith, Kruschwitz, Laur, & Schley, 2008).

**Statement of the Problem**

Little empirical research is available to managers explaining how organizations can be transformed to reduce their environmental footprint while increasing their profitability (Dunphy et al., 2007; Esty & Winston, 2006; Vaccaro, 2007). Managers' strategies and decisions within organizations are based mostly upon the financial bottom line, with little regard for the natural environment. Now that organizations will have to cope with the impact of population growth, rising energy costs, and global warming, it is both financially and socially important to consider the natural environment in all aspects of business. Customers are now more concerned with the negative effects of depleting fossil fuels, harmful chemicals, and high energy costs (Esty & Winston, 2006). In Europe and in some ways globally, a carbon credit trading market is developing (Hoffman, 2007a). When an organization goes beyond government compliance for environmental standards, carbon credits can be sold for a profit. As the carbon credit trading market increases, a reduced environmental footprint becomes a fungible economic asset. A greater understanding of organizational change as it relates to environmental footprint reduction is needed to help equip managers in developing, implementing, and following through in enacting organizational transformation.

Einstein posited that new problems often cannot be solved with old solutions (Schwandt & Marquardt, 2000). The problems presented by global warming (one of the greatest challenges to organizations in modern time in regard to preserving the natural environment) require organizations to transform in fundamental ways to adapt to these new challenges. This study sought to apply an innovative theoretical lens to examine how organizational sustainability can be achieved. By examining sustainability principles, the phases of change experienced by organizations during organization-wide transformation toward sustainability, and the ways in which social systems may need to be restructured during this adaptation, a greater understanding of an effective organizational change methodology will be gained.

**Purpose**

The purpose of this research study is to understand the organizational change processes that DuPont experienced in order to incorporate natural environmental values into its business strategy while simultaneously increasing its profit margin (Hoffman, 2007a; Holliday, 2001; Holliday, Schmeidheiny, & Watts, 2002). One goal of studying how DuPont succeeded in this transformation is to understand the underlying dynamics, interactions, and principles of change at the organizational level when an organization is in the process of reducing its environmental footprint.

**Research Questions**

The research questions are divided into two categories: primary research question and supporting research questions. The primary research question is the overarching research question. The supporting research questions bring the primary research question to a lower level of abstraction (Hatch, 1997), so that components of the primary research

question may be analyzed. There are three areas of supporting research questions: sustainability principles, stages of change, and restructuring social interactions.

*Primary Research Question:* What actions, decisions, interactions, and operations did DuPont undertake to incorporate natural environmental values into its business strategy, while simultaneously increasing its profit margin from the 1989 to 2008?

*Supporting Research Questions:*

(Area 1) Sustainability Principles

1. What principles guided DuPont in reducing its environmental footprint?
2. How did DuPont's business strategy influence its approach to sustainability?
3. What indicators did DuPont and its stakeholders use to measure DuPont's improvement at reducing its environmental footprint, and what was measured?
4. What role did senior management and the corporate board serve in DuPont's transformation?
5. What role did employees play in DuPont's transformation?
6. What methods were used to communicate with employees?

(Area 2) Stages of Change

7. What stages of organizational change did DuPont progress through in developing its current approach toward organizational sustainability?
8. What resistance to change did DuPont have to overcome internally, and how was it overcome?

9. What resistance to change did DuPont have to overcome externally, and how was it overcome?
10. What key external events influenced DuPont's decision to reduce its environmental footprint, and how did each event shape DuPont?

(Area 3) Restructuring Social Interactions

11. How have other organizations influenced DuPont in its path toward developing and executing sustainability strategies?
12. In what ways does restructuring the social interactions within an organization maximize the use of existing resources and knowledge?
13. Do organizations require isomorphism across organizational levels to achieve sustainability?
14. How did DuPont's organizational structure change to support its focus on sustainability?

**Foreshadowed Problems, Conjectures, or Exploratory Questions**

Several potential problems could have arisen during this study, including DuPont's distrust of the researcher, the researcher's failure to ask the right questions, saturation, difficultly in making sense of the data, and researcher bias. These potential problems could have been a threat to trustworthiness (Ridenour & Newman, 2008). Chapter 3 explains the strategy for how these foreshadowed problems were controlled and their potential impact on trustworthiness.

**Gaps Between Research, Theory, and Practice**

The gaps between the research and theory, theory and practice, and practice and research literatures indicate areas that are yet to be explored and understood. In some

ways practice is ahead of theory, and in other ways theory is ahead of practice. In terms of sustainability, the research is generally lagging behind both theory and practice.

*Between Research and Theory*

Theory indicates there are many benefits to sustainable development initiatives, while research has verified only some of those benefits. For example, Hall and Vredenburg (2004b) assert that sustainability initiatives contribute to innovation, but research verifying that statement is still forthcoming. However, in terms of the economic benefits of sustainability, research is beginning to fill that gap (Christmann, 2000a; Hoffman, 2007a; Sharma et al., 2007).

In addition, theory is applied in multiple sectors and multiple industries (Hoffman, 2001, 2007a), while research is often focused on one sector or industry. Most of the impacts of climate change affect all sectors and industries (IPCC, 2007). Solutions that can be applied to multiple stakeholders are needed. More empirical research is this area may provide solutions.

*Between Theory and Practice*

In many ways the practice of sustainability is ahead of theory. Hoffman (2001) indicates that a middle ground is needed between research and theory, so that the two can inform each other. He also found a lack of research applying organizational science to understanding how organizations can reduce their environmental footprint. Elkington (1997, 2001) is both a theorist and practitioner in the area of sustainability. He started one of the most successful consulting firms in the area of sustainable development called SustainAbility, with offices in both Europe and the United States (SustainAbility, 2008). His work integrates theory and practice. His theory is not grounded in the literature in the

field of sustainability, although it is cutting edge in terms of relating the benefits to methods that achieve organizational sustainability. In 1997, Elkington explained the seven blindspots of business that sustainability could help organizations to see: (1) the business value of sustainability, (2) criticality of social and environmental aspects of business, (3) sustainability issues are unavoidable, (4) responsibility goes beyond the factory fence, (5) alliances can breed competitive advantage [2+2=50], (6) balancing short and long term market needs, and (7) complexity [7 dimensional world]. This contribution was a result of the coaching and consulting he did as a practitioner. As he works with his clients, many of whom are Fortune 500 Chief Executive Officers (CEOs), he puts his ideas into writing, which informs the field of sustainability as to what works in the field (Elkington, 2001; Elkington & Hartigan, 2008). He provides plausible explanations for business problems using sustainability-based solutions.

Hart (2005) and Hart and Christensen (2002) describe how companies have innovated at the bottom of the pyramid (BOP). The BOP refers to the 4 billion people in the world in the bottom 20th percentile of income, living off less than $2 a day (Prahalad, 2006). Poverty in the BOP can be eradicated partly by selling low-cost products to this group, which would help the group develop economically (Prahalad, 2006). For example, Hart and Christenson (2002) describe how Honda in the 1980s built a durable, low-cost motorcycle targeting middle- to low-income groups, and this motorcycle earned more market share than many of the flashier competitors. This innovation helped middle- to low-income individuals to purchase transportation vehicles, while using less raw materials and fossil fuels than competitors. Analyzing the dynamics behind this practice helps to inform theory.

In some ways, theory oversimplifies the difficult process of innovating in terms of sustainability. Oversimplifying a difficult process such as sustainable organizational innovation for the purpose of generalization may cause organizations to fail in the first attempts at innovation toward sustainability. As a result, the affected organization may not try again to reduce their environmental footprint beyond what is legally required. For instance, Nattras and Altomare (1999) simplify some of the models for sustainability. This simplification informs organizations, but may stall progress by leading to misconceptions. Thorngate (1976) postulated that theory can only be general, accurate, or simple. More theory that is accurate and specific is needed. In specific ways theory can be applied to multiple industries is needed to guide the practice of sustainability, so that more of its complexity may be understood. One way to do this is by conducting more case studies on how organizations innovate in terms of sustainability. Then success and failures can be benchmarked for best practices, leapfrogging (Pachauri & Batra, 2001), and mistakes to avoid.

*Between Practice and Research*

One of the gaps between practice and research is that research showing the economic benefits of sustainability is often industry specific and lacks generalizability to other industries (Christmann, 2000a). This may make some types of organizations reluctant to be the first ones to innovate toward sustainability, because they fear negative economic impacts or a loss in competitive advantage due to increasing transparency. Diamond (2005) asserts that the issues facing the petroleum, coal, fishing, and forestry industries all have the same environmental linchpin controlling their long-term success. In all four industries, Diamond (2005) asserts that depleting a resource (causing great

environmental damage) may reap some short-term economic benefits, although in the long term, conservation is more economically sustainable.

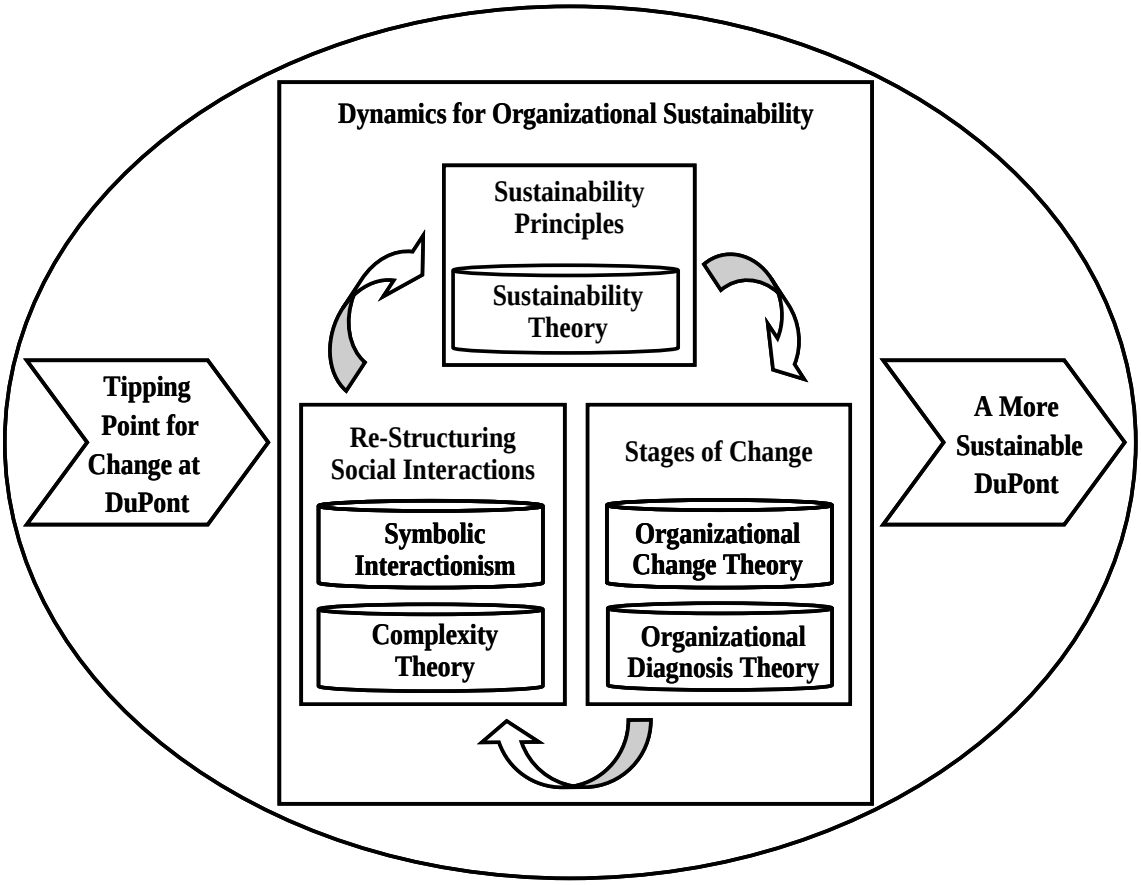
## Conceptual Framework

The conceptual framework for this study (see Figure 1 on the following page) was based on the literature described in Chapter 2. Miles and Huberman (1994) define a conceptual framework as, "Either graphically or in a narrative form, the main things to be studied—the key factors, constructs or variables—and the presumed relationship among them" (p. 18). The conceptual framework both informs the basis for the research in this study and provides a basis for interpreting the findings in the discussion section that will conclude this dissertation. The intent of this study is to contribute to the bodies of literature related to each of the constructs and theoretical lenses depicted within this conceptual framework. The specific elements of this study's conceptual framework are as follows.

### *Tipping Point for Change at DuPont*

Gladwell (2000) describes a tipping point as a moment of critical mass that, once it occurs, inevitably leads to transformation. In 1989, DuPont was being protested by Greenpeace, whose activists were urging DuPont to improve its treatment of the natural environment (Murphy & Dee, 1992). This protest may have served as a tipping point toward adopting sustainability at DuPont. Later that same year, DuPont began its public journey to change its systems, structures, and processes to go above and beyond the required levels of GHG emissions regulations and drastically reduce its environmental footprint. DuPont has always gone beyond compliance with environmental regulations (DuPont, 2008b; Holliday, 2001; Kinnane, 2002). In 1989, a new change was occurring

**Figure 1. Conceptual Framework: Change Process for Organizational Stability**




at DuPont, a change toward sustainability, where DuPont would soon become a leading organization at reducing its environmental footprint.

*Dynamics for Organizational Sustainability*

This element of the framework includes sustainability principles, stages of change, and restructuring social interactions—the main constructs for this research study. Each construct has a theoretical lense associated with it. A theoretical lense provides the theoretical basis for examining each construct (Burrell & Morgan, 1979). Each theoretical lense reflects a certain world view with its own assumptions and interpretations of the object being analyzed (Maturana, 1988; Varela, Thompson, &

Rosch, 1991). The theoretical lenses are not exclusive to each construct. However, each theoretical lense closely associates with its designated construct.

The construct of sustainability, or "Sustainability Principles," was examined using sustainability theory. Sustainability is both a set of values and an organizational strategy focusing on reducing the impact to the environment, survival, aligning the organizational mission to contribute to society, and social responsibility (Brundtland Commission, 1987; Carroll, 1999; Filho, 2000).

"Stages of Change" relates to organizational change theory and organizational diagnosis theory. Organizational change is the intentional or unintentional change to an organization's systems, structures, or processes (French & Bell, 1990; Sutton & Straw, 1995; Weick, 1995). A system is a set of elements standing in interaction (Bertalanffy, 1955; Schwandt & Szabla, 2007). Organizations consist of several interrelated subsystems, including (but not limited to) strategic, human, technological, structural, and managerial subsystems (Morgan, 1996). Structures include organizational or societal principles and rules that operate systems and processes, organizational frameworks, and physical structures (e.g., buildings) (Giddens, 1984).. A typical representation of an organizational structure is an organizational chart (Hatch, 1997). A process is a sequence of interrelated tasks or a sequence of changes (Wheatley, 1992) (e.g., a communication process). Organizational diagnosis draws on concepts, models, and methods to examine an organization's current state and assists in determining ways to solve problems or enhance organizational effectiveness (Harrison & Shirom, 1999).

"Restructuring Social Interactions" is the process of changing how people construct their acts by interpreting and defining the acts of each other, and that

interpretation directs social action (Blumer, 1969; Mead, 1934). The researcher in this study examined social interaction using symbolic interactionism (Blumer, 1969) and complexity theory (Hazy, Goldstein, & Lichtenstein, 2007; Morgan, 1996). Symbolic interactionism is a way of exploring how human beings interact and what determines their social action (Blumer, 1969). Complexity is a science that examines the way complex adaptive systems (CASs) function, develop, and interrelate to other systems (Hazy, Goldstein, & Lichtenstein, 2007; Morgan, 1996).

Based on these constructs, theoretical lenses, and need for research, the primary and supporting research questions were determined. It is the intent of the researcher that new insight into how organizational change can inform organizational sustainability will be gleaned by interpreting the findings at the conclusion of this research study using these concepts.

### *A More Sustainable DuPont*

This element was the goal for DuPont when it began its transformation in 1989. Yet sustainability is not only the goal, but also a daily practice that an organization must engage in. In this sense, sustainability is more of a journey than a goal (as with many human values, where the means and ends are the same).

## Summary of the Methodology

This study sought to explore how organizations can reduce their environmental footprint and increase or maintain their profitability at the same time. To study this phenomenon, case study is an appropriate method of inquiry. Merriam (1998) indicates that case study is an appropriate method of inquiry when an in-depth understanding of a

phenomenon is being undertaken. What makes case study unique is its focus on a single unit or bounded system (Merriam, 1998).

A single case study was chosen for the research in this dissertation study. Yin (2002) indicates that a single case study is appropriate when it is confirming, challenging, or extending theory. This study is extending theory to increase the understanding of the role of organizational change in organizational sustainability. Currently, the practice of organizational sustainability is moving faster than theory or models for organizational sustainability (Dunphy et al., 2007; Schwandt & Marquardt, 2000). More critical examination that establishes theory for why and how organizational sustainability can occur is needed (Sharma et al., 2007; Wustenhagen et al., 2008).

The data-gathering methods for this case study included document review, archival record review, secondary research and literature review, interview, and observation. Interview was the main data-gathering method, because the researcher did not believe a sufficient amount of data would be found in written documentation to fully answer my research questions. After the data gathering was completed, this assumption was confirmed. The researcher assumed that the organization studied (DuPont) kept its development of strategic direction closely held. The researcher sought to inductively create a process-based model explaining how DuPont was able to incorporate sustainability into its business strategy through interview. There were a few gaps in DuPont's organizational change for sustainability experience identified during data gathering and data analysis, such as the role of government regulation (e.g., the Montreal Protocol) and the dates when Greenpeace protested DuPont in the mid- to late 1980s. To

fill in these gaps, secondary research sources along with their citations were included in Chapter 4.

**Limitations**

Because this study is a case study of one organization, the results may only be applicable to organizations in similar industries and size, operating in similar regions and cultures to those of DuPont. The interviews were mainly retrospective, looking at DuPont's sustainability principles, stages of change, and restructuring of social interactions. This may have affected the trustworthiness of some of the statements of the participants in the interviews. This research site was chosen due to it being a good example of an organization that engaged in organizational change toward sustainability. Another reason why this organization was chosen was due to the fact that the researcher had social connections to DuPont through his father. The researcher is the son of the recently retired CEO and Chairman, Chad Holliday. Emotion and prior knowledge of DuPont may have affected the judgment of the researcher and was controlled as much as possible through the research methodology (see Chapter 3 for an account of the controls used to account for possible researcher bias).

**Delimitations**

Due to both limited time and limited access to employees at DuPont, the researcher purposely interviewed current or former senior executives or managers when selecting organizational interview participants. Three controls to help reduce potential negative effects of this delimitation were used: archival record and document review, interview of three stakeholder organizations, and observation of at four of DuPont's strategic planning meetings and stakeholder engagement events.

The researcher initially considered the timeframe of 1960 to 2008. However, after the researcher gathered and analyzed the data for this study, the timeframe was narrowed from 1989 to 2008. 1989 was chosen as the start date for the time range of this research study due to this year being when the tipping point for sustainability was most noticeable. 2008 was chosen as the end date due to 2008 being the year this research study was initiated.

## Definition of Key Terms

This section describes the key terms used in this dissertation (see Table 1). For each term, an operational definition and citation are provided. These terms are used in different ways depending on the field of science being used as a basis. The operational definitions applied in this study are grounded in the fields of organizational science, human resource development, sociology, ecology, complexity science, and management science.

**Table 1. Definition of Key Terms**

| Term | Definition | Source |
|---|---|---|
| Complexity | A science that examines the way complex adaptive systems (CASs) function, develop, and interrelate to other systems. | (Hazy, Goldstein, & Lichtenstein, 2007; Morgan, 1996) |
| Corporate Social Responsibility (CSR) | The responsibility of organizations that goes beyond economic and legal issues to include concerns of the broader social system. | (Carroll, 1979) |
| Environment | The context in which an organization operates. This context has changing and unchanging properties. Organizations affect and are affected by their environment. The environment is composed of natural aspects (e.g., water, plants) and nonnatural aspects (e.g., stock market). | (Emery & Trist, 1965; Parsons & Shils, 1952) |

| Term | Definition | Source |
|---|---|---|
| Environmental Footprint | The sum impact of an individual, organization, community, or society on the natural environment. This includes the sum impact of greenhouse gas (GHG) emissions, resource usage, generative actions, and other, similar considerations. | (Brundtland Commission, 1987; Wackernagel & Rees, 1962) |
| Framework | A set of principles, models, or process that provide direction or insight. | (French & Bell, 1990; Sutton & Straw, 1995; Weick, 1995) |
| Model | A simplified representation. | (Huff, 1990) |
| Natural Environment | Living species and systems of species on the planet, upon which all living organisms are an interdependent part of. | (Capra, 1996) |
| Organizational Change | Intentional or unintentional change to an organization's systems, structures, or processes. | (French & Bell, 1990; Sutton & Straw, 1995; Weick, 1995) |
| Organizational Diagnosis | The process of using concepts, models, and methods to examine an organization's current state and assist in determining ways to solve problems or enhance organizational effectiveness. | (Harrison & Shirom, 1999) |
| Process | A sequence of interrelated tasks or a sequence of changes. | (Wheatley, 1992) |
| Social Interaction | A process in which people construct their acts by interpreting and defining the acts of each other, and this interpretation directs social action. | (Blumer, 1969; Mead, 1934) |
| Stakeholder | Any individual or organization that affects or is affected by an organization. | (Freeman, 1984) |
| Strategy | A pattern of behavior over time that sets direction, focuses effort, defines the organization, and provides consistency. | (Mintzberg, Ahlstrand, & Lampel, 1998) |
| Structure | Organizational or societal principles and rules that operate systems and processes, organizational frameworks, and physical structures (e.g., buildings). | (Giddens, 1984) |

| Term | Definition | Source |
|---|---|---|
| Sustainability | The process in which humanity "meets the needs of the present without compromising the ability of future generations to meet their own need" (p. 8). This implies that every individual, organization, government, and society reduce its environmental footprint and consider others when charting their own success. We are interdependent with each other and with natural environmental systems. | (Brundtland Commission, 1987) |
| Symbolic Interactionism | A way of exploring how human beings interact and what determines their social action. Three premises of symbolic interaction are as follows: "1) Human beings act toward things on the basis of the meaning that the things have for them<br>2) That the meaning of such things is derived from, or arises out of, the social interaction that one has with one's fellows<br>3) That these meanings are handled in, and modified through, an interpretative process used by the person in dealing with the thing he/she encounters" (p. 2). | (Blumer, 1969) |
| System | A set of elements standing in interaction. Organizations consist of several interrelated subsystems, including (but not limited to) strategic, human, technological, structural, and managerial subsystems. | (Bertalanffy, 1955; Morgan, 1996; Schwandt & Szabla, 2007) |
| Theory | A plausible explanation of an event or phenomenon. | (Weick, 1995) |
| Tipping Point | A moment of critical mass that, once it occurs, leads inevitably to a transformation. | (Gladwell, 2000) |

# CHAPTER 2: LITERATURE REVIEW

This chapter provides background and theoretical underpinning for each facet of the conceptual framework. The sections of this chapter are organized according to the major constructs within the conceptual framework: sustainability principles, stages of change, and restructuring social interaction.

## Sustainability Principles

### *Sustainability Theory*

Weick (1995a) asserts that theory is often an approximation and that the higher the certainty of the approximation, the closer the theory will be to the truth. The theory of sustainability is an approximation. As stated previously, sustainability may be best defined as the process of ensuring that humanity "meets the needs of the present without compromising the ability of future generations to meet their own need" (Brundtland Commission, 1987, p. 8). This implies that individuals, organizations, governments, and societies must reduce their environmental footprint and consider others when charting their own success. We are interdependent with each other and with natural environmental systems (Capra, 1996, 2002).

Sustainability also implies durability or survivability (Filho, 2000). Since the beginning of life on the planet, sustainability has been an important issue. All organisms are biologically driven to forward their species and continue the evolution and continuation of life (Wackernagel & Rees, 1962). Human societies, with their ability to engineer technologies and accelerate growth, are now challenging organisms to learn to survive in new types of ecosystems that are coevolving with industrial ones (Ehrenfield, 2004; McKelvey, 2002). This has led to various movements to promote and embody

human and organizational development that is sustainable in a way that can support both ecological and industrial systems. Sustainability is one name that has been given to this movement.

Sustainability is a highly misunderstood concept. It is as broad in its meaning and application as it is paradoxical (Filho, 2000). At first impression, sustainability might seem negative, possibly referring to simply continuing to increase the speed of global development and the depletion of the world's natural resources (Elkington, 1997). The term actually refers to a movement to preserve the earth's resources and create more social, economic, and environmental balance (Brundtland Commission, 1987). This movement relates to all of life and thus can be multilevel, multisectoral (Starik & Rands, 1995) and be based on various intentions and/or different desired outcomes. The movement can be described as *teleological* in that it moves toward an intention or goal (Maturana, 1978). Sustainability is part of some corporations' values, is a benchmark of the United Nations' policy, and is engaged in by individuals, institutions, and many organizations (Bendell, 2000; Epstein, 2008; Holliday et al., 2002).

*Development of the Concept of Sustainability*

The term *sustainability*, also known as *sustainable development*, first appeared in literature in 1987 in the book, *Our Common Future: The World Commission on Environment and Development*, written by the Brundtland Commission. In 1987 a meeting was convened among many of the world's Western leaders to come up with some solutions to global development problems. A particular area of concern was the increase of environmental problems. At this time, the term *sustainability* was coined and defined as "ensuring that humanity meets the needs of the present without compromising

the ability of future generations to meet their own needs" (Brundtland Commission, 1987, p. 8).

In 1992 and 2002, larger forums on global environmental policy and related issues—called the Earth Summits—were held. The Earth Summits worked to foster global cooperation for sustainability. The plans and strategies initiated during these summits are carried out by the United Nations, individual countries, organizations, and business associations. One example of an organization that was formed as part of one of the Earth Summits is the World Business Council for Sustainable Development (WBCSD). As of 2008, the WBCSD consisted of over 200 member organizations, which are mostly Fortune 200 companies (WBCSD, 2007; 2008). The WBCSD formed a coalition with the Earth Summits and has a mission to incorporate sustainable development values into the global business community.

Though some efforts were made to increase awareness of sustainable development in the for-profit sectors, it was not until the early 2000s that awareness levels significantly increased. In a qualitative study of CEOs in fossil fuel industries in Canada, Hay (1996) found that industry leaders had little to no awareness of sustainable development or related issues. Shortly after that time, in an indirectly related paper, Hart (1997) outlined a few strategies for companies to lessen their environmental impact with his landmark article, "Strategies for a Sustainable World." This article was one of the five most highly requested *Harvard Business Review* articles of all time (up to 2009), indicating that interest in sustainability was higher among for-profit (business) organizations. This increase in interest triggered the need for new words and language to allow for new types of thinking (Robichaud, Giroux, & Taylor, 2004).

Bendell (2000) introduced the term *civil society* to refer to the work of nongovernment organizations (NGOs) or partnerships between various sectors (e.g., for-profit, not-for-profit, and government) for the purpose of improving society in terms of social, environmental, and economic impacts (2000b). These broad categories are inclusive of all aspects of society, such as water issues, education, healthcare, and development-related issues.

In a study of 88 chemical companies, Christmann (2000b) found that integrating environmental policy into best practices enhances competitive advantage. One limitation is that in nonchemical industries, the results may not be the same. Diamond (2005) asserts that the industries involving timber, fishing, coal, and petroleum all face the same core issues: conservation of resources, preventing and controlling environmental pollution (because cleanup costs more than prevention), and the need to increase their ability to see problems before they occur (i.e., foresight and proaction [Mintzberg et al., 1998; Varela, 1999]). Although Diamond (2005) does not consider sustainability a competitive advantage for particular industries, he considers it a survival strategy for organizations and society as a whole.

Elkington (2001) further argues that the for-profit sector (business leaders in particular) can lead the sustainability revolution. He bases his argument on the idea that CEOs have the greatest capability and power to create change, and that citizen CEOs are a mechanism for organizational change toward sustainability in corporations. Holliday et al. (2002) present 67 case studies of corporations, examining how they implement sustainability into their organizations. The organizations studied by Holliday et al. (2002)

attempted to change industry standards, whereas Elkington (2001) focuses on changing the way individual leaders think.

Sharma and Starik (2002, 2004) have published two books focused on research in the areas of corporate social responsibility, stakeholder issues, and sustainability. Their work consists of contributions from the Academy of Management's (AOM's) interest group Organizations and the Natural Environment (ONE) members' research. They suggest strategies and present research on sustainability in various areas. ONE is a division of the AOM and is dedicated to the advancement of research, teaching, and service in the area of relationships between organizations and the natural environment (AOM, 2008).

In 2003, Hall and Vredenburg asserted that managers do not have the capability to understand sustainable development based on their lack of training in sustainability in business schools. Sustainability requires managers to learn how to innovate in new ways. As part of the argument, Hall and Vredenburg (2003) coined the term *Sustainable Development Innovation*, referring to the idea that knowledge innovation is inclusive of the triple-bottom line—economic, social, and environmental values (Elkington, 1997).

*Sustainability Constructs*

Sustainability is a complex issue affecting business, education, health, government, ecosystems, and all areas of life. Depending on the level of analysis or category of sustainability, the concept of sustainability has a different connotation, meaning, and application. This study seeks to understand how organizational change can enable sustainability within organizations. This section describes various constructs within the field of sustainability. The constructs presented in this section will be applied

as needed to interpret the findings of this study. Several constructs are described below, but those most closely related to this study are corporate social responsibility (CSR), collaboration, corporate greening, thought innovation, and stakeholder engagement.

*Corporate Social Responsibility*: CSR is the responsibility of organizations that goes beyond economic and legal issues to include concerns of the broader social system (e.g., development, public safety, poverty alleviation, and education) (Carroll, 1979). Often CSR is perceived as philanthropy directed from an affluent organization to a less affluent organization or community, rather than an ongoing supportive relationship between an organization and another organization, community, or society as a whole (Austin, 2000).

*Collaboration*: Collaboration is where two or more individuals or organizations work together on a task, venture, or challenge (Austin, 2000; Carroll, 1979). The degree of openness, length of effort, and degree to which resources are shared all determine the magnitude of the collaborative effort (Austin, 2000).

*Industrial Ecology:* This is a field derived from ecology examining the relationship between natural and industrial systems (Ehrenfield, 2004). For organizations to successfully reduce their environmental footprint, a harmony must be reached between an organization and its environment.

*Corporate Greening*: Hart (1997) states that corporations normally consider greening in terms of risk reduction, reengineering, or cost cutting. For organizations to go beyond the typical approach of corporate greening, greening must become part of the core business strategy (Gilding, Hogarth, & Reed, 2002; Hart, 1997).

*Thought Innovation:* Rogers (1962) defines innovation as "an idea, practice, or object that is perceived as new by an individual or other unit of adoption" (p. 12). Rogers says that this newness does not need to be solely in terms of knowledge, but that it can also be in terms of persuasion, or a decision to adopt a new strategy, idea, or policy. Hall and Vredenburg (2003) related innovation to sustainable development issues, such as stakeholder engagement, by coining the phrase s*ustainable development innovation*. Hall and Vredenburg (2003) describe sustainable development innovation as the competencies that individuals or organizations apply to "manage complex and often ambiguous, context specific variables" (p. 136).

Often business innovation is focused on the product (Hamel, 2000), but Hamel (2000) asserts that focusing on the product leads to blindspots. Hamel believes that organizations must engage in the innovation of business concepts (knowledge) and avoid focusing exclusively on product innovation. A misconception is created by focusing only on the product and not seeing the thought structures and processes behind the innovation strategy. Hamel (2000) terms that fallacy "myopic thinking"—that is, failing to see the processes and structures of innovation.

*Understanding Ambiguity:* Understanding ambiguity is a competency that enables an organization to identify the appropriate stakeholders with whom to align themselves (Hall & Vredenburg, 2004b). Hall and Vredenburg (2004) indicate there is a need for ambiguity capabilities to understand the benefits and risks both tacit and explicit in stakeholder relationships. Within this competency is a need for learning the differences among risk, ambiguity, and uncertainty factors that are particular to an organization's position (Hall & Vredenburg, 2004b). A risk is a situation where both the variables and

probabilities of causing harm are known. With uncertainty, the variables are known, but the probabilities are unknown. With ambiguity, neither the variables nor the probabilities can be identified or estimated. A stakeholder can assist an organization in reducing ambiguity to better assess uncertainty and risk, which will reduce costs associated with recovering from failures or disasters.

*Seeing Knowledge Gaps:* There is a close relationship between capabilities and knowledge. Sveiby (1997) defines knowledge as "a capacity to act" (p. 37). The definitions of the terms *capability*, *capacity*, and *competency* overlap and are often incorrectly used interchangeably. When an organization experiences a gap in its knowledge or capability, there is often a need to fill that gap. Leonard-Barton (1995) states that a capability gap occurs when strategic knowledge or expertise is not available within the organization. When this occurs, there is a need for that organization to either develop the needed competencies within that organization, seek the expertise outside the organization, or both.

*Moving from the Triple-Bottom Line to the Single-Bottom Line:* The *triple-bottom line* is a term coined by Elkington (1997) referring to companies' reduction of negative impacts—and increase of positive impacts—on the environment, society, and economics. Hall and Vredenburg (2003) point out that managers typically do not have the training it takes to deal with triple-bottom line issues, and that in M.B.A. programs typically the only bottom line is the economic one. Specialized competencies need to be learned by organizations to move their core values closer toward the triple-bottom line.

Gilding, Hogarth, and Reed (2002) popularized the concept of the single-bottom line of sustainability, describing sustainability as being part of an organization's business

strategy. This is counter to the triple-bottom line because it asserts that sustainability is a core and integral part of business, rather than something that is additional to an organization's business strategy. An organization that adheres to the single-bottom line must have sustainability as the core of its business strategy, processes, and structures.

*Stakeholder Issues:* Stakeholder theory is now an accepted term as part of the lexicon of management theory and strategy (Walsh, 2005). Yet, practicing stakeholder engagement is still a marginal activity in the for-profit sector (Austin, 2000; Brinkerhoff, 2002; Holliday, 2004). Most of the innovation that takes place in for-profit companies only benefits the wealthiest nations, not the other four-fifths of the world's population. Hart (2005) and Hart and Christensen (2002) call this trend *destructive innovation*. One of the ways this type of destructive innovation is harmful is the creation of more robotic or machine automation in the place of human labor, so people whose jobs involve manual labor are no longer needed (Hart, 2005). This practice is common in manufacturing plants. The effect is that less-skilled laborers have a more difficult time finding a job.

When business engage stakeholders, such as governments, community groups, nongovernment organizations, customers, schools, and other organizations, new possible business opportunities that benefit the business and the surrounding stakeholders can be realized, capitalized upon, and learned from (Hart, 2005). The literature on stakeholder theory lacks two major things: (1) studies that prove the positive economic returns of stakeholder engagement and (2) robust explanations of what competencies are needed at the organizational level to actively engage with stakeholders (Freeman, 1984; McWilliams & Siegel, 2001; Sharma, 2002; Sharma & Starik, 2004a).

*Awareness:* Elkington (1997) identified seven blindspots that managers have in the workplace that could be better seen with an understanding of sustainability: markets, values, transparency, life-cycle technology, partnerships, time, and corporate governance. Six years later, Hall and Vredenburg (2003) indicated that managers are not prepared in M.B.A. programs to innovate for sustainability-related issues and that sustainable innovation must be learned in order to engage in sustainable development innovation. In more recent years, from 2004 to 2008, sustainability education has increased because of the greater demand within organizations for cost savings and a reduction in environmental footprint (Blackburn, 2007; Dunphy et al., 2007; Merriam, Caffarella, & Baumgartner, 2007; Sharma et al., 2007; Wustenhagen et al., 2008).

*Capitalism:* Research is still gaining consensus as to whether increasing sustainability awareness and developing sustainability-related competencies yield greater economic returns. Freeman (1984), McWillams and Siegel (2001), and Hart (2005) indicate that increased research is needed to better understand the economic benefits of sustainability. One of the difficulties of implementing sustainability initiatives is that company leaders have a fiduciary responsibility to make profits for the shareholders (Diamond, 2005). Conducting more research in the area of economic benefits may help sell the idea to more organizations.

### *Implications of Sustainability*

Sustainability is a new term, but has been practiced since the beginning of time, or else no society would have ever survived (Diamond, 2005). The challenge that exists today is whether the existing resources can be conserved and shared between and among nations with the increase of interaction between ecological and industrial systems. The

increase in capitalism and increase in depletion of natural resources has spurred interest in sustainability issues in corporations, in governments, among individuals, and in many types of organizations.

Global meetings in 1987, 1992, and 2002 have been part of the stage for the conversation among individuals, organizations, and nations on sustainability-related issues. In the late 1990s, the relationship between sustainability and the economic bottom line found its way into the literature on sustainability (Elkington, 1997; Hawken, Lovins, & Lovins, 1999). Since 2000, more of the benefits of sustainability, such as innovation, have been examined (Hall & Vredenburg, 2003, 2004a; Hart, 2005) and are becoming part of organizational strategy for competitive advantage (Christmann, 2000b; Sharma & Starik, 2002, 2004b).

For sustainability to become a greater part of organizational culture, sustainability must be taught in universities, colleges, and other educational institutions as part of organization, management, and business strategy (Filho, 2002; Hall & Vredenburg, 2003). A greater shift toward sustainability requires a shift in organizational strategy from the triple-bottom line of sustainable development to the new single-bottom line that has sustainability at its core (Ghoshal, 2005; Hall & Vredenburg, 2003). Because of the increased demand for sustainability, leading universities are beginning to incorporate ecology into their M.B.A. programs (BGP, 2008). For the shift in sustainability to occur in organizations, organizations must reevaluate and innovate the assumptions of their organizational strategy, goals, and practices. With the threats facing organizations in 2008—including climate change, economic recession, population increase, and shifting markets—organizational sustainability is no longer a luxury or just philanthropy, but it is

an imperative for survival (Friedman, 2008). For additional descriptions of foundational literature related to sustainability, see Appendix A.

## Stages of Change

Stages of change relate to organizational change theory and organizational diagnosis theory. Organizational change is intentional or unintentional change to an organization's systems, structures, or processes (French & Bell, 1990; Sutton & Straw, 1995; Weick, 1995). A system is a set of elements standing in interaction (Bertalanffy, 1955; Schwandt & Szabla, 2007). Organizations consist of several interrelated subsystems, including (but not limited to) strategic, human, technological, structural, and managerial subsystems (Morgan, 1996). Structures include organizational or societal principles and rules that operate systems and processes, organizational frameworks, and physical structures (e.g., buildings) (Giddens, 1984). A typical representation of an organizational structure is an organizational chart (Hatch, 1997). A process is a sequence of interrelated tasks or a sequence of changes, such as a communication process (Wheatley, 1992). Organizational diagnosis uses concepts, models, and methods to examine an organization's current state and assists in determining ways to solve problems or enhance organizational effectiveness (Harrison & Shirom, 1999).

### *Organizational Change Theory*

Organizational change is the theory, practice, and phenomena within organizations relating to change within organizations. This change can be transformational (changing the values, norms, and strategic direction of an organization) or functional (changing the operating procedures, processes, policies, or other organizational standards). The field of organizational change began developing within

postindustrial society, when interest in process improvement became popular (Hatch, 1997). Organizational change can be framed in many ways. It can be related to management, leadership, organizational learning, organizational diagnosis, process improvement, and other areas (French & Bell, 1990). Organizational change often seems to occur in sporadic revolutionary bursts of change, because of the external forces (e.g., the market) leading change to occur (Hamel, 2000). More often, the change occurs in bouts of punctuated equilibrium, where evolutionary change and revolutionary change occur in cycles (Gersick, 1988, 1991).

*Revolutionary Versus Evolutionary*

There is much debate as to whether organizational change occurs through revolution or evolution (Brown & Eisenhardt, 1997; Gersick, 1991; Romanelli & Tushman, 1994). A revolution is a period during which sudden changes take place in an organization, and the changes are commonly accompanied by a serious upheaval of management practices (Greiner, 1991). In contrast, Brown and Eisenhardt (1997) assert that change is evolutionary—gradual change over a relatively long period of time—and that many organizations compete by changing continuously. Other change theorists assert that change occurs through both evolution and revolution (Gersick, 1991; Greiner, 1996; Thietart and Forgues, 1995; Weick and Quinn, 1999).

*Evolutionary Process:* Starkey and Crane (2003) state that the prevailing view of organizations is anthropocentric—that is, rooted in the old paradigm of enlightenment views, based on human progress through the exploitation of nature. The assumptions, values, and beliefs of current organizations are based on economic criteria, which typically ignore ecological concerns (Daly & Farley, 2003). The ecological paradigm

represents a counter view to the anthropocentric one. Through an evolutionary process of gradual change, a new way of interpreting and integrating ecological theories can be introduced. One of the ways in which an ecological paradigm can be introduced is by calling on organizations to examine both their organizational history and human evolutionary history. This may help organizations to see how the future of the human species depends on humans' decisions today. Starkey and Crane (2003) assert that we might be approaching a critical mass of consciousness that could challenge the current relationship of the human species with the environment (Throop, Starik, & Rands, 1993). One of the keys to convincing organizations to incorporate environmental values into strategic management is to show organizations how to see beyond their short-term needs and toward long-term evolutionary ones.

*Revolutionary Process:* As a case study for sustainable development innovation revolution, we can look at the company Monsato (Hall & Vredenburg, 2003). Monsato innovated technologically by creating genetically modified foods, but failed to innovate using sustainability principles. One of the reasons Monsato failed is that it ignored so-called "secondary stakeholders," including grassroots activists, safety activists, local communities, animal rights activists, and environmental groups. Secondary stakeholders may need to be included in sustainable development innovation, because they possess specialized knowledge and power to influence customers. For organizations to be successful at innovation, alliances must be created between and among organizations at all levels of society so that better solutions may be determined.

To incorporate sustainable development-related innovations into organizations, vastly different knowledge management—organizational, administrative, and

infrastructure—is required (Davis & Powell, 1992; Hall & Vredenburg, 2003; Hamel & Valikangas, 2003). In some organizations, the current competencies can actually hinder the organization from innovating and blind it from exploring new opportunities. For example, in the future, a car manufacturer may leap forward to produce hydrogen fuel cell engines instead of producing new types of combustion engines (Hall & Vredenburg, 2003). Every organization needs to find ways of leaping forward in order to remain competitive and be sustainable (Pachauri, 2004).

### *Punctuated Equilibrium*

While some theorists view change in terms of evolutionary or revolutionary, a more realistic view may be one that incorporates the two. Gersick (1991) asserts that change is evolutionary, punctuated with periods of revolution. The periods of revolution can be caused by external forces, such as increased competition, changes in customer demand, a lack of resources, or even sudden impacts of climate change. When needed, an organization can impose revolutionary change upon itself in order to make a leap forward in innovation. Part of what makes organizational change for sustainability a paradigm shift is that it may include leaps forward. Before we can create new strategies, we need to understand the leading contemporary strategies and model for organizational change and effectiveness.

### *Normative Versus Rational*

Barley and Kunda (1992) state that in times of economic depression, as compared to times of economic success, different management strategies are needed by organizations. Based on the study of management ideologies from 1870 to 1992, Barley and Kunda (1992) propose a long-wave economic theory as follows:

> During times of economic success organizations have implemented rational models of management, focusing most on streamlining models for increased production. During times of economic depression organizations implement normative models, which focus more on the employee or an organizations' members, in the areas of: thoughts, emotions and welfare. (Pp. 363-390)

*Organizational Diagnosis*

Organizational diagnosis draws on concepts, models, and methods to examine an organization's current state and assists in determining ways to solve problems or enhance organizational effectiveness (Burke, 1982; Harrison & Shirom, 1999). The models described in Table 2 include several of the leading models for organizational strategy and change formulation. The models that have an emphasis on ecology or sustainability have a symbol resembling a hand holding a leaf. These models have helped organizations to consider their needs in terms of economics and organizational effectiveness. One major component missing from most of these models is consideration of the natural environment as a strategic lever for success.

**Table 2. Organizational Diagnosis Models**

 = inclusion of ecology or sustainability

| Model Name | Type of Model | Source | Model Components |
|---|---|---|---|
| Burke-Litwin Model of Organizational Performance and Change | Organizational Performance and Change | Burke, 1982) | External Environment, Leadership, Mission and Strategy, Organizational Culture, Structure, Management Practices, Structure, Systems (Policies and Procedures), Work Unit Climate, Task Requirements and Individual Skills/Abilities, Motivation, Individual Needs and Values, Individual and Organizational Performance, and Feedback |

| Model Name | Type of Model | Source | Model Components |
|---|---|---|---|
| Competing Values Framework: Effectiveness | Organizational Effectiveness | (Quin, 2001; Quin & Rohrbaugh, 1983) | Adaptability–Readiness, Growth-Resource Acquisition–External Support, Productivity–Efficiency, Planning–Goal Setting, Stability–Control, Information Management–Communication, Cohesion–Morale, Value of Human Resources Training *(Note: has a few more components inclusive of Quin and Rohrbaugh [1983]. Also, this model is an integration of various other models. It is a further developed version of the Effectiveness Spatial Model)* |
| Creating Sustainable Value  | Shareholder Value and Strategic Planning | (Hart & Milstein, 2003) | - Innovation<br>- Risk Reduction<br>- Reputation<br>- Growth Path<br>- Drivers<br>- Internal & External Strategy<br>- Short- and Long-Term Strategy |
| Eco-Advantage Strategy  | Strategy for Sustainability | (Esty & Winston, 2006) | - Tracking<br>- Culture<br>- Risk<br>- Players/Stakeholder<br>- Barriers<br>- Value/Benefits |
| Ecologically Sustainable Organization (ESO)  | Multilevel Systems Approach | (Starik & Rands, 1995) | - Ecological Level<br>- Individual Level<br>- Organizational Level<br>- Political-Economic Level<br>- Sociocultural Level |

| Model Name | Type of Model | Source | Model Components |
|---|---|---|---|
| Effectiveness Spatial Model | Organizational Effectiveness | (Quin & Rohrbaugh, 1983) | Open Systems Model, Rational Goal Model, Internal Process Model, Human Relations Model, Flexibility, External Focus, Control, Internal Focus, Maintaining Flexibility–Readiness, Planning Objectives Selling Evaluation, Informational Management Coordination, Maintaining Cohesion–Morale, Growth Resource Acquisition–External Support, Productivity–Efficiency, Value and Development of Human Resources |
| Five Competitive Forces Model | Competitive Advantage | (Porter, 1980) | Potential Entrants, Buyers, Substitutes, Suppliers, and Industry Competitors |
| High-Performance Model Based on the Linkage Model | Organizational Performance | (Rucci, Kim, & Quinn, 1998; Wiley, 1996) | Leadership Practices (Customer Orientation, Quality Emphasis, Employee Training, Involvement/Empowerment), Employee Results (Information/Knowledge, Teamwork/Cooperation, Overall Satisfaction, Employee Retention), Customer Results (Responsive Service, Product Quality, Overall Satisfaction, Customer Retention), Business Performance (Sales Growth, Market Share, Productivity, Long-Term Profitability) |
| Lawler: Performance and Satisfaction | Motivation and Performance | (Lawler & Porter, 1967) | Performance (Accomplishments), Intrinsic Reward, Extrinsic Reward, Perceived Equitable Reward Level, Satisfaction |
| McKinsey's 7-S Model | Organizational Effectiveness | (Peters & Waterman, 1983) | Structure, Systems, Style, Staff, Skills, Strategy, and Shared Values |

| Model Name | Type of Model | Source | Model Components |
|---|---|---|---|
| Performance Improvement Model | Organizational Performance | (Swanson, 1994) | Analyze, Design, Develop, Implement, Evaluate, Inputs, Outputs, Organization (Mission and Strategy, Organizational Structure, Technology, and Human Resources), Environment (Economic Forces, Political Forces, and Cultural Forces) |
| Sustainability Operating System (SOS)  | Structure for Building a Sustainable Organization | (Blackburn, 2007) | - Drivers<br>- Efficient Enabler<br>- Pathway<br>- Evaluators |
| The Balanced Scorecard | Strategic Performance | (Kaplan & Norton, 1996) | Financial, Internal Business Process, Learning and Growth, Customer, Vision, Strategy. (Note: within each of the first four components are Objectives, Measures, Targets, and Initiatives) |
| Transformational Change Program  | Ten Steps for Creating a Change Program | (Dunphy et al., 2007) | - Gap Analysis Between Current and Desired State<br>- Assess Readiness to Change<br>- Go Beyond Compliance<br>- Launch and Manage Change Program |
| Waves of Sustainability  | Six Phases of Transformation an Organization Goes Through in Becoming Sustainable | (Dunphy et al., 2007) | - Rejection<br>- Nonresponsiveness<br>- Compliance<br>- Efficiency<br>- Strategic Proactivity<br>- The Sustaining Corporation |

**Restructuring Social Interactions**

Organizations are small societies. As within societies, organizations have rules, norms, and patterns of social behavior (Schutz, 1967; Weick, 1979). These interactions and transactions can be examined at various levels: individual, group, organizational, interorganizational, and beyond. One goal of almost every organization is for the people who belong to that organization to follow the direction or strategy determined by its

leaders (Barnard, 1938; Bass, 1985). As an organization's leadership determines how to change its organizational strategy, a challenge is how to direct and encourage the organization to follow the new strategy. One way to face this challenge is by examining the interactions among the people within the organization.

Restructuring social interactions is the way people construct their acts by interpreting and defining the acts of each other, and that interpretation directs social action (Blumer, 1969; Mead, 1934). The researcher in this study examined social interaction using symbolic interactionism and complexity theory (Hazy, Goldstein, & Lichtenstein, 2007; Morgan, 1996). Symbolic interactionism is a way of exploring how human beings interact and what determines their social action (Blumer, 1969). Complexity is a science that examines the way complex adaptive systems (CASs) function, develop, and interrelate to other systems (Hazy, Goldstein, & Lichtenstein, 2007; Morgan, 1996).

*Social Psychological Background of Symbolic Interactionism*

Mead integrated thought from the fields of sociology, psychology, ecology, and biology and is credited as founder of social psychology (Blumer, 1969; Mead, 1934). One of the criticisms of his work is that he never published a book, though he did publish more than 115 articles (The Mead Project, 2004). Blumer (1969) integrated many of Mead's ideas into the theory of symbolic interactionism. Symbolic interactionism is a way of exploring how human beings interact and what determines their social action (Blumer, 1969). Symbolic interactionism is a theoretical lense that will be applied in this study to shed light on the nature of the interactions among the senior management, employees, and stakeholder. Constructs of social psychology that relate to this study are

reflexivity, subjectivity, living systems, temporality, social interaction, social act, and symbolic interactionism.

*Reflexivity:* Mead (1934) believed that reflection provides a delayed reaction necessary for intelligent behavior. Reflection is a process through which the mind gathers information by bending backwards towards itself to investigate its own thoughts and thought process (Mead, 1938). Reflective thinking allows the self to complete the process of interaction with the symbols experienced in social interaction (Mead, 1938). Reflection relates to the self in that "the core dynamic of self is reflexivity—reflexivity informs the role of the self by taking another's perspective, which is critical for communication based on significant symbols" (Weigert & Gecas, 2003, p. 277).

*Subjectivity and Objects:* Mead refers to object as anything that can be referred to as either real or imaginary (Blumer, 1969). He believes that the "I" and "me" parts of the self are both objects that interact with each other in an attempt to make sense of the world. Human beings, as objects, are products of their social surroundings, which imprint the self with assumptions about how the self should function in society. These assumptions are implicit, which require reflection during the process of self-interaction to be realized. When a question is asked, the answer is automatically related back to one's own experience, making all thought subjective in nature (Mead, 1938). Mead saw the self as constantly engaged in a process of interaction with itself, constantly making self-reference to make sense of the world (Blumer, 1969). The stimuli with which the self interacts in the environment are symbols (Mead, 1938). A person makes sense of the world when "the mind measure[s] the interaction of the external environment, self, and past experience (memory)" (Mead, 1938, p. 78). Mead's view of self-interaction with the

world is similar to biology's conception of a living system (Bateson, 1979; Morgan, 1996).

*Living Systems:* Mead rejected the mechanistic assumption of science that every effect can be reduced to its causal factors (Mead, 1938) and that more organic or living systems models of life are more accurate than linear ones. Mead never explicitly stated a unified theory of human interaction, but it has been suggested that one was implicit in his teachings and writings (Blumer, 1969). Mead's unified theory, is as follows:

> A biological individual (a) is born into social (micro and macro society) and physical environments. From those environments the individual acquires an increasingly complex repertoire of covert and overt behavior. As the person gains increasing skill, the person has increasing influence on both micro and macro society and on the broader environmental systems. As all components of the system are interconnected in an organic whole, changes in any part of the system can influence other parts, creating dynamic changes in the whole system (Baldwin, 1986, p. 49).

This unified theory shows the organic nature of Mead's conception, but leaves out much of the central dynamics. To understand Mead, one must explore the finer points of his philosophy. One such point is temporality.

*Temporality*: Mead (1938) believed that the past, present and future comingle in the present:

> In the twisting of a plant toward the light, the later effect of the light reached by the twisting controls the process. The twisting is a process of adjustment to an oncoming event. The emergent reacts to the process itself. This process-oriented nature contradicts the mechanistic model, which denies such processes and emergence itself. (P. iii)

Mead's description of the flower implies that effect precedes cause and that life is process oriented rather than linear (i.e., life is not structured by cause and effect). In *The Philosophy of the Act*, Mead (1938) says that "The unit of existence is the act, not the moment" (p. 65).

*Social Interaction:* Mead identified two levels of social interaction: symbolic interaction and nonsymbolic interaction (As described in Blumer, 1969). In nonsymbolic interaction, human beings respond directly to one another's gestures or actions (Blumer, 1969). In symbolic interaction, the type of interaction Mead was most concerned with, people interpret each other's gestures and act on the basis of the meaning yielded by the interaction (Blumer, 1969). In social interaction, people construct their acts by interpreting and defining the acts of each other (Blumer, 1969), and that interpretation directs social action.

*Social Act (or Joint Action):* Blumer (1969) uses the term *joint action* in place of Mead's term, *social act*. Joint action refers to the larger collective form of action that is constituted by the fitting together of lines of behavior of the separate participants. The most important, yet most overlooked point about joint action is its subjective and socially interactive nature:

> To be understood, a society must be seen and grasped in terms of the action that comprises it. Next, such action has to be seen and treated, not by tracing the separate lines of action of the participants—whether the participants are individuals, collectives, or organizations—but in terms of the joint action into which the separate lines of action fit and merge. Few students of human society have fully grasped this point or its implications. (Blumer, 1969, p. 71)

*Symbolic Interactionism:* Symbolic interactionism is the term Bloomer (1969) coined based on Mead's theories of human interaction. Symbolic interactionism is a way of exploring how human beings interact and what determines their social action. Three premises of symbolic interaction are as follows:

1) Human beings act toward things on the basis of the meaning that the things have for them
2) That the meaning of such things is derived from, or arises out of, the social interaction that one has with one's fellows

3) That these meanings are handled in, and modified through, an interpretative process used by the person in dealing with the thing he/she encounters. (Blumer, 1969, p. 2)

Symbolic interaction is based on a number of root images: human groups or societies, social interaction, objects, the human being as an actor, human action, and the interconnection of the lines of action (Blumer, 1969).

Another dynamic supporting the model of symbolic interactionism is Mead's notion of the three gestures. According to Mead, people decide which action to take based on three gestures:

1) Signification of what the person to whom it is directed is to do
2) Signification of what the person who is making the gestures plans to do
3) Signification of the joint action that is to arise by the articulation of the acts of both. (Blumer, 1969, p. 9)

*Complexity Theory*

Complexity theory examines the way complex adaptive systems (CASs) function, develop, and interrelate to other systems (Hazy et al., 2007; Morgan, 1996). The first serious recognition of the complexity of social systems challenged the usefulness and applicability of both the traditional equilibrium model (Buckley, 1967; Schwandt, Holliday, & Pandit, 2008. Social systems were considered open and negentropic; they "are open 'internally' as well as externally in that the interchanges among their components may result in significant changes in the nature of the components themselves with important consequences for the system as a whole" (Buckley, 1967, p. 490). This initial conceptualization of complexity developed into chaos theory.

CAS theory is committed to the study of the often unpredictable behavior of living systems (Capra, 1996; Stacey, Griffin, & Shaw, 2000). The social system coevolves through emergent social phenomena that allow it to regenerate and self-

organize agents' knowledge schemes and social structures for potential next interactions (Dooley & Van de Ven, 1999; Schwandt et al., 2008). Three characteristics of CASs are nonlinearity, emergence and self-regeneration, and schemata (or schema).

*Nonlinearity* refers to multiple causations over time and space from human interactions that reflect both nonadditive and nonproportional attributes of the system (e.g., small actions can result in potentially large consequences, and vice versa). Human poverty and poor health represent social problems at multiple levels of analysis concerning complex and nonlinear human actions. Therefore, there are no simple, direct cause-effect social solutions (Schwandt et al., 2008).

*Emergence and self-generation* mean that, over time and space, novel social patterns manifest themselves at higher levels of abstraction or analysis, but are related to repeated and reciprocating nonlinear human interactions. "Each new level of complexity would exhibit the construction of new structures with new properties that transcend lower-level characteristics and dynamics" (Goldstein, 2007, p. 70; Schwandt et al., 2008). An example of this can be seen in the use of all the trees on Easter Island to provide shelter for the inhabitants. This use resulted in patterns of deforestation, land erosion, and finally the collapse of the society (Diamond, 2005).

*Schemata, or schema*, provide cognitive and emotional guidance for agents and the collective in their social interactions. They consist of sets of rules for sense making (Anderson, 1999). Often the unconscious parts of ourselves affect our conscious minds without the conscious mind being aware of this effect (Varela et al., 1991). For example, if a person in uncomfortable feeling a certain emotion (e.g., anger or sadness), that person may avoid asking questions or making statements that would trigger an uncomfortable

emotional reaction in the other person. In this sense the rules that govern schemata are inclusive of both how we the individual's experience and the perception of how an action may cause a reaction in another person.

The application of these characteristics—nonlinearity, emergence/self-generation, and schemata—to the human condition has necessitated the addition of the uniquely human characteristic of "tension," or "latent social strain" (Parsons & Smelser, 1956; Schwandt et al., 2008). These latent forces are derived from situations in which existing schemata may not provide sufficient guidance for interaction. McKelvey (2002) sees these adaptive tensions manifested in language as a process of self-organizing the social system: "Simultaneously, these adaptive tensions (1) define appropriate efficaciously adaptive directions and (2) deal with what economists call 'agency problems' by focusing agent's attention on relevant technologies, markets, products, etc." (p. 12).

The complexity of the human systems is derived from their continuously coevolving interactions. These interactions are not only between individuals, but also among groups, organizations, and societies having different and unique cultures, contexts, constraints, capabilities, goals, means, and desires. Social entrepreneurship systems "are profoundly affected by the ability of the community to combine and adapt in an innovative way a variety of ancestral and new skills, experiences, cooperative practices, and values" (Peredo & Chrisman, 2006, p. 319). These interactions are nonlinear and reciprocating (Gouldner, 1960) and can lead to novel solutions to social problems, or they can simply reinforce current conditions.

*Theoretical Considerations:* Within social systems, individuals are also considered an independent, complex, adaptive microsystem socially learning and

changing through interactions with other independent agents (Schwandt et al., 2008). Simultaneously, these continuous reciprocating interactions are the elements of an emergent social mesosystem with a structure, order, and meaning. Mesosystem structures emerge in response to the need for social integration and reduction of equivocality. They influence the range and goals of future structuring actions of the individual agents. Microinteractions (i.e., individual interactions) simultaneously structure and are structured by the mesocollective. These reciprocating interactions can be characterized as both learning by the individual (Bandura, 1999) and collective learning at the mesolevel of analysis (Schwandt & Marquardt, 2000).

*Pragmatic Consideration:* These interactions occur over both space and time, may be nonproportional, and create new patterns of interactions that may, or may not, contribute to the solutions of the social problem. The diversity, frequency, and quality of the involvement may enhance the community's capacity for generating novel solutions. The patterns of interaction that emerge from these interactions at the mesolevel coevolve from the microlevel interactions of agents (e.g., collaborative sharing of information and resources). The agents may represent an ever broadening scope of differing levels of the community (levels of organizations, levels of governments, level of for-profit and not-for-profit, etc.) as the solution patterns coevolve with the agents' actions (Schwandt et al., 2008).

Unfortunately, little research has been completed that allows us to examine the dynamics of interactions in the context of organizational sustainability. What we have are the stories and cases of individuals who have succeeded under these conditions. We need research that looks at the multilevel nature of these interactions and the emergent

consequences, both positive and negative. The research in this study seeks to contribute to this body of literature (Schwandt et al., 2008).

# CHAPTER 3: METHODS

## Overview of Methodology

This study sought to understand how organizations can incorporate natural environmental values into their business strategies and increase their profitability at the same time. To study this phenomenon, case study is an appropriate method of inquiry. Merriam (1998) indicates that case study is an appropriate method of inquiry when an in-depth understanding of a phenomenon is sought. What makes case study unique is its focus on a single unit or bounded system (Merriam, 1998), which in this case is DuPont.

For this study, a single case study was chosen. Yin (2002) indicates that a single case study is appropriate when it is confirming, challenging, or extending theory. Currently, the practice of organizational sustainability is moving faster than research or theory for organizational sustainability (Dunphy et al., 2007; Schwandt & Marquardt, 2000). More empirical research examining how organizational sustainability can occur is needed to increase the reliability of theory and the efficacy of practice.

A second rationale for a single case study is that the system being studied is a revelatory case. DuPont is a leader in organizational change as it relates to reducing its environmental footprint. From 1990 to 2008, DuPont has reduced its GHG emissions by 72% (Hoffman, 2007a). This study details how this organization was able to significantly reduce its environmental footprint.

### *Data-Gathering Methods*

The data-gathering methods for this case study included document and archival record review, interview, and observation. Multiple data-gathering methods were used to increase trustworthiness of the study. Using multiple data collection methods

counterbalances the weaknesses of each method and creates multiple checks for information (Ridenour & Newman, 2008). Interview was the main data-gathering method used in this study, because little data was found in written documentation that fully addresses the research questions. An assumption of the researcher was that the organization being studied (DuPont) keeps its development of strategic direction proprietary. Through interviews, the researcher sought to inductively create a process-based model explaining how DuPont was able to incorporate sustainability into its business strategy. The following sections discuss the three methods in more detail.

*Document, Archival Record, and Secondary Research Review:* Document review included literature from primary and secondary research sources, journals, and books. Archival record review included documents from DuPont's library for scholars; items provided by contacts who are employees; DuPont documentation that has been released publicly; and audio and video recordings of documentaries, news, or commercials related to DuPont. A weakness of using historical records is that the researcher was not present when the records were being created. To increase the trustworthiness of document and archival record review, the researcher checked the original/primary data sources (Ridenour & Newman, 2008). Secondary research sources were reviewed, including publications, interviews, and studies completed by other researchers.

Although dissertations typically do not include secondary research in their findings chapter, this dissertation does so in order to fill a few gaps in DuPont's organizational change for sustainability experience identified during data gathering and data analysis. Part of the reason there were gaps is that some of the events being studied occurred more than twenty years ago (i.e., in the mid- to late 1980s). Some of the events

that occurred in the mid- to late 1980s may have been difficult for the interview participants to recall. For example, references to two events (among others) are cited in Chapter 4 from the mid- to late 1980s relating to the Montreal Protocol and Greenpeace protests. A reader of this dissertation can determine which sources are primary data versus secondary data by the citation style—primary data has the key words *personal communication* and the date of the interview within its citation, while secondary data are cited using the author's last name(s) and year. During data gathering, approximately 40 relevant books, periodicals, and other documents that contained secondary data related to this study were identified and referenced (see Appendix B).

To review archived documents, the researcher visited the Hagley Museum and Library, which is dedicated to preserving the history of American enterprise, with a specific focus on preserving and sharing DuPont's history (Hagley, 2009). A 25-year time seal is applied to collections that have current materials concerning people who are still living. According to this rule, corporate owned documents submitted by DuPont to Hagley cannot be made publicly available until 25 years passes from the time the documents were created. As a result, little documentation submitted by DuPont to Hagley relevant to this study was obtained.

*Interview:* Focused interviews included current and former Chief Executive Officers, Vice-Presidents, Senior Executives, and Managers at DuPont; a member of the Health Advisory Board to DuPont; and a consultant who advised DuPont. A structured interview format was used to elicit similar categories of information from each interviewee. To increase the trustworthiness of the interviews, the researcher has checked the research questions against the objectives of the study, practiced interviewing during

graduate-level research projects, included an ample number of interviewees to achieve saturation, checked for consistency across the interviews, and debriefed the interview participants after the interview when validating the interview transcription (Ridenour & Newman, 2008).

In total, 12 formal interviews were conducted using the interview protocol. *Saturation* was achieved, defined as the point at which no new information, properties, or patterns emerge from the data (Strauss & Corbin, 1998). By the third interview, several of the answers and patterns of answers remained the same. By the last interview no new significant information was gained. Initially purposeful sampling was applied to choose interview participants. Then the snowball method (Ridenour & Newman, 2008) for choosing interview participants was applied, in that as each participant was interviewed, each person was asked to recommend who would be a good current or former DuPont leader to interview. Additionally, two unstructured interviews were used to gather data, described as personal communications in the citations and references for this study.

*Observation:* Observation consisted of four meetings across 2 days that focused on reviewing issues related to health and agriculture including new product development in the context of DuPont's business strategy. This 2-day event was the Health Advisory Board Meeting on July 13 to 14, 2009. This advisory board is a group of leading doctors from North America formed in 2002 who meet annually to advise DuPont on health issue for employees and on new products. Observation of these meetings allowed the researcher to study nonverbal cues, social interactions, and the experience of the participants.

Ridenour and Newman (2008) describe three categories of observation: participative, reactive, and unobtrusive. This research study used unobtrusive observation, whereby the observer (i.e., the researcher) did not interact with the people and situation being observed. To strengthen the trustworthiness of the observations, the researcher focused on the particular comments, behavior, and actions of the participants (rather than the general attributes).

*Plan for Allocating Time to Each Research Method*

*Interview:* At the outset of this study, the researcher planned to spend 20-30 hours on interviews. There were 12 interviews total, and each interview lasted 1 to 2 hours. After each interview, the researcher spent 1 hour to verify the data collected during the interview and make sure the researcher recorded what they meant to say.

*Document Review:* At the outset of this study, the researcher planned to spend 50 to 300 hours on document reviews. the researcher reviewed documentation related to the subject of this case study until saturation was achieved. This documentation included empirical studies, journal articles, books, newspapers, and other related literature.

*Archival Record Review:* At the outset of this study, the researcher planned to spend 50 to 300 hours on archival record review. The researcher reviewed archival records until saturation was achieved or there were no more records, whichever came first. DuPont has an academic research library in Wilmington, Delaware, with various artifacts created by DuPont or another party with DuPont as a focus. These artifacts included reports, internal research studies, letters by employees, advertisements in paper or video/DVD, documentaries, interviews on video/DVD, audio recordings or other forms of media. Because DuPont prohibits the release of records that were created in the

last 25 years, no active internal DuPont records were found. However, it was useful to see the history of DuPont through the available archival records in order to provide a context for the study.

*Observation:* At the outset of this study, the researcher planned to spend 6 to 24 hours on observation. Four meetings related to sustainability were observed at DuPont to gain a sense of the language used to describe sustainability, the current issues, meeting procedures, current strategy, and the composition of the team that leads sustainability strategy. The meetings focused on aspects of DuPont's market-facing sustainability business strategy development. This 2-day event was the Health Advisory Board Meeting, July 13 & 14, 2009.

**Foreshadowed Problems, Conjectures, or Exploratory Questions**

Several potential problems might have arisen during this study, including DuPont's distrust of the researcher, the researcher's failure to ask the right questions, saturation, difficultly in making sense of the data, and researcher bias. These potential problems could have prevented the research from yielding answers to the intended research questions. The following controls were put in place as precautions.

*DuPont's Distrust of the Researcher*

As with most organizations, DuPont must keep certain information confidential for a variety of reasons: to protect intellectual capital and prevent it from reaching competitors, to protect personal information, to protect jobs (no one wants to look negligent or unprofessional), and to keep its mistakes from getting media attention. To gain the trust of interview participants before each interview, the researcher provided participants with a brief description of the purpose of this study and a consent form

describing how information would be protected (see Appendix C). After the results of each interview were transcribed, the participants were asked to verify that the data provided was accurate. If interview participants had been distrusting and uncooperative, additional measures could have been taken, such as modifying the interview questions and only taking handwritten notes at the interview (rather than recording and transcribing). As it turned out, the interview participants were trusting of the researcher in this study and were cooperative, so the researcher was able to closely follow the interview protocol, including completing and storing the release forms, maintaining confidentiality, recording the interviews, using a third party to transcribe the interviews, reviewing the transcripts with each interview participant to make any suggested corrections, applying a snowball method to choose participants, and following up a second time with several interview participants to confirm that the researcher in this study interpreted their comments correctly.

*Researcher's Failure to Ask the Right Questions*

After each interview, the data gathered was given a cursory examination by the researcher to determine if the raw data was actually answering the interview questions being asked. If the gap between the questions and answers had been too large, the interview questions and protocol would have been modified. Modifications may have included making the questions more direct, having fewer questions, or increasing the time allotted to each interview. As it turned out, the data gathered after each interview was relating to the questions being asked, so there was no need to change the interview questions or the protocol.

*Memory*

While gathering data, the general timeframe for this study being considered was 1960 to 2008. Once the data for this study was gathered and analyzed, a more specific timeframe was determined. The specific timeframe for this study was 1989 to 2008. Even though some of the interview participants have worked at DuPont for several decades, they may not have remembered what happened during specific events or timeframes. Written documentation was used to validate the interview data. If interview data from a particular participant was contrary to written documentation, the data would be compared to additional interview data and written documentation. Also, as needed, small follow-up interviews were conducted with participants to ask about contradictions or gaps.

*Saturation*

It can be difficult to determine when a study has reached the point of saturation (i.e., the point at which no additional information will significantly improve trustworthiness). Additional interviews and document review were completed to ensure saturation. By the third interview, several of the responses from the interview participants were the same. As the following nine interviews were conducted, more details were uncovered that elaborated on the research findings and did not in any way contradict the data gathered during the first interviews.

*Difficulty in Making Sense of the Data*

There might have been difficulty in making sense of the data, including clustering and drawing conclusions. If this problem had arisen, more data would have been gathered. At the completion of the data gathering, it was determined that an ample of amount of data was gathered and that clear conclusions could be drawn.

*Researcher Bias*

Throughout the study, researcher bias could have been an issue. The researcher is the son of a lifetime DuPont executive. Having heard stories from DuPont employees when attending DuPont events, and having previous exposure to DuPont in the media, the researcher could have had a biased view. For example, in the past, the researcher may have ignored negative articles or television broadcasts. During the interviews and record review, both negative and positive data were captured to accurately understand what occurred. To keep a good relationship between the researcher and DuPont, as any negative data were gathered, the researcher worked with his dissertation advisors to present findings and conclusions in a way that has academic integrity, without creating negative ramifications for DuPont.

Another potential area of researcher bias was that the researcher is passionate about the environment and sustainability. This interest could have caused the researcher to pay more attention to written documentation and interviews than to other types of data. During the review of written documentation, data gathering, and data analysis, a conscious effort was made to objectively examine and consider all types of data that may contribute to this study.

**Subjectivity Statement**

The researcher chose DuPont as a case study because DuPont is a leader at reducing its environmental footprint and has documented its experience. Being a leader and having documentation are two excellent qualities for a case study (Murphy & Dee, 1992). For both personal and professional reasons, the researcher wanted to know how

DuPont changed its business strategy and practices to become a leader at reducing its environmental footprint.

The researcher wanted to know how DuPont changed so drastically. His father began working for DuPont as a summer intern and continued after he graduated from college. All the researcher's life, he has been surrounded by DuPont news and stories. From 1998 to 2008, his father served as DuPont CEO, and from 1999 to 2009, he served as Chairman of the Board. DuPont does not openly share the details of how it stays ahead of its competitors. Little is known about how DuPont has become successful as an innovator in business by reducing its environmental footprint and increasing its use of biological processes.

The researcher has heard much DuPont legend and lore through his childhood and adult life, but one story has impacted him the most. In 1989, DuPont was being protested by Greenpeace, whose activists were urging DuPont to improve its treatment of the natural environment (Murphy & Dee, 1992) . Many DuPont senior managers credit this event as DuPont's tipping point toward sustainability. Later in 1989, DuPont began its public journey to change its systems, structures, and processes to go above and beyond the required levels of GHG emissions regulations and drastically reduce its environmental footprint. DuPont has always gone beyond compliance with environmental regulations (DuPont, 2008b; Holliday, 2001; Kinnane, 2002). In 1989, a change was occurring at DuPont, a change toward sustainability, and DuPont would soon become a leading organization at reducing its environmental footprint.

When the researcher was gathering data for this study, particularly during document review and interviews, he included the three decades preceding 1989, in case

there were other events that may have impacted or served as a tipping point for DuPont's transition toward sustainability. Once the data gathering was completed, the researcher determined that some events that occurred in the mid- to late 1980s did impact this study. These impacts are reported in Chapter 4.

## Statement of Potential Significance

Through this dissertation the researcher sought findings that could contribute to practice, research, and theory. The focus of this dissertation is to examine various aspects of DuPont's organizational change process, as it relates to incorporating environmental values into its business strategy. Through this examination, some potential outcomes include the following.

### *Practice*

In Europe, organizations have a limit or cap placed on them by their respective governments on how much carbon dioxide ($CO_2$) may be emitted by these organizations. If that cap is exceeded, fines result. If an organization emits less $CO_2$ than its cap in a given year, credits are given. These credits can be sold on the open market. This system used in Europe is called the "cap and trade" system. If the cap and trade system becomes mandatory for a majority of organizations around the world, organizational sustainability will become even more profitable (Esty & Winston, 2006).

Organizations that do not have any experience in changing to reduce their environmental footprint will need help determining strategies for change. DuPont is an organization that has had great success in reducing its $CO_2$ emissions and other environmental indicators. Some of the lessons learned about how DuPont changed may be useful in guiding other organizations.

*Research*

The methodology applied in conducting this research may be useful in conducting future studies of organizational sustainability, specifically how organizations can incorporate environmental values into business strategy and increase profitability. Aspects of the methodology that may be useful are the timeframe studied; information sources; interview protocol; how bias was controlled; how findings were related to practice, research, and theory; and how findings were applied to a possible new model for organizational sustainability.

*Theory*

Various resources indicate that managers are ill equipped to manage the complexities involved with the triple-bottom line of sustainability and organizational change for sustainability (Ghoshal, 2005; Hall & Vredenburg, 2003). The case may be that some managers are equipped to cope with this type or complexity while others are not. This study may uncover an explanation or theory of why some managers can cope with the type of change involved with organization sustainability and others cannot. In addition, this study examines some of the dynamics of complexity and how they relate to the shift toward greater harmony with the environment at DuPont.

## Research Procedures

The research procedures were designed and followed in order to increase the trustworthiness of this research study. Trustworthiness was controlled in this study by including three modes of evidence (triangulation), reviewing the research questions with the dissertation committee and updating the research questions based on feedback to make them less directive, piloting the research questions, establishing and following the

interview protocol, reviewing the data codes with peers and updating the codes based on feedback, reviewing the coding process with peers and updating the process based on feedback, using a transcription service to transcribe the interviews, and by performing member checks with the interview transcripts. The following sections describe the research procedures applies to increase the trustworthiness of this research study.

*Modes of Evidence and Triangulation*

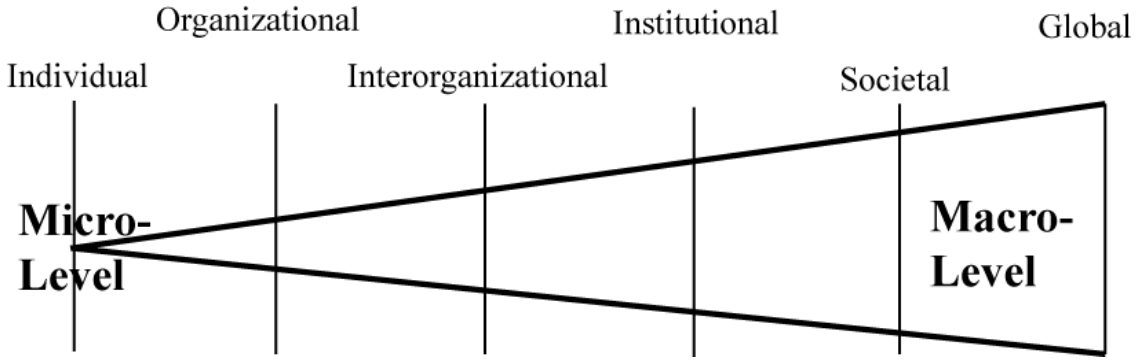
When a phenomenon is examined from various points of view, the subjectivity of the researcher is better controlled. Triangulation is a method of gaining at least three points of view of a phenomenon. One benefit of triangulation is effectively containing the researcher's subjectivity using confirmation, contradiction, and validation. Triangulation creates converging lines of inquiry to increase the trustworthiness of the research (Yin, 2002).

Triangulation was achieved in this study by including three modes of evidence as data sources: (1) document and archival record review, (2) focused interviews, and (3) observation. Document review included literature from primary and secondary research sources, journals, and books. Archival record review included documents from DuPont's library for scholars; items provided by contacts who are employees; DuPont documentation that has been released publicly; and audiovisual recordings of documentaries, news, or commercials related to DuPont. Focused interviews included current or former senior executives or managers at DuPont and a consultant to DuPont. Observation was of meetings at DuPont, including three planning sessions during the Health Advisory Board Meetings, July 13 to 14, 2009, at DuPont where the focus was on health/nutrition, agriculture, and resource availability aspects of sustainability strategy.

*Level of Analysis*

In regard to sustainability, based on an integration of Giddens (1990) and Starik and Rands (1995) there are five levels of analysis for conducting research: individual, organizational, interorganizational, institutional, and global. An additional category that may be useful to include is the societal level. In the hierarchy established by Giddens (1990), societal level may fit best between institutional and global levels (see Figure 2). This study focuses on the organizational level of analysis. The organizational level of analysis was chosen because there is a lack of research exploring the role of organizational change as it related to sustainability (Hoffman, 2001).

**Figure 2. Levels of Sustainability**




(based on models from both Giddens, 1990; Starik & Rands 1995)

*Interview Participants*

At the outset of this study, three interview groups were planned to be interviewed: DuPont leaders who are current or former employees, two advocacy organizations that are NGOs, and a consulting firm that advised DuPont on its sustainability approach. Based on input from the first three interview participants and the plan to use a snowball technique for choosing interviewees, the researcher determined that the interviews should

focus solely on current or former DuPont leaders. Interviews from other organizations were not included because the advocacy organizations may not have had as much information related to this study as current or former DuPont leaders.

The first group, DuPont leaders, consisted of 10 leaders at DuPont in the area of sustainability: the CEO, Senior Vice Presidents (VPs), VPs, or people who worked directly with one of the aforementioned groups. This group included both current and former DuPont employees. The exact titles of the interview participants are not provided to protect confidentiality.

The second group, NGOs, was chosen because it is a different type of stakeholder in DuPont's sustainability approach than DuPont. NGOs serve as advocates and subject matter experts on issues, such as environmental issues. The first choice for an NGO to interview was an advocate for sustainability to DuPont. The second choice for an NGO was one that was previously or is currently an adversary to DuPont. At the outset of this study, the researcher planed to interview one to three leaders from each NGO. During the interview process with DuPont, two of the DuPont interview participants recommended to not invest any time in interviewing an NGO(s) due to the focus of this study, due to an NGO being unlikely to know DuPont's internal organization story relating to sustainability. As a result, no interviews were conducted with an NGO. Instead two people outside DuPont who served as paid consultants were interviewed to gain another perspective, as described in the following two paragraphs.

The third group was a consulting firm that advised DuPont on its sustainability approach. This stakeholder was chosen in order to assess the role of a paid advisor in

developing DuPont's sustainability approach. One former consultant from this firm was interviewed.

During the planning and selection of interview participants with the sponsor for this research project at DuPont, this study was designed to only interview participants from DuPont. As a result, only current or former DuPont employees were interviewed for this study. However, two unstructured conversations were held in addition to the formal interviews. One was with a DuPont Health Advisory Board member, a university professor and physician who advised DuPont. A second was with a University Professor and Consultant who advised DuPont during its sustainability transformation.

*Pilot of Interview Questions*

In a graduate course on case study methodology, the researcher piloted the interview questions with a DuPont employee. Based on feedback and the results of the questions the researcher adjusted the language in the interview questions to better relate to the language used within DuPont culture. In addition, based on feedback received during the proposal defense of this research study, the interview questions were improved by making them less leading and broader in nature. Prior to conducting the interviews with DuPont leaders, the researcher in this study completed archival record and document review.

*Interview Preparation and Closure*

In order to make the interviews productive and effective, the researcher took several measures to prepare for, conduct, and close the interview; and secure the interview data:

1. Request the DuPont sponsor to invite each selected current or retired employee to participate in the study.
2. Put new batteries in the digital voice recorder and check it before each interview.
3. Review the Research Consent Form (see Appendix C) with each interviewee and answer any questions. Provide a copy to the interviewee.
4. Conduct the interview.
5. At the conclusion of each interview, take note of each interviewee's demeanor.
6. Email the interview recording to a transcriptionist and have it returned via email to the researcher.
7. Review the transcription for errors
8. Email or mail a transcript of the interview to the interviewee, depending on their preference, 1 to 3 weeks after each interview. Have the interviewee review the transcript and updated it if needed.
9. Store all data in a secure location.

*Interview Question Overview*

A general set of interview questions was developed and used with all the interviews. These questions were developed so that there would be a minimal amount of leading on the part of the researcher. In case it was needed, a second version of the interview questions with prompts and probes was created (see Appendix D), which the researcher could have used as a tool during an interview.

*Interview Questions*

The interview questions were as follows:

1. This study is about sustainability. In your words, what does sustainability mean to this organization?
2. Tell me your story of how DuPont reduced its environmental footprint yet remained profitable.
3. How did DuPont communicate sustainability?
4. How is success measured in this area?
5. What role do you play in DuPont's sustainability efforts?
6. How do you view your role in relation to others in the organization?
7. What were the events that influenced DuPont's decision to reduce its environmental footprint?
8. Was there any resistance to change?
9. If so, tell me about how it was resolved.
10. What other things can you tell me about DuPont's sustainability efforts?

**Human Participants and Ethics Precautions**

Precautions were taken to reduce any possible negative effects of conducting this case study. The George Washington University Institutional Review Board (IRB) approval process was followed. Written permission to interview was sought from DuPont before beginning the interviews using a consent form following the George Washington University Social/Behavioral Consent Guidance Document (see Appendix C). Confidentiality for every interview participant was observed. The records of this study will be kept private. In any publication or presentations, the researcher will not include

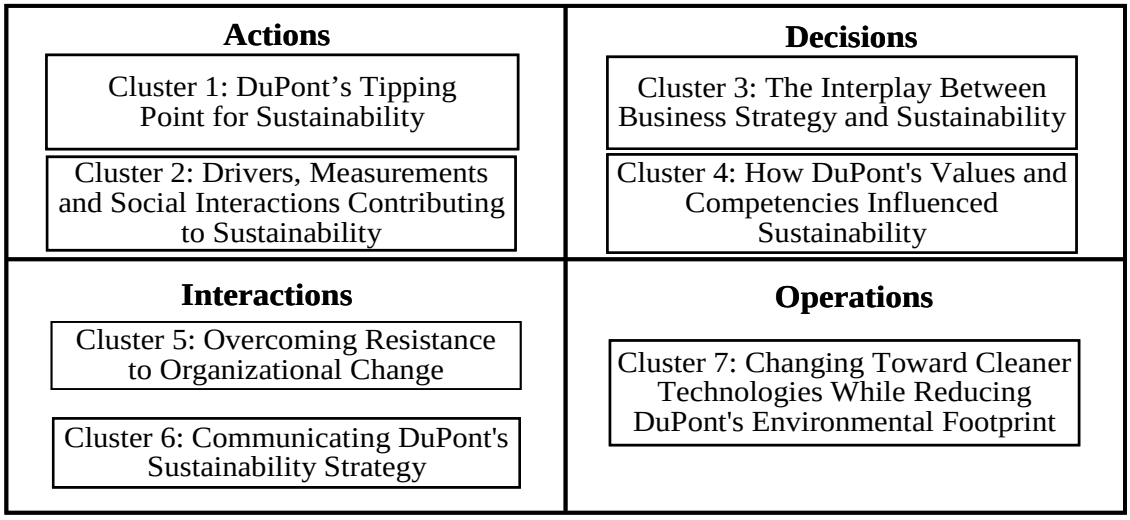
any information that would make it possible to identify the individual subjects. Research records will be stored securely, and only the researcher will have access to the records.

## CHAPTER 4: FINDINGS

### Introduction

As data were gathered, it was entered into a data analysis software application called Atlas Ti 5.5 for later analysis. Data were analyzed based on the primary research question, "What actions, decisions, interactions, and operations did DuPont undertake to incorporate natural environmental values into its business strategy, while simultaneously increasing its profit margin from the 1989 to 2008?" The initial section of this chapter describes how data were analyzed and made sense of using an inductive process to derive the data codes, clusters, and themes from the raw data. The subsequent sections report the findings of the data analysis. The data analysis is organized by the four areas of inquiry within the primary research question: (1) actions, (2) decisions, (3) interactions, and (4) operations. During the data gathering, seven data clusters were developed. Each of these clusters aligns to one of the four areas of inquiry within the primary research question (see Figure 3).

**Figure 3. Data Cluster Correspondence to the Four Areas of Inquiry within the Primary Research Question**



## Process for Developing Data Codes, Data Clusters, and Themes

As described in the Chapter 3, data were gathered using three methods: document review, observation, and interview. Of these three data-gathering methods, the largest quantity of data came from interview. Once gathered, data were entered into Atlas Ti 5.5 as rich text format Word documents. As both Miles and Huberman (1994) and Merriam (1998) recommend, the data were analyzed several times during data gathering and at the completion of data gathering. An inductive method for analyzing the data was applied, moving from a low to high level of abstraction.

The inductive process for developing data clusters followed the three initial steps of Carney's Ladder of Analytical Abstraction: (1) create a text to work on, (2) try out coding categories to find one that fits, and (3) identify clusters and themes in the overall data (Ridenour & Newman, 2008).

### *Create a Text to Work On*

All the data gathered through interview, observation, and document review was converted into rich text files and stored in Atlas Ti. 5.5. Many steps were taken to develop the rich text files. For instance, in the case of the interview data, the sequential steps for analyzing each interview were as follows: (a) a digital recording was made of the interview, (b) a sound file was emailed to a transcriptionist, (c) the interview on the sound file was manually typed into a rich text file, (d) the rich text file was emailed to the researcher, (e) the rich text file was emailed to interview participant for member check, (f) corrections or changes to the transcripts were communicated to the researcher via email or telephone, and (g) the updated rich text file was loaded into Atlas Ti 5.5.

*Try Out Coding Categories to Find One that Fits*

As Miles and Huberman recommend (1994), before setting out to code the data a provisional list of codes was developed. Merriam (1998) defines codes as “shorthand designations [such as a single word, letter, number, phrase or combination of these] to various aspects of data allowing the researcher to easily retrieve specific pieces of data” (p. 164). Based on the research questions and transcripts from the first two interviews, 20 codes were created and applied in the initial coding of the data (see Appendix E). After this initial code list was reviewed by the dissertation committee for researcher bias, trustworthiness, and the appropriate level of specificity, more codes were created.

As the remaining 10 interview transcripts were coded, the number of codes increased. During the coding process, the codes were checked for duplication and relevance. The three members of the dissertation committee provided peer debriefing during the data gathering process, code development, and analysis of the data. Ridenour and Newman (2008) refer to *peer debriefing* as a process to "check out their [researchers] emerging construction of meaning with other professionals or colleagues." (p. 58). Once the coding was completed, there were 138 codes. The researcher then reduced this list of 138 codes by (a) merging codes with one or two quotations with similar codes and (b) adjusting the code names to represent a higher level of abstraction as needed. As a result, most of the codes with one or two quotations were combined with other codes with similar meaning. The new and final list of codes contained 90 codes (see Appendix F).

*Identify Clusters and Themes in the Overall Data*

Once all the data were coded, the codes were divided into clusters. Miles and Huberman (1984) define a cluster as a “grouping or conceptualizing of objects that have

similar patterns or characteristics" (p. 249). The Network View Manager of Atlas Ti 5.5 was used to assist in making sense of the data (for a network view of the codes and clusters, see Appendix G). After these clusters were reviewed, two of the clusters were merged due to their overlapping meaning. The final data clusters are defined in Table 3**.** These seven clusters serve as the high-level framework for reporting the findings in this chapter.

**Table 3. Final Data Cluster Names**

| Cluster Name | Description |
|---|---|
| 1. DuPont's Tipping Point for Sustainability | A brief history of DuPont describing key dates, products, major changes, and the tipping point for sustainability. |
| 2. Drivers, Measurements and Social Interactions Contributing to Sustainability | Drivers for sustainability, greening, new language, regard for the environment, social responsibility, and a description of the organizations that most influenced DuPont. |
| 3. The Interplay Between Business Strategy and Sustainability | The driver for what products and services are marketed then sold, and how to be competitive. This includes concepts such as business-facing goals, competitive advantage, economics, business case, resilience, and velocity. |
| 4. How DuPont's Values and Competencies Influenced Sustainability | Core values, safety, innovation, and the dynamics of an organization. |
| 5. Overcoming Resistance to Organizational Change | The organizational change process, organizational structure, speed of change, and change champion(s). |
| 6. Communicating DuPont's Sustainability Strategy | The way information is developed and delivered internally and externally. This includes concepts such as internal communication, external marketing, role of Chief Executive Officer (CEO) communication, and recognition. |

| Cluster Name | Description |
|---|---|
| 7. Changing Toward Cleaner Technologies While Reducing DuPont's Environmental Footprint | Deep well injection, emissions reduction, and influencers. |

Once the data gathering from interviews and observation was completed, additional data were gathered using secondary research to fill in a few gaps in DuPont's organizational change for sustainability experience. These gaps were identified during data gathering and data analysis. Part of the reason there were gaps is that some of the events being studied occurred more than twenty years ago, in the mid- to late 1980s. These events may have been difficult for the interview participants to recall.

Throughout this chapter, the reader can determine which sources are primary data versus secondary data by the citation style—primary data citations contain the key words *personal communication* and the date of the interview, while secondary data citations use the author's last name(s) and year. During data gathering, approximately 40 relevant books, periodicals, and other documents that contained secondary data related to this study were identified and referenced (see Appendix B).

**Themes Based on Data Coding and Data Clusters**

After the data clusters were interpreted through the lens of the conceptual framework, five themes were determined. For a complete representation of how the clusters relate to the constructs and related research questions, see Appendix I. These themes form the basis of the discussion and conclusions in Chapter 5:

- *Theme 1: The Role of Sustainability in Developing a Business Strategy*. This theme relates to the interplay between business strategy and sustainability. The research suggests organizational sustainability should be inclusive of operations, products & services, and social responsibility. This theme is based on data clusters 1, 3, and 7.
- *Theme 2: Principles for Effective Organizational Sustainability.* This theme relates to principles that guide organizations in transformation toward sustainability, in the context of the external environment. This theme is based on data clusters 2 and 4.
- *Theme 3: Resistance to Organizational Change for Sustainability*. This theme describes resistance to change, its challenge and opportunities. This theme is based on data clusters 1 and 5.
- *Theme 4: Role of Senior Management in Sustainability Transformation.* This theme describes how senior management—including CEOs, Vice Presidents, and other executives—influence organizational change toward sustainability. This theme is based on data clusters 3, 6, and 7.
- *Theme 5: Influence of Stakeholders.* This theme defines the role of stakeholders and describes the criticality of understanding the customers' current and future needs. This theme is based on data clusters 1, 2, 5, and 6.

Before the findings of data represented by the seven clusters are presented, a brief history of DuPont is described.

**Brief History of DuPont**

The time boundary for this case study is 1989 to 2008. To provide a context for this study, this section describes the overall history of DuPont. DuPont was founded in 1802 near Wilmington, Delaware, by E.I. du Pont (Kinnane, 2002). The first product made by DuPont was gunpowder. By the mid-nineteenth century, DuPont was the largest supplier of gunpowder to the U.S. military. In 1902, three great grandsons of E.I. du Pont gained ownership of the company and bought several small chemical companies. Because of the anti-trust requirements of the Sherman Act, the company was divided into three parts: DuPont, Hercules Powder Company, and Atlas Powder Company. In the 1920s, DuPont released the invention of several polymers, neoprene, and synthetic rubber. In 1935, it released the invention of Nylon. From the 1950s to the 1970s, DuPont invented many new materials, including, Dacron, Nomex, Lycra, Tyvek, and Kevlar. In 1981, DuPont acquired Conoco, the petroleum and natural gas producer. Eighteen years later, in 1999, Conoco was sold as part of DuPont's cleaner living initiative.

In 2008, DuPont operated in more than 70 countries with more than 60,000 employees yielding $30.5 billion in revenue (DuPont, 2009d). That same year, DuPont had 80 lines of business tied to five business platforms: (1) agriculture and nutrition, (2) coating and color technologies, (3) electronic and communication technologies, (4) performance materials, and (5) safety and protection. Products from these five platforms include high-yield seeds, soy protein, photovoltaic materials, industrial resins, and newer versions of DuPont polymers developed over the last century.

DuPont's journey from producing explosives, then polymers, then the wide array of products sold in 2008 represents a fundamental shift in the science applied to create these products. Before 1990, approximately 100% of DuPont's products were chemical

based. By 2008, 30% of DuPont's products were plant based (or bio based), while 70% were chemical based. This shift in product base has occurred in tandem with a reduced environmental footprint and a 72% reduction in GHGs from 1990 to 2008. This shift in product base and company culture at DuPont is characterized as sustainability.

The remainder of this chapter describes the results of the data analysis. The sections correspond to the four areas of inquiry within the primary research question: actions, decisions, interactions, and operations. Each of the seven data clusters aligns to one of the four areas of inquiry within the primary research question.

## Actions

Actions are the visible steps that DuPont engaged in relating to organizational change toward sustainability. These actions marked sudden or incremental changes to DuPont's approach toward the way it conducts business. The two data clusters that most relate to these actions are Cluster 1 (DuPont's Tipping Point for Sustainability) and Cluster 2 (Drivers, Measurements and Social Interactions Contributing to Sustainability).

### *Cluster 1: DuPont's Tipping Point for Sustainability*

This cluster provides a brief history of DuPont relating to key influences, dates, products, major changes, and the tipping point for sustainability. Table 4 provides an overview of this cluster.

**Table 4. Overview of Cluster 1: DuPont's Tipping Point for Sustainability**

| Idea within Data Cluster | Description |
|---|---|
| The Tipping Point | CEO Ed Woolard's speech to the American Chamber of Commerce in London (Woolard, 1989) |
| U.S. Government Regulation and Reporting | The highest profile negative publicity DuPont has received for high emissions was part of the U.S. EPA's Toxic Release Inventory (TRI) in 1989 (Hoffman, 2001). This report is what Greenpeace used as the basis for its protests of DuPont (Murphy & Dee, 1992). |
| Montreal Protocol Chlorofluorocarbon (CFC) Awareness | In 1988, as part of the Geneva Convention, the Montreal Protocol was established. This protocol was set forth by the United Nations Environment Programme (UNEP). It limits the amount of greenhouse gases an organization and company may release into the atmosphere (UNEP, 1990). |
| Nongovernment Organizations (NGOs) | From 1988 to 1990, the NGO Greenpeace protested against DuPont's production of CFCs and other chemicals in order to influence DuPont to stop production of potentially harmful chemicals and weaken public opinion toward DuPont (Murphy & Dee, 1992). |
| Public Opinion | The increased awareness of the public was linked to the increased availability of information describing the problems relating the ozone layer depletion caused by the release of GHGs into the atmosphere (Brundtland Commission, 1987; Daly & Townsend, 1993; Guthrie, Grimm, & Smith, 1991; Hoffman, 2001). |
| Customer Need | CFC suppliers were required to lower their emissions due to the Montreal Protocol and customer need for products with a lower environmental footprint (#1236, personal communication, April 9, 2009). |
| Innovation | DuPont has a culture of innovation (#1239, personal communication, April 30, 2009). |
| DuPont's Core Values | Since the founding of DuPont in 1802, safety, health, and environmental stewardship have been part of the core values of DuPont (DuPont, 2009d; Kinnane, 2002). |

The most visible tipping point that shows DuPont's shift toward sustainability is former DuPont CEO Ed Woolard's (CEO 1989- 1996) speech to the American Chamber of Commerce in London (Woolard, 1989). On May 4, 1989, when Woolard announced his new position as CEO of DuPont, he stated:

> One of our chief concerns is environmental stewardship... In other words, I'm calling for corporate environmentalism—which I define as an attitude and a performance commitment that place corporate environmental stewardship fully in line with public desires and expectations. (Woolard, 1989, pp. 1-2)

This tipping point was preceded by various forces that influenced Woolard to announce DuPont's commitment to corporate environmentalism, which then grew into sustainability. These forces include: U.S. government regulation and reporting, Montreal Protocol and CFC awareness, nongovernment organizations (NGOs), public opinion, customer need, innovation, and DuPont's core values.

*U.S. Government Regulation and Reporting:* Compliance with government regulation is one of the foundational drivers for reducing the environmental footprint at DuPont. The highest profile negative publicity that DuPont has received for high emissions was part of the U.S. Environmental Protection Agency's (EPA's) Toxic Release Inventory (TRI) in 1989 (Hoffman, 2001). This report is what Greenpeace used as the basis for its protests of DuPont. In October 1989, the EPA sued DuPont and seven other companies "to require them to reimburse the EPA for money it spent to remove hazardous wastes from a Delaware landfill" (Murphy & Dee, 1992, p. 6).

*Montreal Protocol and CFC Awareness:* In 1988, as part of the Geneva Convention, the Montreal Protocol was established. This protocol was set forth by the United Nations Environment Programme (UNEP). It limits the amount of GHGs an organization or company may release into the atmosphere (UNEP, 1990). Since that time, the Montreal Protocol has been viewed as one of the main weapons to fight against global warming (Gronewold, 2009). According to Hoffman (2007),

> In March 1988, after the signing of the Montreal Protocol, DuPont announced a voluntary and unilateral phase-out of CFCs through an orderly transition to alternatives. In 1991, the company began operation of the world's first manufacturing facility for the hydrochlorofluorocarbon (HFC)—134a, an alternative to CFCs. Today, CFC alternatives comprise two to three percent of DuPont's portfolio. (P. 91)

*Nongovernment Organizations (NGOs):* NGOs serve as advocates and subject matter experts on issues (Austin, 2000). NGOs can have a supportive or confrontational stance toward an organization (Elkington, 1997). Several NGOs had supportive relationships toward DuPont as its sustainability program developed during 1990's and continued to the present day (as of the time of writing this dissertation). The NGO in the past that had the confrontational and antagonistic relationship with DuPont was Greenpeace. Greenpeace's confrontation with DuPont served as one of the influences that created DuPont's tipping point toward sustainability.

From 1988 to 1990, the NGO Greenpeace protested against DuPont's production of CFCs and other chemicals in order to influence DuPont to stop production of potentially harmful chemicals and weaken public opinion toward DuPont (Friedman & Miles, 2006). In 1988, Greenpeace had 3.3 million members in more than 22 countries (Murphy & Dee, 1992). On April 28, 1988, Greenpeace climbers rappelled down the front of the DuPont building in Wilmington, Delaware, during the annual stockholders' meeting to protest plans for a toxic chemical incinerator at a DuPont plant in Deepwater, New Jersey. The protesters hung a banner that read: "DuPont: Better Things for Better Living?! Toxic Prevention, Not Incineration!" (Murphy & Dees, 1992, p. 6). DuPont's response to this first protest was sending John McAllister, executive assistant for Safety, Health and Environmental Affairs at Du Pont, to meet with Greenpeace (Murphy & Dees, 1992). John McAllister of Du Pont commented:

> We met with them to try to explain our position on CFCs. We reminded them that Du Pont has led the international negotiations to phase out production of CFCs, but the position of Greenpeace is "cease production of CFCs now." Does this mean that people can't use their refrigerators any more? (Murphy & Dees, 1992, p. 8)

Murphy and Dees (1992) indicate that protests by Greenpeace related to CFCs were at their height in August 1989. Greenpeace's protest on August 29, 1989, gained the most media attention of all the Greenpeace protests of DuPont. This event also triggered new conversations about environmental performance and corporate environmentalism among DuPont's senior leaders.

> August 29, 1989, three Greenpeace activists slipped past the barbed wire and security cameras of the Du Pont Chambers Works plant, climbed a 180-ft water tower, rigged a contraption to prevent anyone from following them up the tower, and hung a giant blue ribbon from the top of it declaring DuPont "Number 1, in contributing to destruction of the ozone layer. The next day, more members of Greenpeace bolted an 8-ft-square steel box with two young women activists inside to a Contrail line to block DuPont tank car shipments of CFCs. The Greenpeace activists demanded that DuPont acknowledge the harmfulness not only of CFCs but also of its potential replacements and stop production of CFCs immediately to prevent the interim ozone damage expected during DuPont's lO-year phase out of CFCs (P. 8)

The internal response among DuPont leadership to the Greenpeace protests was significant (#1235, personal communication, March 12, 2009). Willard (2005) describes the situation:

> Public relations (PR) crises get corporate attention. In 1988, Greenpeace activists scaled the wall of a DuPont plant in New Jersey and hung a big "DuPont Number One Polluter" banner facing the Delaware Memorial Bridge, used by thousands of commuters. TV cameras arrived. DuPont CEO Chad Holliday [CEO 1998- 2008] recalls that as a key day DuPont decided to change. (P. 57)

As a response to the protests by Greenpeace, the low scores on the EPA's Toxic Release Inventory, public demand, and because it was the right thing to do, DuPont's senior leaders paused to reflect on this protest event.

> The day Greenpeace protested DuPont and hung up the banner declaring DuPont the number one polluter, several of DuPont's senior leaders were meeting at DuPont headquarters on August 29, 1989. One of the comments within DuPont that day was "you know, they [Greenpeace] are right". DuPont does need to improve its environmental performance and do what is right for the community. (#1237, personal communication, April 17, 2009)

*Public Opinion:* From the late 1980s to 1990, among the public there was an increased amount of information about CFCs, the TRI, the Montreal Protocol, clean air, and related topics (Brundtland Commission, 1987; Daly & Townsend, 1993; Guthrie et al., 1991; Hoffman, 2001). The increased awareness of the public was linked to the increased availability of information describing the problems relating the ozone layer depletion caused by the release of GHGs into the atmosphere.

*Customer Need:* The Montreal Protocol, initiated in 1988, raised the standards for allowable emissions of GHGs. This protocol forced companies to use, produce, and sell products containing gases that had a decreased negative effect on the ozone layer: "DuPont had some very unhappy customers because they knew that that transition was going to impose costs on their operation and one of the big auto companies was routinely calling up its, then, CEO" (#1236, personal communication, April 9, 2009).

*Innovation:* DuPont has a culture of innovation. In the late 1980s, since there was a trend to reduce the products that released GHGs into the atmosphere, DuPont wanted to be the first company to develop and sell cleaner refrigerants. (In the past, refrigerants had been made from GHGs.) DuPont leadership realized that DuPont needed to be quick to invent non-GHG-releasing products and reduce their environmental footprint, or else their competition might be quicker to do so. Interview participant #1239 stated:

> DuPont probably is a victim of its past success. It has been so successful in the past in terms of developing new inventions. There was no Nylon before we (DuPont) invented it. There was something else, but it wasn't Nylon. We had a tremendous research and development arm. We *were* the only game in town, the only game in the world, and other people around the world have caught up. We still have some of the smartest people in the world, although that capability to invent is no longer exclusive to DuPont as it was in the past. (Personal communication, April 30, 2009)

*DuPont's Core Values:* Since the founding of DuPont in 1802, safety, health, and environmental stewardship have been part of the core values of DuPont (DuPont, 2009d; Kinnane, 2002). Once there was scientific evidence that certain products of DuPont were harming the ozone layer, DuPont phased out the production of these products and introduced cleaner alternatives. Because DuPont's core values have a strong emphasis on safety and the environment, it was natural for DuPont employees to develop both large-scale and small-scale solutions to everyday environmental issues within DuPont's operations. Interview participant #1236 stated:

> We had existing structures in place for safety that we could then leverage into environmental performance. People knew the line responsibility to do safety and if you made environment your line responsibility, people knew how to fall in line to do it. That was hugely useful and I think that for the most part environmental controls are not hugely expensive. There are times when there are major capital expenditures. Often it is just improved practices and paying attention to things that you were not paying attention to before. At one plant in Europe there was a leaking pump seal. Someone would just wash the leaking materials into the sewer using a hose. The plant manager said, "Now wait a minute. I pay for those raw materials. I'm leaking them out. I'm paying for the water, to pump the water, it's going into the sewer to my wastewater and treatment plant, and I'm paying to operate that wastewater treatment plant to destroy the raw materials that I paid for." He told the operations manager to "Go around and collect all the hoses. If anyone wants a hose they have to come and ask you for a hose, and you ask them why they want it. If they say it is due to a leaky pump seal you are going to say, "'Well, why don't you fix the damn pump seal?'" That very simple thing, that awareness to think it is not so much a leak, it is "I pay for the material that is leaking" instead of converting it to product, I'm paying again to treat it and that's kind of dumb and how do I fix it? So I think the solutions are simpler than most people imagine. Managers often tend to think of large-scale investments like a scrubber or similar product, although

there are a lot of small solutions that are useful—it is a matter of making or helping people think about it. (Personal communication, April 9, 2009)

*Cluster 2: Drivers, Measurements and Social Interactions Contributing to Sustainability*

This section describes the data gathered related to new language, drivers for sustainability, regard for the environment, social responsibility, and resource and energy efficiency. These concepts explain how DuPont defines sustainable growth, also referred to as sustainability, within DuPont. DuPont has a mission of sustainable growth, defined as "the creation of shareholder and societal value while we reduce our environmental footprint along the value chains in which we operate" (#1238, personal communication, April 30, 2009). Table 5 provides an overview of this cluster.

**Table 5. Overview of Cluster 2: Drivers, Measurements and Social Interactions Contributing to Sustainability**

| Idea within Data Cluster | Description |
|---|---|
| New Language | To communicate DuPont's sustainability focus, the language was authored or adopted to meet DuPont needs by a collaborative effort between DuPont's Public Relations Department, Dupont's Communication Department, and Dupont's leaders. |
| Drivers for Sustainability | Energy needs are one of the main drivers for sustainability. |
| Goal Setting | One of the measures of DuPont's sustainability success is the progress DuPont makes against its sustainability goals. |
| Awards | For more than 50 years, DuPont has had ways to reward individual performance (#1237, personal communication, March 29, 2009). |
| Regard for the Environment | From 1990 to 2008, DuPont reduced its global GHG emissions, measured as $CO_2$ equivalents, by 72% (DuPont, 2009) and shifted its product line from a 100% chemical makeup to a 70% chemical and 30% biological makeup. |
| Coalition Building | Part of what has made DuPont a success in terms of sustainability is its ability to build new networks or coalitions. |
| Social Responsibility | Social responsibility is more essential to sustainability than the environment, although the two areas are mutually dependent on one another. |

| Idea within Data Cluster | Description |
|---|---|
| Principles for Sustainability | The principles that guided DuPont in developing its sustainability strategy. |
| Resource and Energy Efficiency | Energy and resource efficiency as a competitive advantage are bolstered by reducing practices that are inefficient. |

*New Language:* To communicate DuPont's sustainability focus, the language was authored or adopted by DuPont's Public Relations Department, DuPont's Communication Department, and DuPont's leaders. The first term associated with sustainability was *corporate environmentalism,* coined in 1989 for DuPont CEO Ed Woolard's speech to the American Chamber of Commerce in London (Woolard, 1989). Later, the concept developed into *sustainable growth* or *sustainability* during Chad Holliday's tenure as DuPont CEO (#1244, personal communication, August 7, 2009). As part of this study, each interview participant was asked to describe what sustainability means to DuPont in their own words. Most interview participants simply stated the formal definition of sustainable growth that is part of DuPont's mission. Table 6 contains some sample descriptions that DuPont leaders provided that either elaborates on the formal DuPont mission or provides some insight into the meaning of sustainability.

**Table 6. Sample Descriptions of Sustainability by DuPont Leaders**

| Description | Reference |
|---|---|
| Finding a way to grow and meet the needs of humanity without increasing the load on the planet. | (#1237, personal communication, March 29, 2009) |
| We actually created the definition for sustainable growth back in 1998 and so it is creating shareholder and societal value while reducing the environmental footprint along our supply chains. | (#1237, personal communication, March 29, 2009) |
| For a company to embark on a process of sustainable growth, its leaders and employees have to understand two critical things: what they value and how they create value. | (Holliday, 2001, p. 131) |

| Description | Reference |
|---|---|
| Sustainability is in a very consistent disciplined way always doing right things right, which are in the best interest of your stakeholders and your stakeholders include your shareholders, but it also includes your employees, your customers and almost more important in many instances for a company like DuPont, it does include the community that you operate in. The whole idea around creating sustainable outcomes is right things right all the time and doing them in a way where you have the interest of the key people that support you and are involved. | (#1240, personal communication, May 1, 2009). |

*Sustainability* is a highly debated term (see Chapter 2 for the discourse).

Blackburn (2007) states that the word is often misused:

> Companies like DuPont that use the term sustainable growth intend it to mean corporate sustainability as defined by the TBL [Triple-Bottom Line], adding the word growth to make clear sustainability is not about stagnation. However to others, the word growth is to be avoided because it suggests the need to increase size or consumption, irrespective of other ways of adding value through sustainability. Some even think these words mean simply perpetual growth with no social or environmental emphasis at all. (P. 6)

In a personal communication, Hart was asked his opinion of sustainability. He replied:

> I do not think in terms of an organization being sustainable or not sustainable. There are technologies, practices, and strategies that are more or less sustainable. It is hard to draw a fixed boundary around an organization, so the reverberations of an organization's impact upstream and downstream are difficult to quantify, witness the difficulty of making life cycle analyses... I think more in terms of green [incremental] vs. beyond green [leapfrog] strategies. (Personal communication, September 9, 2009)

For an organization to embody Hart's (1997, 2001, 2005, 2009) concept of *beyond green*, it must have a low environmental footprint in its internal processes and in its market-facing products, and it must consider the bottom of the pyramid in processes, products, and services. *Bottom of the pyramid* refers to the people at the bottom of the economic pyramid: the world's poorest, representing two-thirds of the world's population. More

than 4 billion people worldwide live on less than two dollars per day (Epstein, 2008; Hart, 1997, 2005; Hart & Christensen, 2002). Hart commented that if a parallel is drawn between sustainability and beyond green, he no longer sees DuPont as being a sustainable organization:

> DuPont has recently deemphasized "beyond green" in its sustainability approach. I have now stopped using DuPont in my presentations to provide an example of the companies with the most sustainable strategies. DuPont has less regard for disruptive [clean] technologies and the bottom of the pyramid now than it did a few years back. DuPont has gone back to standard sustainability or greening [as in greening vs. beyond greening]. DuPont is now focused less on disruptive innovation and appears to have less inclusion of the underserved at the base of the pyramid than in the recent past. (Personal communication, September 9, 2009)

Before 2008, Hart viewed DuPont as an organization that is beyond green (Personal communication, September 9, 2009). He now considers DuPont merely green because of what appears to be a lesser regard for the bottom of the pyramid.

A further consideration in language as it relates to sustainability is the customer. Interview participant #1236 stated:

> You have got to think beyond your little business because if you see the world only through your little lens you're missing a whole lot. You have to be able to put other people's hats on, put your customer's hat on, put the NGO's hat on and try to see the world through their perspective, because that will help inform your own perspective. (Personal communication, April 9, 2009)

*Drivers for Sustainability:* Senge et al. (2008) describe "three mega sustainability trends that DuPont believes will shape the markets of the future: (1) the drive for renewable energy and materials, (2) the demand for greater safety and security, and (3) the need for increased food production" (p. 130). Interview participant #1234 agreed with the focus on energy: "energy and energy policy and energy pricing and energy security are clearly going to be a driver for DuPont's business strategy" (Personal communication,

April 17, 2009). In further agreement, Linda Fisher, Vice President, DuPont Safety, Health and Environment and Chief Sustainability Officer, said:

> We need to understand, measure, and assess market opportunities. How do you know and communicate which products will be successful in a GHG-constrained world? How should we target our research? Can we find creative ways to use renewables? Can we change societal behavior through products and technologies? The company that answers these questions successfully will be the winner. (Hoffman, 2007, p. 102)

*Goal Setting:* One of the measures of DuPont's sustainability success is the progress DuPont makes toward its sustainability goals. Progress toward these goals is published in DuPont's annual report. DuPont's 2015 Reducing Footprint Goals focus on achieving lower GHG emissions, improving water conservation, increasing car efficiency through its fleet, and further reducing global air carcinogen emissions (for more details, see Appendix J) (DuPont, 2009a). The strategy for achieving the sustainability goals is as follows:

> To achieve sustainable growth, DuPont has developed a three-pronged strategy for action. First, "integrated science" unites chemistry, biology, and other sciences to develop processes and products that are efficient and environmentally friendly. Second, "knowledge intensity" creates value when more knowledge content is added to products and services. Third, "productivity improvement" elevates productivity from an operational to a more central, strategic level. (Holliday, 2001, p. 131)

Another goal-setting method at DuPont is 'stretch goals'. DuPont sets stretch goals for business improvement and sustainability to push the envelope on how DuPont operates and creates value for customers, shareholders, and other stakeholders (#1244, personal communication, August 7, 2009).

*Awards:* For more than 50 years, DuPont has rewarded individual performance (#1237, personal communication, March 29, 2009). In the 1990s, both individual and

business department awards were presented. Both types of awards had significance within the company and community. Interview participant #1237 states:

> We put in what I call an internal cap and trade that basically allowed organizations to come forward with their very best projects outside their normal budget that they thought would earn a good return for shareholders, and equally important that it would reduce the environmental impact of a company. We found individual units started competing for that money, and it became a badge of honor to compete and win for that. The second thing we did was create sustainable growth awards so as people throughout the company performed specific actions to reduce the environmental impact, we were able to reward that at the country and local level. Ultimately 10 to 15 groups annually received awards. This created a lot of status and prestige for people working on those subjects. The third piece is having a sustainable growth officer go meet with each business and really have them talk about the entire value chain they are a part of, not just their part or what happens to their product with the next customer, but their customers' customers' customer—looking all the way from the basic raw materials to the recycle step. This examines the whole value chain. Thinking about the value chain yields a lot more possibilities than just thinking about shareholders in the process. (Personal communication, March 29, 2009)

In 1990, DuPont began offering awards to employees for achievement related to emissions reduction, energy efficiency, water conservation, and new products that reduce DuPont's or its customers' environmental footprint. Interview participant #1237 stated:

> DuPont created sustainable growth awards so as people throughout the company did specific actions to reduce the environmental impact, we were able to reward that at the country and local level and ultimately get it up to a group of about 10 to 15 awards annually for the corporation. That created a lot of status and prestige to people working on those subjects and it made a tremendous difference in what we are doing. (Personal communication, March 29, 2009)

In addition to internal awards, DuPont has received at least one prestigious award annually since its efforts to develop sustainability began in the early 1990s. For example, in 2003, the Environmental Excellence Award, from the U.S. EPA, was presented jointly to DuPont and Chrysler (#1238, personal communication, April 30, 2009).

*Regard for the Environment:* From 1990 to 2008, DuPont has reduced its global GHG emissions, measured as $CO_2$ equivalents, by 72% (DuPont, 2009). By 2015,

DuPont plans to further reduce its GHG emissions at least an additional 15% from a base year of 2004 (for more details, see Appendix J) (DuPont, 2009). From 1990 to 2008, in support of DuPont's market-facing goals, the science and materials that make up DuPont's products have shifted from a 100% chemical-based materials to 70% chemical-based materials and 30% bio-based materials (DuPont, 2009c).

*Coalition Building:* Part of what has made DuPont a success in terms of sustainability has been its ability to build new networks or coalitions. In support of sustainability, DuPont has founded new coalitions and departed from some existing business networks in order to maintain higher values than those of former coalitions. One sustainability-related coalition is the U.S. Climate Action Partnership (USCAP). USCAP is an alliance of major businesses and leading climate and environmental groups that have come together to call on the federal government to enact legislation requiring significant reductions of GHG emissions (USCAP, 2006).

A group with goals contrary to USCAP, which DuPont once belonged to and then departed from, is called the Global Climate Coalition. Flannety (2005) describes DuPont's involvement as follows:

> The Global Climate Coalition is an industry lobby group founded in 1989 by fifty oil, gas, coal, auto, and chemical corporations. During the eleven years of its existence the organization gave $60 million in political donations and spent millions more on propaganda. The stated purpose of the Global Climate Coalition was to "cast doubt on the theory of global warming." It spread misinformation and doubt wherever it could, and among its more effective scare tactics was the claim that addressing climate change could add fifty cents per gallon to the price of gasoline in the United States. Its greatest success, however, was the role it played in the 1992 Rio Earth Summit's failure to adopt strong measures to protect all humans from the danger of climate change. As the scientific evidence for climate change began to firm up, the agenda of the Global Climate Coalition was reevaluated by some members. DuPont left in 1997. Presumably it had learned from its experience with the Montreal Protocol that regulation to control pollutants can be good for business. (P. 243)

*Social Responsibility:* Social responsibility is a natural extension of DuPont's core values of (1) safety and health, (2) environmental stewardship, (3) highest ethical behavior, and (4) respect and value for people (DuPont, 2009d). Social responsibility is a way of looking out for the safety of the community and environment. Social responsibility is more essential to sustainability than the environment, although the two areas are mutually dependent on one another. Interview participant #1242 states:

> The environmental footprint story gets told a lot, but the new products that have sustainability-related market-facing goals to grow businesses like Kevlar (that protects people's lives) and Tyvek (that saves energy in housing)—that is going to be the big story for DuPont in the future. It appears to be an environmental footprint story, but the real transformation going on in DuPont has to do with the societal value of the products and services. (Personal communication, April 24, 2009)

Another aspect of social responsibility is that of awareness. DuPont is forced to be socially aware of the perception of its intentions and actions or face the consequences. Dupont must manage perceptions as well as adhere to legal requirements. Interview participant #1240 states:

> We operate in a way where if we're not environmental sensitive, our right to operate will be revoked. So from a practical point of view there's a social interface there, and that right to operate in many instances may be based on perception not necessarily based on fact so there's a real interface there. (Personal communication, May 1, 2009)

Principles for Sustainability: The principles that guided DuPont in developing its sustainability strategy describe the ways sustainability manifested when it was applied at DuPont. Table 7 describes a sample of DuPont's principles for sustainability.

**Table 7. Sample of DuPont's Principles for Sustainability**

| Title of Principle | Description of Principle |
|---|---|
| Make Sustainability Part of Every Aspect of the Organization | Sustainability must be part of every aspect of the organization rather than be a separate area. Typically, an organization will create a separate sustainability unit and appoint a sustainability officer in each business. Then, over time, the goal is to integrate sustainability into every aspect of the organization (#1237, personal communication, March 29, 2009). |
| Change Champion | A leader of organizational and business change toward sustainability is needed at the most senior level of the organization. This person leads the effort to maintain the sustainability strategy, invest in sustainability, innovate, communicate, and engage the stakeholders. Additional leaders are needed at every level of the organization (e.g., at each site and in each business). (#1237, personal communication, March 29, 2009) |
| Timing | DuPont strives to create products so that they will be available as the customer needs them at the right time and right price. Sometimes this requires convincing the customer that the product will be needed (#1238, personal communication, April 30, 2009). |
| Resilience | One of DuPont's core competencies is resilience. This competency has enabled DuPont to be in business for more than 200 years. |
| Repurposing Technology | DuPont's leading products are applied in new ways that go beyond the original purpose for the product. This repurposing of technology is a type of innovation (#1240, personal communication, May 1, 2009). |
| Strategic Placement in the Value Chain | In the past, DuPont would often strive for vertical integration within a certain industry for a certain type of product. Today (in 2008), DuPont typically will focus its business in one area of the value chain (#1242, personal communication, April 24, 2009). |
| Continuous Realignment | DuPont continuously realigns its organizational change management strategy and business strategy (Goldemberg, 1998). |
| Goals, Measurement, and Reporting | Goals, measurement, and reporting should be in place for operations, products, services, and social responsibility (#1237, personal communication, March 29, 2009). |

*Resource and Energy Efficiency:* Resource and energy efficiency are important to every part of the value chain. The design, manufacturing, delivery, and disposal of products and all their related waste materials can reduce costs through resource and

energy efficiency. Energy and resource efficiency as a competitive advantage are bolstered by reducing practices that are inefficient. Interview participant #1242 states:

> The company still has a great deal of waste, although substantial elimination of waste by making products rather than waste has a huge financial benefit for the company. Starting in 1995 we began looking more closely at the numerator and wanted something that grows while the waste, energy, and similar areas decreased. That is how we transitioned into sustainable growth. Sustainable growth is increasing shareholder and societal value (it is a numerator), while decreasing the environmental footprint along the value chains. Now we are doing two things: increasing the good and reducing the bad—as you do this your margins become higher and your profitability increases. (Personal communication, April 24, 2009)

Energy efficiency and renewable energy are highly competitive areas because they are vital to all aspects of society around the globe. DuPont is developing biofuels. One recommendation from interview participant # 1234 was that DuPont concentrate more of its effort in this area:

> We are probably spread thinner than we can be to be successful long term. We should concentrate more on specific areas, giving us more ability to succeed. For example, if you look at agriculture and biofuels we are competing with giants. As a long-term big planner we are going to have to put more money into it. The only way we can do that is if we are not investing money in other businesses that perhaps have been critical to our past, and do not necessarily allow us to increase investment in our efforts in other areas. (Personal communication, April 17, 2009)

**Decisions**

Decisions are the choices that DuPont had to make to determine how sustainability would be engaged in. These decisions affected every aspect of the DuPont organization: operations, products and services, management style, roles, communications, and various other areas. The two clusters described in this section include Cluster 3 (The Interplay Between Business Strategy and Sustainability) and Cluster 4 (How DuPont's Values and Competencies Influenced Sustainability).

*Cluster 3: The Interplay Between Business Strategy and Sustainability*

Since 1989, sustainability has been an explicit part of DuPont's business strategy. Each year since then, sustainability has become a greater part of DuPont's business strategy. Table 8 provides an overview of this cluster.

**Table 8. Overview of Cluster 3: The Interplay Between Business Strategy and Sustainability**

| Idea within Data Cluster | Description |
|---|---|
| Competitive Advantage | DuPont set itself apart from its competitors in the chemical industry and rebranded itself as a science company that has strengths in multiple industries. |
| DuPont Business Management and Strategy Model | The three components of the organization are structures, processes, and systems. The management methodology consists of strategy, people, and execution. |
| Business Case | By 1995, DuPont was leading the chemical industry in sustainable business practices. |
| Business-Facing Goals | DuPont incorporates sustainability into its business goals by having clear and measurable targets. |
| Economics | DuPont strives to create products so that they will be available as the customer needs them at the right time and right price. |
| Resilience | One of DuPont's core competencies is resilience. It has enabled DuPont to be in business for more than 200 years. |
| Velocity | DuPont created clear goals and drivers for its sustainability strategy. These goals were bolstered by leaders who followed through on the goals. |

*Competitive Advantage:* DuPont keeps a competitive advantage by staying ahead of environmental legislation:

> DuPont, for instance, includes environmentalists on its internal biotechnology advisory panel. Our ability to get product to market is moving faster than the EPA's ability to get rules out, and we want to agree in advance on what the rules of the road should be, said Linda J. Fisher, Vice President, DuPont Safety, Health and Environment and Chief Sustainability Officer. (Dunphy et al., 2007, p. 78)

DuPont set itself apart from its competitors in the chemical industry and rebranded itself as a science company that has strengths in multiple industries: "Paul

Tebo said that DuPont's shift toward biotechnology, chemistry, and natural systems, as opposed to synthetic ones is clearly a transformational change" (Senge et al., 2008, p. 125).

DuPont currently has a safety consulting business, through which DuPont teaches and certifies other organizations in safety. DuPont is entering into a similar business related to water and energy efficiency and waste reduction. Interview participant #1240 stated:

> Today we're beginning to investigate how we can start to sell knowledge and new ideas to people. One of DuPont's new services is called *operational effectiveness*, meaning that we share knowledge related to areas where we have become more energy efficient and more environmentally friendly on the basis of minimizing water usage or minimizing emissions or releases. We can sell that knowledge and information to people through a process similar to the way we sell knowledge and information related to safety. (Personal communication, May 1, 2009)

*DuPont Business Management and Strategy Model:* Figure 4 and Table 9 depict how DuPont considers its organizational components and management methodology. Regardless of the type of transformation, DuPont applies this high-level methodology to manage both organizational change and its own organization on a day-to-day basis (#1237, personal communication, March 29, 2009).

Three components of the organization are structures, processes, and systems. Structures are the reporting relations between people and organizational units (e.g., organizational chart). Processes are the interactions between people and groups (e.g., performance evaluations). Systems are the mechanisms for information exchange between people and business units (e.g., capital resource planning) (#1237, personal communication, March 29, 2009).

DuPont's management methodology consists of strategy, people, and execution. Strategy is the short- and long-term desired positioning (e.g., annual review process). People are the human beings who lead and operate the organization (e.g., training). Execution is the actions taken, resources deployed, and results delivered (e.g., weekly process review).

**Figure 4. DuPont Business Management and Strategy Model**

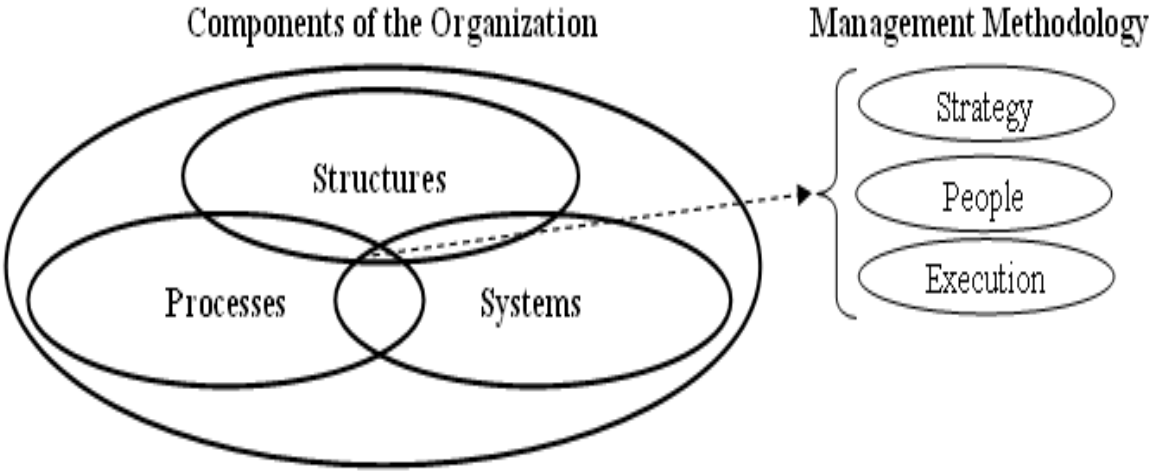



**Table 9. Description of DuPont's Business Management & Strategy Model**

| | | | |
|---|---|---|---|
| Components of the Organization | **Structures** | **Processes** | **Systems** |
| | • Reporting relationships between people and organizational units<br>• E.g. organizational chart | • Interactions between people and groups<br>• E.g. performance evaluation | • Mechanisms for information exchange between people and business units<br>• E.g. capital resource planning |
| Management Methodology | **Strategy** | **People** | **Execution** |
| | • Short and long term desired positioning<br>• E.g. annual review process | • Human beings that lead and operate the organization<br>• E.g. training | • Actions taken, resources deployed, and results delivered<br>• E.g. weekly process review |

*Business Case:* By 1995, DuPont was leading the chemical industry in sustainable business practices. Hoffman (2001) said:

> In 1995, Harvard strategy professor Michael Porter wrote in the Harvard Business Review that environmental protection was not a threat to the corporate enterprise but rather an opportunity, one that could increase its competitive advantage in the marketplace. Put another way, he was arguing that any company that made pollution control expenditures beyond what was required by law was now practicing pure and unadulterated capitalism. Consistent with this shift in mindset, a 1991 survey by the Conference Board found that 77 percent of U.S. companies had a formal system in place for proactively identifying key environmental issues! And executives from corporations such as Dow, Monsanto, DuPont, and Union Carbide were actively espousing the benefits of proactive environmental management while instituting programs for community relations, product stewardship, pollution prevention, and environmental leadership, all in the name of increasing corporate competitiveness and shareholder returns. (Pp. 3-4)

*Business-Facing Goals:* DuPont incorporates sustainability into its business goals by having clear and measurable targets. Hart (2005) said:

> [Former] DuPont CEO Chad Holliday recently commented: "The objective for our industry ought to be sustainable growth. In the [twenty-first] century, we are going to have to find ways to create value while decreasing our environmental footprint." In the late 1990s, I worked with DuPont Vice President Paul Tebo and others to analyze the corporate footprint by comparing the total pounds of materials consumed per annum in each business with shareholder value added (SVA) per pound. The analysis highlighted three distinct groups of businesses for DuPont. (P. 45)

Lowering waste, energy usage, and emissions were the first step in DuPont's path toward sustainability in the early 1990s. Hoffman (2001) said:

> In 1991, DuPont announced a $500 million capital improvement plan at three North and South Carolina chemical plants, which it claimed would reduce air emissions by 60 percent while increasing production by 20 percent. The "win-win" scenario replaced pollution prevention and waste minimization as the dominant rhetoric and logic. In a 1995 Times Mirror poll, 69 percent of Americans believed that environmental protection and economic development could work together. (Pp. 155-156)

Interview participant #1238 states: “Internally there was the annual report on how DuPont was doing versus our goals in order to provide feedback on our goals. In many cases individual units had specific goals themselves so they shared the impacts with their employees” (#1237, personal communication, March 29, 2009).

*Economics:* DuPont strives to create products so that they will be available as the customer needs them at the right time and right price. Interview participant #1238 stated:

> DuPont is very customer oriented. We really try to anticipate what customers’ needs are now and what they will be in the future. Sometimes it is impossible to see everything. You try to look at that next step out there, anticipate it and then you have to convince the customer sometimes. When it is a costing war, they don’t want to buy it, they want everything lower cost. It is important to anticipate and at the same time be very cost competitive too. (Personal communication, April 30, 2009)

*Resilience:* One of DuPont’s core competencies is resilience. It has enabled DuPont to be in business for more than 200 years. Interview participant #1240 stated:

> DuPont has been in existence for over 200 years and it would like to be around for 300 so becoming more sustainable allows it to position itself to be able to move in that direction, but it must put itself in a position to where it has other qualities and characteristics that allow it to remain resilient even under the pressure of things that are unrelated to anything to do with the environment or anything to do with business results. Simple examples…we had a gigantic storm that—that impacted some of our operating units some years ago and they were devastating and fortunately we had an excellent recovery process in place that allowed us to get back fast and to be back in a position to where we didn’t lose any more than we did so we were able to remain resilient even in the face of a catastrophic type of occurrence there are aspects of the whole notion of resilience that is different than the concept of sustainability in and of itself.
>
> A lot of people worry about loss of intellectual property and they worry about communicating too much. The reality is, is that [aside]…yes, the reality of it is, is that sustainability in order to achieve it, which I believe has as its ultimate goal business or enterprise resilience, things happen no matter how careful you are or how disciplined you are, and you need to be able to cope with those issues in a long-term sense, so the whole issue ultimately is about business resilience. (Personal communication, May 1, 2009)

*Velocity:* DuPont created clear goals and drivers for its sustainability strategy. These goals were bolstered by leaders who followed through on the goals. Holliday (2001) describes DuPont's strategy:

> To achieve sustainable growth, DuPont has developed a three-pronged strategy for action. First, "integrated science" unites chemistry, biology, and other sciences to develop processes and products that are efficient and environmentally friendly. Second, "knowledge intensity" creates value when more knowledge content is added to products and services. Third, "productivity improvement" elevates productivity from an operational to a more central, strategic level. (P. 131)

*Cluster 4: How DuPont's Values and Competencies Influenced Sustainability*

DuPont's core values connect DuPont's past, present, and future. The core values are the foundation that DuPont moves from when it works to develop a new product, enter a new market, or consider solutions to a problem facing the company. Interview participant #1238 stated:

> What connects the person who works for the company today to the person who worked for the company in 1812? It is a certain set of values, a certain way of doing business, a certain commitment to science and technology and so on. That is where the core values become important. (Woolard, 1989)

When DuPont works to develop better products, the products must align with the core values. Interview participant #1240 stated that when DuPont looks at the marketplace and works to determine what new products are needed, "We [DuPont] are looking at making things better and easier, and looking at ways that we can adapt the world around us today so that people are more efficient and effective, particularly that they are safer and healthier" (personal communication, May 1, 2009). Table 10 provides an overview of this cluster.

**Table 10. Overview of Cluster 4: How DuPont's Values and Competencies Influenced Sustainability**

| Idea within Data Cluster | Description |
|---|---|
| Core Values | DuPont's core values are (1) safety and health, (2) environmental stewardship, (3) highest ethical behavior, and (4) respect and value for people (DuPont, 2009d; Holliday et al., 2002). |
| Innovation | "Since 1802, DuPont has been awarded patents for more than 34,000 inventions, meaning that, on average, we have introduced a new innovation every other day for the last two centuries" (DuPont, 2009a, p. 4). |
| Knowledge as a Resource | DuPont applies several methods for problem solving and sharing knowledge within the company. One technique for problem solving is exercising the *5 How's* (#1238, personal communication, April 30, 2009). |
| Repurposing Technology | DuPont's leading products are applied in new ways after their development that goes beyond the original purpose for the product. This repurposing of technology is a type of innovation (#1240, personal communication, May 1, 2009). |
| Strategic Placement in the Value Chain | In the past, DuPont would often strive for vertical integration within a certain industry for a certain type of product. Today (in 2008), DuPont typically will focus its business on one area of the value chain(#1240, personal communication, May 1, 2009). |
| Rigorous Research and Development | Many of DuPont's best products required two to three decades to develop (#1243, personal communication, July 13, 2009). |

*Core Values:* DuPont's core values are (1) safety and health, (2) environmental stewardship, (3) highest ethical behavior, and (4) respect and value for people (DuPont, 2009d; Holliday et al., 2002). Interview participant #1238 said:

> DuPont always has been a company that is dedicated to safety, environmental ethics & stewardship, and respect for people. These values have always been part of the DuPont core principles. Although with the recent emphasis on the sustainability effort, the company has even become more oriented to have a better future and have goals that are stricter for our own planter and ensuring our customers have those products that will be used efficiently. (Personal communication, April 30, 2009)

Agreeing with this statement, interview participant #1240 stated, “Safety, health, the environment, and people treatment and ethics is built into our DNA” (Personal communication, May 1, 2009).

Among the core principles at DuPont, throughout the history of DuPont the greatest emphasis has been on safety. Interview participant #1239 stated:

> Since the inception of DuPont, whenever there was a change in the manufacturing process there was always a family member on that shift when the change was made. The element of safety as a core value has been there forever. I think we evolved along the way to include respect for all people and environment [and environmental health] as we became more of these things. (personal communication, April 30, 2009)

Safety is the first lesson DuPont employees learn on their first day working at DuPont. Interview participant #1238 stated:

> I recall my first day on the job at DuPont. I had to wear glasses all the time, even when I went outside I wore the glasses. It was very hard to get used to wearing glasses because I had never worn glasses. We do not want any accidents. The very first thing you learn is to always wear your safety glasses. (Personal communication, April 30, 2009)

A natural extension of DuPont’s emphasis on safety is sustainability. Sustainability extends DuPont’s over-200-year-old emphasis on safety from the wellbeing of employees to the wellbeing of the community and the environment. During the late 1980s, there was an increased scientific and public awareness of environmental issues (Hoffman, 2001; Hounshell & Smith, 1988; Murphy & Dee, 1992). Once DuPont realized there was a need to improve its environmental controls, the value of environmental stewardship became more explicit as a core value at DuPont, although implicitly the value was already there. This stewardship for the environment was extended as a requirement for many of its customers further down the product value chain. Here is an example of requiring

customers to have high regard for the environment in order to be allowed to purchase a potential environmentally harmful product from interview participant #1240:

> DuPont's commitment in the area of product stewardship as it relates to environmental and human health protection is exemplified when we look at how we produced a number of electronic gases called in product nomenclature 116, a gas needed in the manufacturing of microchips. In one case when microchips were fabricated and broken down into component parts, they are put into chambers and exposed to this gas, creating a cleaning process that cleans off any type of contaminate, oils or other materials. Then once they are clean they can be processed and stored away. It is a very valuable gas, although the gas is an aggressive global warmer. When we sold the gas, we would only sell it to people who would sign a document and then verify the approach that once they had used the gas in the chamber they could no longer reuse the gas. The customers system was required to be set up so that it would not vent the gas into the atmosphere, otherwise DuPont would not sell the gas 116 to that particular customer. We would only sell the gas to a customer who would incinerate it back to basically hydrogen and water vapor when finished using it in a way that it would became environmentally friendly. That is an example of an intended product stewardship approach around being able to provide something people can use that was very valuable, and providing it in a way that would not result in future damage to the environment. (Personal communication, May 1, 2009)

Regard for the environment and safety in many cases led to the invention, development, and manufacturing of new products. On December 3, 1984, more than 40 tons of methyl isocyanate gas leaked from a Union Carbide–owned pesticide plant in Bhopal, India (Broughton, 2005). As a result of this accident at another company, DuPont invented new ways to keep communities and employees safe. Interview participant #1240 stated:

> DuPont manufactured methyl isocyanate at one of its plants and transported it over the road in tank trucks to another plant at quite some distance in order to produce another product. As a result of what occurred, there in Bhopal, it became obvious to us that we should not be putting other people at risk just in our own business interest and so the business was told we can no longer do that unless you can find a safer way. To have built the plant, to have produced the material at the new site, the site where they actually did consume it would have been too expensive so the business would have gone out of business. But the technical people working with engineering redesigned the process at the plant where the material could be created, methyl isocyanate was created inside the

> pipes and consumed in the pipes in a reaction mechanism so there was never any free methyl isocyanate in the environment and we could shut down the plant that made it, no longer move it over the roads, but still make the same products that we made before. (Personal communication, May 1, 2009)

DuPont's values have led the direction for how innovation occurs both in DuPont's internal processes (research and development and manufacturing) and in the products that are chosen for development.

*Innovation:* DuPont has a history of being a market leader because it has the best products within its industry(s) (Chandler, 2005; Chandler, Bruchey, & Galambos, 1968; Chandler, 1962; Charan, 2009): "Since 1802, DuPont has been awarded patents for more than 34,000 inventions, meaning that, on average, we have introduced a new innovation every other day for the last two centuries" (DuPont, 2009a, p. 4). DuPont's ability to use innovation to develop or apply previously developed science in new ways gives it a competitive advantage over its competition. The themes related to innovation indicated by the data in this study include knowledge as a resource, repurposing technology, strategic placement in the value chain, and rigorous research and development.

*Knowledge as a Resource:* One of DuPont's greatest assets is its intellectual capital. This capital resides in the employees' minds, data repositories, patents, and in the thousands of internal reports detailing DuPont's research and development of new science and how that science can be applied to new products.

One technique for looking more deeply at a phenomenon to better understand the principles guiding it is the *5 How's*. Interview participant #1238 stated that DuPont will ask five questions to deeply consider a phenomenon. This technique is based on Toyota's *5 Why's*. This technique is both a training exercise and a standard problem-solving technique. Interview participant #1238 states:

> One DuPont training theme is that we keep asking the question, "How do you know this?" This question technique is similar to a line of questioning Toyota employs. When there is a problem in Toyota they apply the 5 why's. For instance, at Toyota if the problem is a defect in the car, one asks, "Well why?" Then one replies to each answer with the question, "Well why?" Then one continues to ask 5 why's. At DuPont we ask the five how's, "How do you know?" Well, how do you know that? (Personal communication, April 30, 2009)

These questions may lead the questioner to realize that he or she does not have the answer yet, and this realization often makes apparent any underlying assumptions that may be false. Understanding the underlying assumptions and rationale can help find the answers needed to innovate.

As of 2008, DuPont has a safety consulting business that is being expanded to offer e-learning and training globally. A future opportunity for DuPont will be to offer training and consulting to customers related to the management of energy, water, and carbon. Interview participant #1240 stated:

> Today DuPont is beginning to investigate how we can start to sell knowledge and new ideas to people from an area called *operational excellence*, for example as it relates to energy efficiency. DuPont has become more environmentally friendly on the basis of minimizing water usage and minimizing emissions or releases. We can sell that information to customers through a process similar to the way we sell the safety sales. We are opening up the door to a whole collection of new services [called *operational excellence*]. DuPont is aggressively trying to grow business in this area and would like to see businesses like this grow into billions of dollars a year worth of revenue. It is back to this idea of how do I have more knowledge-intensive businesses so that I am creating more shareholder value on the basis of the knowledge that is in the product of the service as opposed to requiring raw materials and energy be a component part of the process. (Personal communication, May 1, 2009)

*Repurposing Technology:* DuPont has various market-leading products, such as Kevlar, Nomex, and Solae soy protein. DuPont's leading products are applied in new ways after their development that goes beyond the original purpose for the product. This

repurposing of technology is a type of innovation. Interview participant #1240 describes how Nomex was applied to improve the performance of cell phones:

> One DuPont engineer figured out that if you make cell phone circuit board using Nomex rather than fiber glass, the electrical properties are the same without loss of function and those boards did not flex. This allows the manufacturer to make a cell phone that essentially will never break based on the old trend. All you have to do is use the DuPont product. Due to the knowledge that is in that product versus the knowledge that was in that fiberglass product, you can sell it for a lot more money. A small piece of Nomex sells for a lot more money than a lot of the fiber would due to its value and use in terms of putting it in the cell phone. (Personal communication, May 1, 2009)

*Strategic Placement in the Value Chain:* In the past, DuPont would often strive for vertical integration within a certain industry for a certain type of product. Today (in 2009), DuPont typically will focus its business in one area of the value chain. Interview participant #1240 stated:

> DuPont was of a view that we have to control the entire value chain. We have advanced to the point where we look at where the value is in the value chain. We want to be where the value is and not necessarily control the entire value chain. (Personal communication, May 1, 2009)

Interview participant #1244 agreed with interview participant #1240 that DuPont now chooses smaller segments within the value chain to focus on. Interview participant #1244 also noted the complication of competing with lower quality products with a much lower price:

> The old paradigm within DuPont was discover something, get a patent, build a plant to produce the product—and then nobody can now compete with us. It is so clear those days were over when Japan, Korea, and other countries were coming up with great ideas. For instance in one case the Koreans would buy technology from the Japanese, build a plant, then make a product 80 percent as good as DuPont and sell it for 60 percent of the price. (Personal communication, August 7, 2009)

*Rigorous Research and Development:* Many of DuPont's best products required two to three decades to develop. Nylon was released in 1935. It

required close to three decades of polymer development for DuPont to invent and then bring Nylon to market (#1243, personal communication, July 13, 2009). The case has been the same with DuPont's sustainability-related products. Interview participant #1240 stated that the initial thinking related to the fundamental science and engineering for sustainability started back in the 1980s (Personal communication, May 1, 2009).

## Interactions

Interactions describes the exchanges that occurred among DuPont leaders and employees, between DuPont and other organizations, and the role of communications. These interactions promoted sustainability, allowed knowledge to be shared, and contributed to developing new strategies aligned with sustainability at DuPont. Two clusters described in this section include Cluster 5 (Overcoming Resistance to Organizational Change) and Cluster 6 (Communicating DuPont's Sustainability Strategy).

### *Cluster 5: Overcoming Resistance to Organizational Change*

During DuPont's transformation toward sustainability, there was resistance to change in several ways. The status quo for employees was to think a certain way that may not have changed over the course of several decades. Many manufacturing plants produced the same materials using the same processes. DuPont was a successful company prior to its shift toward sustainability. Many leaders did not understand why their business area needed to change or how to change it. For the institutional and individual resistance to be overcome, each employee had to embrace sustainability and come to understand the implications for their area within DuPont. Some people resisted

getting involved in the shift toward sustainability at DuPont. Interview participant #1237 stated:

> There were some people who thought we could not do both, have a successful business economically and heal the environment. There were specific stands we took on certain environmental issues that people thought were inappropriate, such as deep-well ejection waste. In the case of deep-well injection, some people thought that was going too far and as it turned out with time it probably was. (Personal communication, March 29, 2009)

The movement to overcome internal and external resistance to sustainability at DuPont was both planned and emergent. The senior management directed the business units to increase efficiency; decrease costs; and decrease the environmental footprint of DuPont's operations, services, and products. How this was to be accomplished in many cases had to be discovered by each business unit. To facilitate the change process, there were incentives, marketing, training, measurement, planning, and intervention from leadership in each business unit as needed. Table 11 provides an overview of this cluster.

**Table 11. Overview of Cluster 5: Overcoming Resistance to Organizational Change**

| Idea within Data Cluster | Description |
|---|---|
| Incentives | Since 1990, DuPont has held an awards program to recognize the best accomplishments across the company. The four areas in which awards are given are science, engineering, marketing and sales, and sustainable growth. |
| Marketing and Outreach | Externally, there was some advertising. DuPont's main method for communicating sustainability to the public was through going to conferences, publishing papers, holding interviews, and trying to get the press to understand and write articles about what DuPont was doing (#1237, personal communication, March 29, 2009). |
| Training | There were various types of training sessions related to the environment and sustainability (#1237, personal communication, March 29, 2009). |

| Idea within Data Cluster | Description |
|---|---|
| Participation in Professional Organizations and Coalitions | DuPont was an active member in various organizations that both helped DuPont leadership to better understand sustainability and allowed DuPont a place where it could influence other organizations to follow its lead in incorporating sustainability into their practices (#1237, personal communication, March 29, 2009). |
| Measurement | The main measure of DuPont's sustainability success is the annual reporting of its progress toward the 7- to 10-year sustainability goals (#1235, personal communication, March 12, 2009). |
| Planning | Every year, each business unit within DuPont has to develop its business plan and goals for the year. Part of that plan has to include a Corporate Environment Plan, so that each business unit's environmental impact can be tracked for its progress (#1235, personal communication, March 12, 2009). |
| Role of Leadership | The change toward sustainability at DuPont was leadership driven, top down (#1242, personal communication, April 24, 2009). |
| Change Champion | Since 1990, DuPont has had a Vice President–level executive with sustainability-focused responsibilities (#1237, personal communication, March 29, 2009). |
| Organizational Structure | DuPont's organizational structure was harnessed to support sustainability and was changed as needed to support the way DuPont was changing. Since 1989, DuPont has had a team that focused on pushing sustainability within DuPont (#1237, personal communication, March 29, 2009). |
| Speed of Change: Evolution vs. Revolution | At DuPont, both types of change occur simultaneously. Many of the breakthrough products that had great profits within a couple years, such as Nylon, relied on two decades of research and development (#1239, personal communication, April 30, 2009). |

*Incentives:* Since 1990, DuPont has held an awards program to recognize the best accomplishments across the company. The four areas in which awards are given are science, engineering, marketing and sales, and sustainable growth. Regarding the sustainable growth award, interview participant #1237 stated:

> DuPont created sustainable growth awards to recognize employees throughout the company who accomplished specific actions to reduce the environmental impact. Rewards were at the country and local level. Ten to 15 individuals or groups were given the award annually. The award created a lot of status and

> prestige to people working on those subjects. This made a tremendous difference in what DuPont was doing. (Personal communication, March 29, 2009)

*Marketing and Outreach:* Externally, there was some advertising. DuPont's main method for communicating sustainability to the public was through going to conferences, publishing papers, holding interviews, and trying to get the press to understand and write articles about what DuPont was doing. Interview participant #1237 stated:

> There was a lot of outreach to local communities, including meeting with individual environmental groups and communities to understand what they were about and we would also reward and recognize employees who would on their own time want to go work on an environmental project. (Personal communication, March 29, 2009)

*Training:* There were various types of training sessions related to the environment and sustainability. Interview participant #1237 stated:

> People from outside would come in to talk about the subject. Paul Gilding [a former leader at Greenpeace] would come in frequently and talk about the environment and how Greenpeace would look at the things DuPont was doing. For example, twice a year there was an annual meeting of senior management where they were trained to talk more about sustainability. (Personal communication, March 29, 2009)

*Participation in Professional Organizations and Coalitions:* DuPont was an active member in various organizations that both helped DuPont leadership to better understand sustainability and allowed DuPont a place where it could influence other organizations to follow its lead in incorporating sustainability into their practices. DuPont has partnerships or other trading relationships with organizations all around the world, including thousands of for-profit organizations, as advocates, trading partners, customers, and suppliers, as well as through trade associations. As a founding member of the U.S. Climate Action Partnership (USCAP), DuPont has worked to pressure Congress to

improve environmental legislation (USCAP, 2006). One proposal was a cap-and-trade system.

In October 2008, leaders at companies in Japan indicated to the then CEO of DuPont, Chad Holliday, that the global economy is starting to take a downturn (Charan, 2009). Based on that feedback, DuPont held emergency meetings to prepare for possible changes, including advising employees how to reallocate their retirement benefits and cutting back 20,000 contractors (Charan, 2009). Regarding customers, interview participant #1237 stated:

> Our customers sometimes will be concerned that you know we would encourage legislation that would increase their cost to make them less competitive so there was some concern likewise of suppliers, but overall it's been very well received. (Personal communication, March 29, 2009)

DuPont has earned several accolades for its involvement with the World Business Council for Sustainable Development (WBCSD). From 2001 to 2002, former CEO Chad Holliday served as the chair for WBCSD. Interview participant #1237 stated:

> The formation of the World Business Council for Sustainability Development, which occurred I guess sometime in the 1990s, was a recognition about other companies globally that were trying to do the same thing so I think that was a big help, participating in that and getting momentum and power from other organizations. (Personal communication, March 29, 2009)

Another organization that DuPont was involved with was the American Chemistry Council. Interview participant #1237 stated:

> What we do have with the American Chemistry Council in the U.S. and their equivalent councils' in all the other countries is something called *responsible care*. This is a series of standards around how chemical companies will operate in a very responsible [way] so that they adhere to the policy. There are third-party audits where groups come in and audit how each company is performing. (Personal communication, March 29, 2009)

*Measurement:* DuPont has various ways of measuring its sustainability progress. In the early 1990s, one method was to analyze the environmental footprint by comparing the total pounds of materials consumed per annum in each business with shareholder value added per pound (Hart, 2005). The main measure of DuPont's sustainability success is the annual reporting of it progress toward the 7- to 10-year sustainability goals. DuPont also reports its emissions through the Chicago Climate Exchange. This is the U.S. exchange for carbon credits. Once there are carbon restraints in the U.S. economy, this exchange will become more prevalent. Interview participant #1235 stated:

> We are a member of the Chicago Climate Exchange, which requires third-party verification of our greenhouse gas emissions reductions so that we can then sell credit. All organizations with sites in the U.S. that are part of the Chicago Climate Exchange grouping do have a third-party audit process. (Personal communication, March 12, 2009)

*Planning:* Every year, each business unit within DuPont has to develop its business plan and goals for the year. Part of that plan has to include a Corporate Environment Plan, so that each business unit's environmental impact can be tracked for its progress (#1235, personal communication, March 12, 2009). At a corporate level, DuPont has seven to ten sustainability goals. Achievement of the Corporate Environment Plan and Sustainability Goals are two of the ways DuPont plans and tracks its growth in terms of sustainability. Each year, DuPont reports it progress toward the sustainability goals. Reporting is part of DuPont's policy of transparency, allowing the public to see what DuPont's environmental footprint currently is and its plans for further reducing the environmental footprint.

*Role of Leadership:* The change toward sustainability at DuPont was leadership driven, top down (#1242, personal communication, April 24, 2009). In 1989, the DuPont

CEO, Ed Woolard, announced that DuPont would embark on a journey to become a more sustainable company. At the time, he used the term *corporate environmentalism*. Once Chad Holliday became CEO in 1998, the word *sustainability* was used. In hindsight, DuPont refers to the actions that were taken during former CEO Ed Woolard's tenure as *sustainability*.

*Change Champion:* When Paul Tebo was appointed Vice President of Environmental, Health and Safety in 1990, his main role was to improve the business case related to the environment. His title was made broader than just the environment, so that he would meet less resistance. In 2004, because sustainability had become mainstream, it was acceptable for Linda J. Fisher to represent DuPont in the same role with the title, Vice President, DuPont Safety, Health and Environment and Chief Sustainability Officer. Interview participant #1237 stated:

> Having a sustainable growth officer go meet with each business and really have them talk about the entire value chain they're a part of and not just their part or what happens to their product to the next customer, but their customer's customer's customer—looking all the way from the basic raw materials to the recycle step. This examines the whole value chain. Thinking about the value chain yields a lot more possibilities than just thinking about shareholders in the process. (Personal communication, March 29, 2009)

DuPont also uses a combination of centralized and decentralized structures, including a corporate group, leaders in each business unit, and leaders at each site (Epstein, 2008, p. 90).

*Organizational Structure:* DuPont's organizational structure was harnessed to support sustainability and was changed as needed to support the way DuPont was changing. Since 1989, DuPont has had a team that focused on pushing sustainability within DuPont. The addition of this group was a shift within the organizational structure.

Over time, this group grew in size, although it remained up to the business leaders to make changes within their business lines. Interview participant #1237 stated:

> On a daily basis, we do not use the sustainability leadership group to create changes within a business line. A more senior leader might need to have a broader perspective. We have found the most effective way of getting things done is through good line organization. When you get down to an individual operator at a plant, they need to understand exactly what they need to do and their job requirements. Individual line leaders that are accountable and responsible find the best way to get things done. (Personal communication, March 29, 2009)

In some cases, a business line leader was unable to reduce the environmental footprint or increase efficiency of the business unit. In those cases, a sustainability subject matter expert would work with the business unit leader to help develop change strategies. In some cases, when a business line could not be made more sustainable, that business may have been sold off or shut down. For instance, in 1999, DuPont's petroleum business, Conoco, was sold off to make way for a more sustainable business unit.

When a customer has a request for a new product, it is difficult to know which business unit to ask to create this product if the requested product does not align specifically with an existing product. In this sense, the organizational structure can work against innovation. Interview participant #1238 said that sales and marketing wants to advance customers' interests and that it is difficult when the customer wants a product that DuPont does not yet offer (Personal communication, April 9, 2009).

*Speed of Change: Evolution vs. Revolution:* DuPont has had periods of both revolutionary change and evolutionary change. At DuPont, both types of change occur simultaneously. Many of the breakthrough products that had great profits within a couple years, such as Nylon, took two decades of research and development. During the 1980s, DuPont began researching alternatives to CFCs, due to their potential negative

environmental impact. In the early 1990s, DuPont began to phase out unsafe CFC's and replace them with safer ones. A confluence of several events from 1989 to 1989 spurred this change, including a report from the EPA—called the Toxic Release Inventory—describing DuPont as the number one polluter, protests from Greenpeace, public demand, and the poor alignment of this news with DuPont's core values. In 1999, DuPont sold off Conoco, its least sustainable business, which focused on natural gas and petroleum production. DuPont replaced Conoco with the seed company Pioneer. Changing one of DuPont's lines of business was a revolutionary change, coupled by its evolutionary path toward sustainability. Another example of selling off a business to improve DuPont's footprint is INVISTA. Interview participant #1239 states:

> The INVISTA business was a source of a great amount of emissions and a huge source of our footprint. By selling the business, we shrunk our footprint tremendously. It was a journey that we went on. (Personal communication, April 30, 2009)

As context for DuPont's shift toward sustainability in 1991, Hoffman (2001) states:

> According to a 1991 survey by the Conference Board, 50 percent of companies viewed the external role of the CEO to be the personification of the company's environmental philosophy. Seventy-six percent of American companies felt that environmental standards were reasonable or technically feasible and that there was general agreement that, philosophically, pollution must be controlled. Survey data also show that by 1992, a total of 40 percent of American companies had a formal environmental policy statement in place. (Pp. 3-4)

*Cluster 6: Communicating DuPont's Sustainability Strategy*

DuPont focuses on business-to-business sales. As a result, communications related to sustainability focus internally on employees or externally on other businesses that are customers. Table 12 provides an overview of this cluster.

**Table 12. Overview of Cluster 6: Communicating DuPont's Sustainability Strategy**

| Idea within Data Cluster | Description |
|---|---|
| Internal Communication | Methods applied at DuPont for internal communications include: website, email, newsletters (paper and electronic), information delivered from employees' first-line managers, training, speakers (e.g., consultants), and awards (#1237, personal communication, March 29, 2009). |
| External Marketing | As DuPont would communicate its products to customers, feedback would also be solicited as to what new products customers needed at the time and in the future (#1237, personal communication, March 29, 2009). |
| Role of the Chief Executive Officer (CEO) Communications | DuPont's transformation toward sustainability was driven by the CEO and other senior executives, such as the Vice President of Sustainability or Vice President of Environment, Health and Safety (#1242, personal communication, April 24, 2009). |

*Internal Communication:* Internal communications use the DuPont website, email, newsletters (paper and electronic), information delivered from employees' first-line managers, training, speakers (e.g., consultants), and awards. Interview participant #1237 stated:

> For senior management, there were training sessions. DuPont would have trainers or speakers come from outside to talk about the subject. Paul Gilding [a former leader at Greenpeace] would come in frequently to talk about the environment and how Greenpeace would look at the things we were doing. For example, twice a year there was an annual meeting of senior management where they were trained to talk more about it. (Personal communication, March 29, 2009)

*External Marketing:* Because DuPont's customer focus is other businesses, DuPont often communicates its new products or innovations in person with current or potential customers. As DuPont would communicate its products to customers, feedback would also be solicited as to what new products customers may need at the time and in the future. In regard to external marketing, interview participant #1237 stated:

> Externally, there was some advertising, but there was mainly going to conferences and giving papers, doing interviews, trying to get the press to understand and write articles about what we were doing. There was a lot of

> outreach to local communities going to meet with individual environmental groups and communities to understand what they were about, and we would also reward and recognize employees who would on their own time want to go work on an environmental project. (Personal communication, March 29, 2009)

*Role of the Chief Executive Officer (CEO) Communications:* During DuPont's transformation toward sustainability from the 1989 to 2008, the CEO has been the key person to communicate DuPont's sustainability goals and strategy to employees, customers, and the public. DuPont's transformation toward sustainability was driven by the CEO and other senior executives, such as the Vice President of Sustainability or Vice President of Environment, Health and Safety (#1242, personal communication, April 24, 2009). One of the strengths of CEO communications for sustainability at DuPont has been in regard to communicating values. Interview participant #1240 stated:

> People like Ed Woolard and Chad Holliday were more socially sensitive as opposed to just being business driven. As a consequence of that, they began to think through what we should have in place as far as future goals for the company and to understand that some of those goals had to be around things that would be described today as making the company "more sustainable" particularly around the areas related to environmental issues. (Personal communication, May 1, 2009)

## Operations

This section describes the way DuPont operates and the factors that leaders had to consider when shifting DuPont's operations to be more sustainable. This section describes one cluster, Cluster 7 (Changing Toward Cleaner Technologies While Reducing DuPont's Environmental Footprint).

### *Cluster 7: Changing Toward Cleaner Technologies While Reducing DuPont's Environmental Footprint*

During DuPont's process of organizational change toward sustainability from the 1989 to 2008, there was an emphasis on shifting existing products and business platforms

to ones that had a smaller environmental footprint and that in some way enables customers to be more sustainable. This section reports the influencing events, organizations, and other factors that enabled DuPont to reduce its environmental footprint. DuPont has learned various lessons from technologies that were phased out due to both their negative environmental impacts and the demand from regulators, customers, special interest groups, communities, and others to develop products using cleaner technologies. Table 13 provides an overview of this cluster.

**Table 13. Overview of Cluster 7: Communicating DuPont's Sustainability Strategy**

| Idea within Data Cluster | Description |
|---|---|
| Influencers | The tipping point in DuPont's shift toward sustainability occurred when DuPont CEO Ed Woolard' gave his speech on "Corporate Environmentalism" to the American Chamber of Commerce in London (#1244, personal communication, August 7, 2009). Forces that led up to that tipping point included U.S. government regulation and reporting, the Montreal Protocol, CFC awareness, NGOs, public opinion, customer need, innovation, and DuPont's core values (#1244, personal communication, August 7, 2009). |
| Proaction | It can take decades for DuPont to complete the foundational research and development to create new technologies. For this reason, DuPont has to be proactive in its research and development and in its regard for environmental regulation (Dunphy et al., 2007). |
| Cost of Energy | Globally, energy usage and requirement are the largest influencers for costs and cost saving (#1234, personal communication, April 17, 2009). |
| Agricultural Demand | Because there is a finite amount of arable land, as population increases the costs for crops will increase, and solutions for how to gain a higher yield on arable land will be needed (#1234, personal communication, April 17, 2009). |
| Public Awareness due to TRI | In 1988, the Toxic Release Inventory (TRI) produced by the U.S. EPA ranked DuPont as the number one polluter in terms of GHGs (Hoffman, 2001). |
| Leadership in Place | Part of the reason why DuPont shifted toward cleaner technologies was that DuPont had the leadership capability to make such a big change (#1240, personal communication, May 1, 2009). |
| Learning Lessons and Moving On | The areas related to lessons learned include CFCs, Okefenokee Swamp $TiO_2$ controversy, nuclear power and the Savannah River Project, and petroleum transition via Conoco (#1237, personal communication, March 29, 2009). |

*Influencers:* The tipping point in DuPont's shift toward sustainability occurred when former DuPont CEO Ed Woolard gave his speech on corporate environmentalism to the American Chamber of Commerce in London (#1244, personal communication, August 7, 2009). Forces that contributed to that tipping point included U.S. government regulation and reporting, the Montreal Protocol, CFC awareness, NGOs, public opinion, customer need, innovation, and DuPont's core values (for a detailed description of these forces, see Cluster 6).

*Proaction:* DuPont strives to go beyond government compliance and be prepared for customer demand. It can take decades for DuPont to complete the foundational research and development to create new technologies. For this reason, DuPont has to be proactive in its research and development and in its consideration for environmental regulations and standards. Dunphy et al. (2007) noted that "DuPont includes environmentalists on its internal biotechnology advisory panel" (p. 78) in order to better understand how to prepare for future trends. Linda Fisher, Vice President, DuPont Safety, Health and Environment and Chief Sustainability Officer, said, "Our ability to get products to market is moving faster than the EPA's ability to get rules out, and we want to agree in advance on what the rules of the road should be" (Dunphy et al., 2007, p. 78).

Some critics of DuPont say that DuPont should have been more proactive in the 1980s. Since that time, DuPont has become more proactive and is an industry leader for its ability to implement sustainable practices and produce sustainable products. Interview participant #1234 stated:

> Many critics ask DuPont, "How could we have not know ahead of time about the TRI and seen an equivalent public issue growing around PFOA [perfluorooctanoic acid]?" The timelines are not that different. I think that is definitely one we missed. (Personal communication, April 17, 2009)

*Cost of Energy:* Globally, energy usage and requirement are the largest influencers for costs and cost saving (#1234, personal communication, April 17, 2009). For DuPont to increase or maintain its profit, energy costs must be maintained or reduced. Another important consideration is that the byproducts of energy production and consumption are the main contributors to global warming. Interview participant #1234 stated:

> Energy, energy policy, energy pricing, and energy security are clearly going to be a driver—whether that comes in the form of climate change regulation, or it comes in the form of skyrocketing petroleum costs, or it comes in the form of conflict in the Middle East. Energy and all the geopolitical issues around energy will absolutely be a direct factor causing costs to skyrocket. They could become demand for different kinds of transportation fuels or energy sources. This could come from demand for more efficient products, which opens up opportunities with our materials and our chemicals. Although, in the larger sense of drivers, it all comes down to kinds of energy, price of energy, and use of energy. (Personal communication, April 17, 2009)

Hoffman (2001) indicated that several factors may influence DuPont to reduce its waste and increase energy efficiency:

> In a departure from previous motivations, the dominant factors driving these initiatives were not just regulation but also cost factors, liability concerns, public scrutiny, and the indirect impact of regulations. A new optimism about the potential for opportunities in corporate environmental management was spreading. The Office of Technology Assessment surveyed industry executives and found that increasing numbers of successful examples of waste reduction yielding net cost savings and more competitive operations support the argument that waste reduction promotes industrial revitalization and economic growth. Momentum was building for the notion that substantially more waste reduction was possible. According to one DuPont executive, "We will see considerable reductions in the percentage of waste generated per pound of product produced, just as we have seen reductions in the consumption of energy over the last ten years. (Pp. 98-99)

The U.S. Council on Competiveness determined energy to be the main issue for organizations within the United States and globally over the next decade in terms of competiveness, carbon footprint, social responsibility, and strengthening economies (Council on Competitiveness, 2009).

*Agricultural Demand:* In 2009, the world population was 6.8 billion people and by 2050 the world population is estimated to increase to 9.4 billion people (Population Reference Bureau, 2009). Because there is a finite amount of arable land, as population increases the costs for crops will increase, and solutions for how to gain a higher yield on arable land will be needed. Interview participant #1234 stated:

> The demands and the expectations related to agriculture, including food, fuel, fiber, and other materials, will directly affect DuPont. If you take them one at a time and look down the road 15 to 20 years, the demands for food globally are going to go up significantly. Then each industry will have to forget about all the other uses of agriculture products. The demand for food will increase due to the growing middle class. Also, in these developing nations I hope that perhaps alternative fuels in the form of biofuels can play some role in the energy question. Also, there will be interest in making foods healthier, delivering more nutrition in ways that we could not do in the past. (Personal communication, April 17, 2009)

*Public Awareness due to TRI:* In 1988, the Toxic Release Inventory (TRI) produced by the U.S. EPA ranked DuPont as the number one polluter in the United States in terms of GHGs (Hoffman, 2001). Interview participant #1234 stated:

> The whole CFC issue was a galvanizing event. DuPont was not necessarily aligned with where the global community was going until some time in the eighties. During this time, DuPont started research on alternatives to CFCs. There must have been enough concern inside the company to start looking at alternative forms of refrigerants and alternative chemistry. A second galvanizing event was the release of the TRI for DuPont, Dow, and Monsanto. The TRI required a public reporting of legal emissions from DuPont. (Personal communication, April 17, 2009)

The TRI report triggered protests by Greenpeace and negative criticism in the media.

*Leadership in Place*: Part of the reason why DuPont shifted toward cleaner technologies was its leadership's capability to engage in such a significant transformation. Interview participant #1240 stated:

> No matter how effective your culture is amongst the current people, since people continue to enter and leave the company the culture needs to be constantly nourished and nurtured. Additionally, you've got to have leadership from the top. (personal communication, May 1, 2009)

*Learning Lessons and Moving On:* This section describes some of the lessons DuPont learned from experiences with products or businesses that did not align with the values of sustainability. The areas relating to lessons learned include CFCs, Okefenokee Swamp $TiO_2$ Controversy, Nuclear Power and the Savannah River Project, and Petroleum Transition via Conoco.

Chlorofluorocarbons (CFCs): In 1998, because of the more stringent air quality regulations set forth by the Montreal Protocol, harmful CFCs were banned. Because DuPont was the world's largest producer of CFCs in 1988, the ban on harmful CFCs caused a great deal of negative publicity for DuPont. As a result, DuPont phased out harmful CFCs from its product line and began producing less harmful alternatives. Interview participant #1237 stated:

> In 1990, DuPont started to reduce our own impact on the environment, and the thrust was to reduce the amount of stuff we put out in the environment even though it was all legal and under proper permit. The other major event was the ozone layer issue related to CFCs. It turned out that a product that goes under the trade name Freon, which is a CFC DuPont invented, was a major contributor to the depletion of the ozone layer. In the 1980s DuPont experienced this controversy and made a commitment to develop replacements. This contributed to DuPont starting to think about the environment in different ways. (Personal communication, March 29, 2009)

Hoffman (2007) stated:

> According to atmospheric scientist and DuPont Environmental Fellow Mack

> McFarland, Molina and Roland's 1974 Nature article linking CFCs with ozone depletion "got the ball rolling." As the largest manufacturer of CFCs at the time, DuPont initiated an internal task force to address the issue and senior management was briefed. Realizing that regulation was imminent, DuPont began exploring alternatives. In March 1988, after the signing of the Montreal Protocol, DuPont announced a voluntary and unilateral phase-out of CFCs through an orderly transition to alternatives. In 1991, the company began operation of the world's first manufacturing facility for the hydrochlorofluorocarbon HFC-134a, an alternative to CFCs. Today, CFC alternatives comprise two to three percent of DuPont's portfolio. (P. 91)

Okefenokee Swamp $TiO_2$ Controversy: When DuPont purchased Okefenokee Swamp with the intention of mining it, controversy erupted. Environmentalists and community leaders protested. DuPont ended up giving the swamp back to the community. Interview participant #1239 stated:

> We started defensive and it turned offensive. You may recall our business $TiO_2$. We have a facility in Stark, Florida, that produces the ore used in Johnsonville. In Stark, Florida, is this geological seam, which we use and mine there. Somewhere along the way somebody came up with this brilliant idea, they did some geological work and they found out that that same seam that's by Stark, Florida, extended right next to the Okefenokee Swamp, and they went out and bought this acreage. It turned out to be in an environmentally sensitive area, bordering the Okefenokee Swamp. We thought we could mine in a very environmentally sensitive way and that it is not a problem. Wrong! The environmentalists there just went crazy in saying this is a natural resource. There was a big PR campaign against us. At corporate we found out too late. We said it looked like we are fighting a losing battle here. We have to have a press conference and grab hold of this so we went down to Atlanta. In the end we ended up donating the land to the community. (Personal communication, April 30, 2009)

Interview participant #1240 stated:

> We lost money, I mean you don't get back what you paid, but maybe we received goodwill for it, on the basis that people said, they may have not done the right thing to start with, but once they recognized it they took care of it. (Personal communication, May 1, 2009)

Nuclear Power and the Savannah River Project: In 2006, DuPont was considering signing a contract to jointly manage a nuclear power waste facility near Atlanta, Georgia.

The project was called the Savannah River Project. DuPont had managed the project before. Interview participant #1248 stated:

> In 2006, one of the Health Advisory Board members recommended to not restart managing it due to the environmental impact. The Physicians for Social Responsibility was asked to explain the negative environmental and public relations impacts. As a result of the stakeholder advice, DuPont decided to opt out of the project. This was an example of DuPont giving up business that was less sustainable in order to adhere to its core values. (Personal communication, July 13, 2009)

Petroleum Transition via Conoco: In 1981, DuPont purchased the company Conoco, a natural gas and petroleum producer. At the time, it was the largest corporate merger in history. Later in 1999, DuPont sold Conoco (DuPont, 2009d). This was an example of DuPont exiting an existing dirty technology. Interview participant #1243 stated:

> In 1989, we still owned Conoco, an oil company, and we still owned Consol, a coal mining company. These were abstract industries, which had a different view of environmentalism. DuPont thought, how is taking oil out of the ground ever going to be considered a sustainable activity? You can extract it in a way that devastates the local environment or you can extract it in a way that actually preserves the local environment and minimizes the environmental impact. In that sense, it is sustainable. There was a tendency to be too literal about sustainability and what it meant as opposed to being creative and expansive about how can we expand our idea on what sustainability is, so there are principles of sustainability that apply to each of our businesses. Some businesses might be better at energy reduction, other businesses are going to be much better at waste reduction, and so forth. Shortly after Chad becomes DuPont CEO, DuPont completed an IPO [Initial Public Offering] of Conoco and made a huge investment in Pioneer. Biotechnology is where the company is going. Most of the remaining DuPont businesses had clearly seen, yes, this is the direction in which we're heading. (Personal communication, July 13, 2009)

Chapter 4 reported the findings of the data gathered through interview, observation, and a document review. The seven data clusters in Chapter 4 described the patterns of data and their relationship to the primary research question. The next chapter interprets the meaning of the data and secondary sources from Chapter 4. Part of this interpretation is communicated by reorganizing and restating the key findings with interpretation. As a result, many of the ideas in Chapter 4 are restated in Chapter 5 in the context of the research questions and themes.

# CHAPTER 5: DISCUSSION

## Introduction

This research study examined the role of organizational change in sustainability, using DuPont as an in-depth case study. Within these parameters, the initial intent of this research study when it was formally proposed in November 2008 was to examine the actions, decisions, interactions, and operations that DuPont undertook to incorporate natural environmental values into its business strategy from the 1989 to 2008. During the inductive analysis of the data, several unintended data clusters and themes emerged. Two general surprises in the findings were (1) the close connection between business strategy and sustainability and (2) the criticality of the social aspect of sustainability.

Environmental footprint reduction is critical to reducing global warming, although it would be incorrect to say that by merely reducing the footprint of organizations, societies will be improved. The data from this study supports the conclusion that environmental footprint reduction supports social responsibility. In other words, in developing strategies for organizational change for sustainability, the first consideration is the needs of the people affected (e.g., customers, employees, and other stakeholders), and the second consideration is the inherent role of, and impact on, the environment. Greatly increasing the ratio of products and services that are sustainable (versus non-sustainable ones) will help reduce environmental footprints across organizations. The results of this study indicate that the thrust of business strategy for sustainability should be based on the triad of sustainable operations, sustainable products and services, and social responsibility.

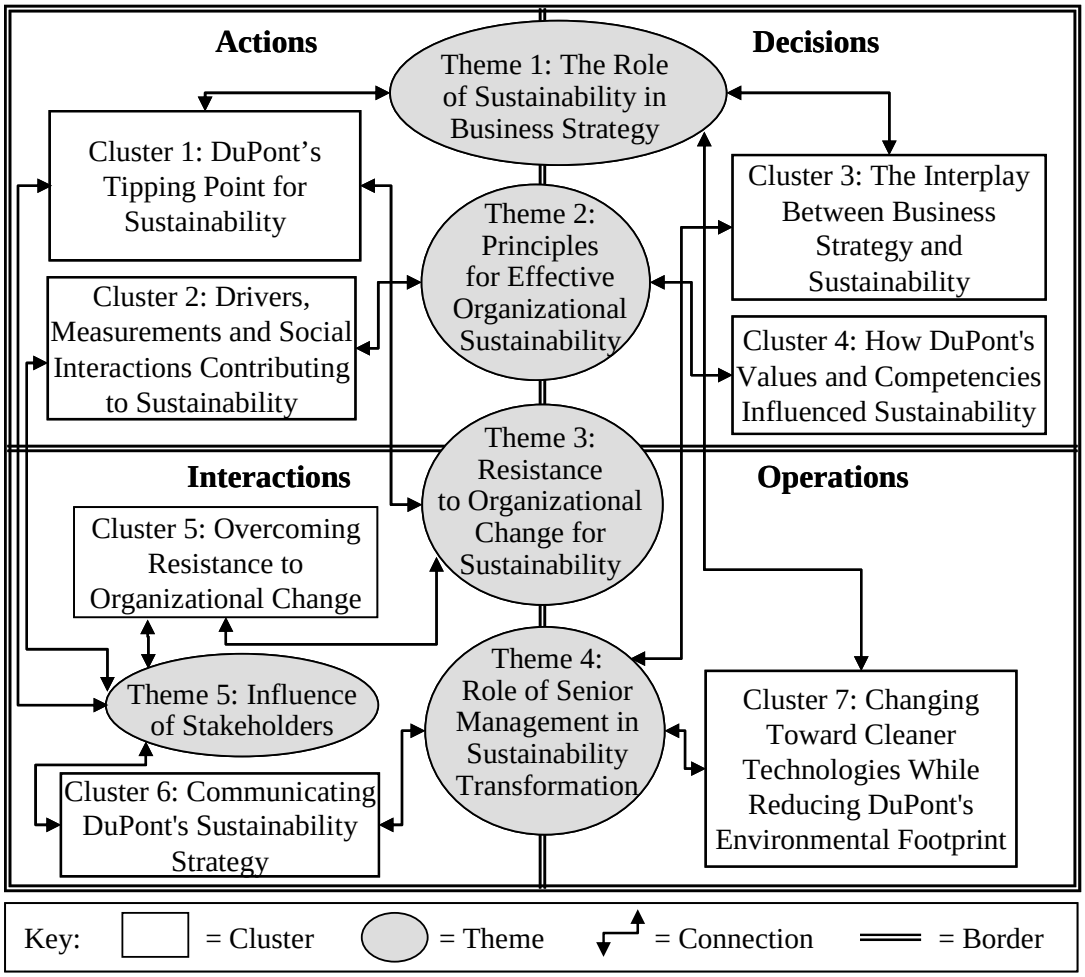
This chapter presents the conclusions based upon the findings of the research and the five themes that emerged during data analysis. This first section provides a summary of the findings based upon their correspondence to the primary research question. The primary research question in this study is, "What actions, decisions, interactions, and operations did DuPont undertake to incorporate natural environmental values into its business strategy, while simultaneously increasing its profit margin from the 1989 to 2008?" The second section provides a discussion of the five themes, with a focus on implications of the findings for theory and practice. The third section describes the interrelations of the themes. The final section describes implications for future research.

In this study, the themes serve as a response to the research questions posed in Chapter 1. Figure 5 depicts how the themes emerged from the data clusters. All five themes have some relationship to all seven data clusters. The arrows show where the closest connections exist between each theme and each data cluster. The quadrants within Figure 5—Actions, Decisions, Interactions, and Operations—depict how the data clusters correspond to the primary research questions. The arrows between the themes and the clusters indicate which clusters supported the development of each theme. (Appendix I provides a more detailed table for how the data clusters, themes, and supporting research questions correspond to one another.)

*Actions*

The main actions that DuPont undertook to become a sustainable organization include making a declaration and then following through with it, setting and achieving goals, making new investments, and coalition building. In 1989, DuPont's then CEO, Ed

**Figure 5. Mapping of Themes to Data Clusters and Four Areas of Inquiry within the Primary Research Question**




Woolard, announced that DuPont would make environmentalism its first goal (Murphy & Dee, 1992; Woolard, 1989). This announcement was the tipping point that initiated DuPont's transformation toward sustainability. From 1998 to 2008, DuPont's then CEO, Chad Holliday, continued to follow through on that declaration by making sustainability part of DuPont's mission, initiating fundamental changes to DuPont's business strategy and products, and increasing the efficiency and efficacy of DuPont's operations (Hoffman, 2007a). From 1990 to 2008, DuPont reduced its GHG emissions worldwide by 72% (DuPont, 2008b; Esty & Winston, 2006; Hoffman, 2007a). From the late 1990s to

2008, DuPont publically communicated its sustainability goals and progress toward those goals on a quarterly basis. In 1999, DuPont sold its petrochemical business, Conoco. Soon afterward, DuPont invested in new business platforms better aligned with sustainability (e.g., in 1999, DuPont acquired Pioneer, a seed manufacturer). With increased costs of energy throughout DuPont's operations, there has been an emphasis on energy and resource efficiency. Successes on one project or at one site are communicated and shared throughout DuPont and then replicated where the solution is a good fit. This reflects the presence of strong internal organizational dynamics. DuPont has built coalitions to shift the behavior of industries and business. These coalitions consist of stakeholder networks, including employees, customers, special interest groups, government, trade organizations, and other organizations.

From 1990 to 2008, DuPont changed its product line from 100% chemical based to 70% chemical based (and 30% biological matter based) (DuPont, 2008a). There is likely no empirical evidence that shows by merely changing a company's product mix to be more biological matter based that the products will have a lower environmental footprint and be better for the environment. Although it is a fundamental aspect of sustainability that organizations develop and offer products and services that are better for society and the environment. Determining whether increasing the biological matter base of a product makes it more sustainable must be determined on a case by case basis. In DuPont's case the main driver that increased its biological matter base was selling its petroleum and natural gas production business (i.e., Conoco) and in return buying an agricultural business (i.e., Pioneer). This shift in product line did contribute to lowering DuPont's environmental footprint (Hoffman, 2007a).

*Decisions*

To become more sustainable, DuPont made decisions regarding what areas to invest in for current and new businesses and for research and development. Before 2000, DuPont's business model focused on vertical integration, where there was an emphasis on owning the entire value chain of product—research and development, supply, manufacturing, and delivery of products and services. After 2000, DuPont focused mainly on the initial phases of the value chain—mainly research and development (Senge et al., 2008). Many of DuPont's products have required twenty years or more of research and development. To align research and development with future market needs, DuPont has established a global stakeholder network consisting of advisory committees, partners, consultants, government representatives, special interest groups, and other organizations. Two of DuPont's committees that provide advice on new product development are the Biotechnology Advisory Board and the Health Advisory Board. Since 1989, DuPont has incrementally worked to increase the number of products that have a lower environmental footprint, contain a greater amount of bio-based materials (instead of chemical-based materials), and serve a purpose for the customer that in some way supports sustainability.

Another decision-making process embedded within each of DuPont's business platforms involves examining how to repurpose existing technology. For example, Kevlar is most widely known as a material for use in bullet-proof vests. Kevlar has been repurposed for use in many other products. In one case, Kevlar has been repurposed to create brake pads for trains. This new application of Kevlar has the social benefit of making transportation safer and the environmental benefit of using fewer natural resources. This repurposing application improved the quality and safety of the brakes and reduced the environmental footprint of the brake pad because of the longer product

lifespan. When the lifespan of a product is increased through enhanced durability, fewer materials are consumed, resulting in a smaller environmental footprint.

*Interactions*

DuPont used interactions to facilitate sustainability at DuPont. These interactions include dynamics, such as the role of leadership, the speed of change, marketing, incentives, and related areas. DuPont's transformation toward sustainability was driven by CEOs and other senior executives, including the Vice President of Sustainability and Vice President of Environment, Health and Safety. These leaders communicated DuPont's sustainability strategy and goals to the DuPont employees and business units, customers, and other stakeholders. Change at DuPont was marked by punctuated equilibrium, where evolutionary cycles of change were accelerated by an occasional abrupt revolutionary change (Gersick, 1991). Marketing for sustainability focused on direct marketing through face-to-face meetings with current and potential customers. There was a focus on asking customers what they needed and then developing the specific products to meet those needs. Several types of incentives were used to promote sustainability within DuPont's businesses. Awards were given to business units for good ideas for investment or the successful completion of projects and to individuals for outstanding contributions in the area of sustainability. Part of the award's value is the recognition across DuPont of contributing the successful idea, project, or business ventures. Another part of the award was usually monetary.

*Operations*

DuPont changed its operations to be more sustainable. Several factors influenced DuPont to make its operations more sustainable: government regulation (e.g., the

Montreal Protocol), the increasing cost of energy, increased consumer demand, and decreased availability of natural resources. DuPont sought to bring sustainability into its operations through the efficiency of its manufacturing plants, buildings, and supply chains; through the material composition of its products; and through the orientation and functionality of its products.

**Discussion of the Themes**

Five themes resulted from the data analysis. These five themes represent the most significant areas of implications for this study based on the findings described in Chapter 4. The following section provides description, discussion, and implications for each of the five themes. Table 14 provides an overview of the five themes.

**Table 14. Overview of the Five Themes**

| Theme | Description |
|---|---|
| Theme 1: The Role of Sustainability in Developing a Business Strategy | This theme relates to the interplay between business strategy and sustainability. The research suggests organizational sustainability should be inclusive of operations, products & services, and social responsibility. |
| Theme 2: Principles for Effective Organizational Sustainability | This theme relates to principles that guide organizations in transformation toward sustainability, in the context of the external environment. |
| Theme 3: Resistance to Organizational Change for Sustainability | This theme describes resistance to change, its challenge and opportunities. |
| Theme 4: Role of Senior Management in Sustainability Transformation | This theme describes how senior management—including CEOs, Vice Presidents, and other executives—influence organizational change toward sustainability. |
| Theme 5: Influence of Stakeholders | This theme defines the role of stakeholders and describes the criticality of understanding the customers' current and future needs. |

*Theme 1: The Role of Sustainability in Developing a Business Strategy*

*Description of Theme 1:* Two major findings of this research study were (1) the close connection between business strategy and sustainability and (2) the criticality of the social responsibility aspect of sustainability. Once DuPont was able to embed sustainability into its business strategy, sustainability became an integrated part of its operations, products, and services. The data from this study supports the conclusion that environmental footprint reduction is a supporting goal of social responsibility. That is, when designing a strategy for organizational change for sustainability, the first consideration is the needs of people affected (e.g., customers, employees, and other stakeholders) and the second consideration is the inherent role of, and impact on, the environment.

*Discussion of Theme 1:* Sustainability is often considered in terms of the *triple-bottom line*, a term coined by Elkington (1997) referring to companies' reduction of negative impacts—and increase of positive impacts—on the environment, society, and economics. Gilding, Hogarth, and Reed (2002) introduced the concept of the single-bottom line of sustainability, describing sustainability as being part of an organization's business strategy. This is an enhancement to the triple-bottom line because it asserts that sustainability is a core and integral part of business, rather than an additional consideration for an organization's business strategy. An organization that adheres to the single-bottom line of sustainability must have sustainability as the core of its business strategy, processes, and structures.

Since 1989, DuPont's approach to sustainability has been rapidly becoming more aligned to the single-bottom line of sustainability, where sustainability is an integrated part of its business strategy. By having an integrated approach DuPont was able to focus

on market facing goals that were sustainable. Many of the products DuPont developed required twenty years or more of research and development. For instance, Nylon required approximately twenty year of research and development. Similarly bio-based fuels, such as biobutanol may require ten to twenty years of research and development before being considered market ready. One fundamental difference between Nylon and biofuels is that Nylon is synthetic based, while bio-fuels are bio-based. “Paul Tebo said that DuPont’s shift toward biotechnology, chemistry, and natural systems, as opposed to synthetic ones is clearly a transformational change” (Senge et al., 2008, p. 125).

*Implications of Theme 1:* Due to the long time frame required for developing products and services, business strategy for sustainability must be considered proactively (Mintzberg & Waters, 1983; Varela, 1999). Aspects of that proactive planning process include determining the customer’s future needs for sustainable products and services. Those needs should direct research & development, sales & marketing, and the timing for making these new products available. The company providing products and services may have to employ organizational change in order to align its operations and products & services to meet the customers’ future needs.

Strategy is non-linear in nature and has to be linked to organizational change. The fundamental way an organization affects individuals and other organizations is through its products and services. As a result for an organization to be sustainable, its products and services must be sustainable. From the time an organization has the initial creative idea for a new product or service to the time the product or service is actually developed and market ready may be several years (as with the case of DuPont). With the current (as of 2010) shifts occurring in environmental legislation (including carbon constraints) and

rise in the cost of both energy and natural resources, in the coming years there will an increasingly stronger business case for sustainable products and services. As a result, this indicates that when formulating business strategy for the coming year, research and development, and related planning must be more innovative and sustainable than the current customer or market needs. When organizational change is in alignment with the business strategy, considerations for equipping leaders' and other employees' capabilities to cope with change must be proactive. Then as product and service development and delivery are realigned to meet future needs, the people within the organization must also be aligned to that future orientation—including organizational structure, job roles, training, communications, knowledge sharing, strategy, and related areas.

*Theme 2: Principles for Effective Organizational Sustainability*

*Description of Theme 2:* The factors to consider for effective organizational change for sustainability are fundamentally the same as effective organizational change for any other purpose. These common factors include: leadership buy-in, strategic organizational alignment, communications, stakeholder engagement, organizational restructuring, training, incentives, organizational change facilitation, and developing an organizational change network. What should be highlighted about organizational change for sustainability is the great difficulty of the challenges being faced by all organizations and societies: population increase, global warming, depletion of fossil fuels, rising energy costs, rapid growth of developing countries, and economic fragility. Another difficulty of organizational change toward sustainability is that for some organizations, the gap between the current state and the desired state of a sustainable organization may be huge.

The costs for this change to be undertaken must be absorbed incrementally or else the expense may be too great for the organization to stay in business.

*Discussion of Theme 2:* During the literature review for organizational change models (described in Chapter 2), the researcher noticed a disconnect between models and theory for (1) organizational change or performance and (2) business strategy. For instance, a commonly used model for organizational change is the Burke-Litwin Model of Organizational Performance and Change (Burke, 1982), and a commonly used model for business strategy is Porter's Five Forces (Porter, 1980) [see Appendix K]. There is an environmental component of some organizational change models (such as the Burke-Litwin Model) that could serve as a link to business strategy. However, there is no strong connection in current theory or strategy between organizational change strategy and business strategy in terms of planning and continuous realignment. Organizations often manage their organizational change strategy and business strategies in solos, and neglect continuously realigning the two. When a change that is as transformational as one toward sustainability is, this alignment is needed in order to achieve the desired change state.

In DuPont's case this alignment between the organizational change process and business strategy was facilitated by appointing a change agent at the Vice President level (beginning in 1989 with Paul Tebo, followed by Linda Fisher in 2004) that was part of the senior leadership's business strategy planning. In addition, DuPont had various senior executives that were joint members of committees related to financial planning, business strategy, research and development, and/or change management.

Having a change champion for sustainability was a key factor in DuPont successfully becoming more sustainable. Additional factors that contributed to DuPont

being an effective organization include: support at the executive and board level; engaging stakeholders including NGOs, government organizations, universities, communities, and other organizations; research and development; having capital available; participation in trade organizations; having experience in organizational change due to the 208 year old age of the company; strong core values; making sustainability part of the mission; and having an extensive award systems in place.

*Implications of Theme 2:* Organizational change toward sustainability can be such a challenge for most organizations that continuous realignment of organizational change process and business strategy may be required for successful change. The researcher in this study proposes that organizations embarking on a sustainability-focused transformational change of their organization, take a leapfrog approach in strategy development. Typically *leapfrogging* is considered in terms of technology—skipping inferior, less efficient, more expensive polluting technologies & industries and move directly to more advanced ones (Goldemberg, 1998). Leapfrogging can also be applied in terms of behavior through organizational change strategy for sustainability. In application leaders and change agents would focus on effective two-way communication and realign their efforts to coordinate with one another as needed. One method for doing this is to make the coordination explicit through documented processes. For example, this document could be called "[Insert organization's name] Plan for Alignment of Change Management Strategy to Business Strategy for Sustainability." Aspects of this plan could include a blueprint of an organization's existing or planned change management network (describing committees for organization-wide engagement and individual delegates within business units [see Appendix L]), measurements and reports for tracking progress,

taxonomy of stakeholder groups, mission/vision/goals, risk and issue management, and related areas (based on Blackburn, 2007; Wade, 2009).

*Theme 3: Resistance to Organizational Change for Sustainability*

*Description of Theme 3:* Piderit (2000) defines resistance to organizational change as an emotional, cognitive, and intentional response to a change initiative that is in some way negative. Most employees' initial reaction to an organizational change initiative has some degree of ambivalence, where there is a mixture of positive and negative reactions along the three dimensions of emotion, cognition, and intention. Pideret (1980) proposes that allowing the causes behind the ambivalence to be examined and learned from, can foster more successful change initiatives, based on generating new knowledge and new possibilities for understanding and action. Resistance to change that goes unaddressed can cause an organizational change initiative to be delayed, increase its costs, or to fail (Pardo del Val & Fuentes, 2003).

*Discussion of Theme 3:* Kotter (1996) proposes that establishing a strong sense of urgency within an organizational in regard to an organizational change initiative increases the likelihood of its success. Establishing a sense or urgency may be a successful tactic for decreasing ambivalence when rapid change is necessary. The sense of urgency as it relates to organizational change is often caused by an unplanned *burning platform*—an issue or event that causes an organization to engage in sudden change [based on the story of a person who jumped off an oil rig risking possible death in order to avoid certain death] (Conner, 1992). When a burning platform is present there is a high degree of urgency. When there is a high degree of urgency, resistance to change is often reduced.

In DuPont's case its tipping point toward sustainability was influenced by a burning platform. DuPont's burning platform was its low score on the Environmental Protection Agency's (EPA) Toxic Release Inventory (TRI) in 1989 and Greenpeace's subsequent protests of DuPont (Murphy & Dee, 1992). These two events raised public awareness of DuPont's poor environmental performance in the mid to late 1980s, and caused DuPont's leadership to have a sense of urgency in saving DuPont's reputation. As a result, resistance to change toward sustainability decreased (at the time it was referred to as corporate environmentalism), leading DuPont's leadership to embark on its transformation toward sustainability.

DuPont did have enough momentum to achieve successful organizational change, although DuPont did face resistance to change in several ways after its tipping point for organizational change toward sustainability. Many manufacturing plants produced the same materials using the same processes for decades, and were reluctant to fix what seemed unbroken. Many senior and middle-level leaders did not understand why their business areas needed to change or how to change. This lack of understanding caused ambivalence. There was a clear effort to understand what ways leaders and other employees considered the change toward sustainability negative. For the institutional and individual resistance to be overcome, each employee had to learn to embrace sustainability and come to realize the implications for his/her business and job within DuPont. From 1989 to 2008, DuPont went through periods of both revolutionary change and evolutionary change. Continuous improvement has been part of this change process. This process has been accompanied by questioning assumptions, searching for smarter ways to solve everyday problems, and by fostering a culture of learning and growth.

*Implications of Theme 3:* Understanding and overcoming organizational resistance is required for organization change to be effective in the long term regardless of whether an organization has a burning platform or not. Change resulting from a burning platform is usually unplanned and sudden in nature. One common feature of unplanned and planned change is that every member of an organization will have some degree negativity toward the organizational change, characterized as ambivalence by Piderit (1980). It is human nature to miss situations or things organization members like, and to resist and feel some type of negative feeling when those things are being taking away or there is a threat of this occurring. Embracing and seeking to understand the negativity can shed light on the most effective ways to direct the organizational change and what factors to consider during the change process. Organizational change facilitation is needed in order to understand organizational change resistance, learn from it, and overcome negative reactions to the organizational change initiative.

When members of an organization are concerned about a new initiative, it is an opportunity to start a conversation. Through conversation and communications information and knowledge about the change effort can be exchanged and shared (e.g., in-person, telephone call, workshop, through a newsletter, email, webcast, or other forms). Through two-way communications (e.g., a townhall style meeting) or assessments (e.g., interviews and surveys) issues causing the resistance to change can be learned about and understood. Gathering and analyzing data about the issues causing resistance to organizational change as a result of a particular organizational change initiative may provide guidance for more effective ways to govern the initiative; generate new knowledge, new possibilities, and better outcomes (Piderit, 1980).

*Theme 4: Role of Senior Management in Sustainability Transformation*

*Description of Theme 4:* Leadership support is one of the most widely recognized critical success factors in any organizational change effort (Charan, 2009; Kotter, 1996; Schwandt & Szabla, 2007; Senge et al., 2008). One of the first steps for initiating organizational change for sustainability is to establish a network of sustainability change agents throughout the organization (Blackburn, 2007; Dunphy et al., 2007; Wade, 2009). Wade (2009) recommends first gaining CEO support, then business unit support, by establishing a strategic change board or committee and working groups within each of the business units (see Appendix L). At DuPont, the initial steps toward organizational sustainability were initiated by the then CEO, Ed Woolard, in 1989. Subsequently, CEO Chad Holliday made sustainability an intrinsic dimension of DuPont's mission, vision, and goals. Other key change champions included: Bill Reilly (DuPont Board Member and form EPA Administrator), Paul Tebo (V.P., DuPont Safety, Health and Environment), Linda Fisher (V.P., DuPont Safety, Health and Environment and Chief Sustainability Officer) and Dawn Rittenhouse (Director, Sustainability), and many others.

*Discussion of Theme 4:* Elkington (2001) argues that the for-profit sector (business leaders in particular) can lead the sustainability revolution. He bases his argument on the idea that CEOs have the greatest capability and power to create change, and that citizen CEOs are a mechanism for organizational change toward sustainability in corporations. Holliday, Schmidheiny, and Watts (2002) present 67 case studies of corporations, examining how sustainability was implemented at these organizations. The organizations studied by Holliday et al. (2002) attempted to change industry standards, whereas Elkington (2001) focuses on examining the way individual leaders think. Hall

and Vredenburg (2003) asserted that managers do not have the capability to understand sustainable development based on their lack of training in sustainability in business schools. Sustainability requires managers to learn how to innovate in new ways.

When an organization experiences a gap in its knowledge or capability, there is often a need to fill that gap. Leonard-Barton (1995) states that a capability gap occurs when strategic knowledge or expertise is not available within the organization. When this occurs, there is a need for that organization to either develop the needed competencies within that organization, seek the expertise outside the organization, or both.

In DuPont's case leaders who interacted more with a wide variety of organizations tended to have a greater capacity for coping with sustainability-related issues. Leaders or managers who were isolated often working everyday at the same location tended to have less awareness of sustainability-related issues or trends (versus leaders or managers who interacted with more stakeholders), thus making it more difficult to align their area of the business to sustainability. This effect on the isolated managers may be due to the level of heterogeneity versus homogeneity of social influences in terms of knowledge development related to sustainability.

*Implications of Theme 4:* The results of this study lend support to the theory that leaders with more heterogeneity in their social interactions and knowledge sharing are more likely to understand sustainability-related issues. This lends support to the theory that loosely coupled social networks [two systems having few variables in common (Glassman, 1973)] are more critical to sustainability-related innovation and business strategy than tightly coupled social networks [responsive systems but not distinct (Orton & Weick, 1990)]. Having greater awareness of sustainability related issues can enable a

leader to be more capable and innovative. Leaders that have more homogenous social interactions, such as managers that always work in a single plant or city may be less likely to have the capacity for innovation toward sustainability, due to less exposure to new ideas and influences. One mechanism for increasing social interactions related to sustainability at one organization is to engage diverse groups of stakeholders.

*Theme 5: Influence of Stakeholders*

*Description of Theme 5:* The most widely used definition of a stakeholder is, "any individual or organization that affects or is affected by an organization (Freeman, 1984, p. 46)." Starik (1994) extends this definition to include all living things—a stakeholder is "any naturally occurring entity which affects or is affected by organizational performance (P. 92)."

Relationships with stakeholders can assist organizations to see the tacit and explicit benefits and risks affecting their position in the marketplace (Hall & Vredenburg, 2004a). Stakeholders can have a supportive, opposive, or neutral stance toward an organization (Elkington, 2001; Friedman & Miles, 2006). A good stakeholder can assist an organization in reducing ambiguity to better assess uncertainty and risk, which will reduce costs associated with recovering from failures or disasters (Hall & Vredenburg, 2004a). When businesses engage stakeholders, such as governments, community groups, nongovernment organizations, customers, schools, and other organizations, new possible business opportunities that benefit the business and the surrounding stakeholders can be realized, capitalized upon, and learned from (Hart, 2005).

*Discussion of Theme 5:* Stakeholder research has identified who the stakeholders are, although there is little guidance on how to prioritize stakeholders in a way that

maximizes the organization's success of changing toward sustainability (Esty & Winston, 2006; Freeman, 1984; Friedman & Miles, 2006).

In DuPont's case nongovernment organizations and governments served as the largest influence in creating the tipping point toward sustainability. In 1989, the bad press related to the EPA low performance ratings of DuPont in the Toxic Release Inventory (TRI) and the subsequent protests by Greenpeace increased DuPont leadership's awareness of DuPont's impact on the environment and the sense of urgency that action was needed.

Evan and Freeman (1993) identify customers as the primary stakeholder based on the principles of corporate legitimacy [corporations should be managed for the benefit of its stakeholders] and the stakeholder fiduciary principle [management has a duty ensure the survival of the organization]. The findings of this study support the conclusion that customers are often the most important stakeholder to a for-profit organization. In practice when organizations develop sustainability strategies there may be an over emphasis on other stakeholders, which may result in products and services that are less sustainable, due to a lack of thorough research & development of products to meet customers' future sustainability needs.

*Implications of Theme 5:* In practice it may seem like an oxymoron to say that sustainability can be achieved by focusing on the customer as the key stakeholder, due to on the surface possibly seeming as though there may not be regard for the environment. An organization with a strong mission that is aligned to sustainability embeds regard for the environment and society within its operations, services, and products. When

sustainability is intrinsic to an organization, consideration of customers' needs results in operations, products & services, and research & development that are sustainable.

At every level of the organization and in every business unit, there must be accountability for integrating sustainability into the organization, including a board or committee for sustainability at the senior-most level of the organization and working groups within each business unit (see Appendix L). The customer is the most important stakeholder to for-profit organizations. The customers' current and future needs in terms of sustainability are what drive the organization to develop its sustainability strategy and business model. Through constant and vigilant direct two-way communication with customers feedback can be shared allowing the needs of customers in terms of services and products to be best understood. Developing products and services that are sustainable may require more thought and time than unsustainable products. As a result to develop products and services that meet the future needs of customers, an organization must actively seek to understand what the customers' changing needs are now and will likely be in the future. In the case of DuPont, sometimes customers were unaware more sustainable products were needed. In those cases DuPont often had to educate and convince customers the new products and services would help their business. In this sense sales & marketing, and research & development for sustainable products and services requires two-way communications—with the goals of organizational alignment and knowledge sharing between organizational levels and business functions.

**Interrelation of the Themes**

In this section theoretical lenses related to complexity, sociology, and biology are drawn upon in order to show some of the interrelations of the five themes. Three areas

where the five themes relate are: awareness, communities of practice, and engaging the whole living system. Sustainability presents more complex challenges to organizations than ever before. Einstein posited that, “No problem can be solved from the same consciousness that created it; we must learn to see the world anew” (Schwandt & Marquardt, 2000, p. 17). Organizations are *non-linear*, referring to multiple causations over time and space from human interactions that reflect both non-additive and non-proportional attributes of the system (Schwandt et al., 2008). To address the challenges related to organizational change for sustainability, individuals within organizations must increase their ability to be more aware of the nonlinear nature of organizations.

*Awareness*

When a leader or other member of an organization is developing strategy for organizational change or business development heightened awareness is needed in order to perceive the relevant factors at each step of the planning and implementation process. Awareness is noticing the patterns of thought, action, and relationships (Bohm, 1996; Croswell & Holliday, 2004; Depraz, Varela, & Vermersch, 2002; Varela, 1999). Awareness is the core process through which each individual can access his or her own experience (Bohm, 1996; Depraz et al., 2002; Scharmer & Varela, 2000). Awareness is generative and transitory in nature, constantly ebbing and flowing each moment, depending on the direction and scope of the focus of the conscious mind (Depraz et al., 2002; Maturana & Varela, 1992).

*Need for Commensurate Complexity:* Members of an organization require *commensurate complexity* in order to make sense of their environment. Commensurate complexity is the principle that an individual must have at least as much internal variety

(in their minds developed through experiences and knowledge) as there is variety within an external situation (Ashby, 1956; Weick, 1979). Because managers do not know what issues each new situation will present a great deal more knowledge than is needed for each situation is required. Allen (2001) created the *law of excess diversity*, stating since we do not know in advance which types or variety we will face in a given situation effective leaders must develop excess variety to respond to a given situation. For this reason, it is important to have varied heterogeneous and loosely coupled networks among an organization's stakeholders, in order to create a wide variety of knowledge sharing resources for changes in the environment.

*Experience:* Experience is needed in order to recognize a change or a problem that is about to occur or while it is occurring. Through experience individuals and organizations can learn various symptoms that indicate a problem may occur, and during their occurrence what some possible solutions to solve the problem may be. Weick (1979) indicates that if an individual does not know how to solve a problem, the symptoms of a problem will be ignored. Schwandt (2005) suggests that individuals within an organization can improve their ability to reveal their blindspots resulting from objectivity through aware reflection during problem solving and strategy development. Leaders who have a greater amount of exposure to stakeholders to their organization (with a heterogeneous knowledge base), and engage in reflective problem solving and strategy development are more likely to have the knowledge and experience to support their organization in coping with issues related to sustainability.

*Communities of Practice*

Communities of Practice (COP) are groups of people informally or formally connected together to share expertise and passion for a common learning and knowledge sharing goal (Wenger, 1998). The primary output of a COP is knowledge. COP members may meet regularly and have set goals. Regardless, of whether knowledge sharing is planned or unplanned, the focus of COPs is the sharing of knowledge and experience in free-flowing and creative ways (Wenger, 1998). COPs can add value to organizations by driving strategy, starting new lines of business, solving problems, transferring best practices, developing professional skills, and by helping companies recruit and retain talent (Wenger, 1998).

In terms of organizational change for sustainability, a change agent network for sustainability can integrate aspects of a COP to increase knowledge sharing. In addition, a constellation of COPs can be created to facilitate knowledge sharing and development related to the impacts and strategies for sustainability for each business unit and function within an organization. These COPs can be maintained using virtual team rooms or wikis for document storage, list serves, regular conference calls, through in-person meetings, and other means. The main benefit of COP networks is knowledge sharing. Tracey and Clark (2003) outline five benefits of networks, which can be applied to relationship between members of difference organizations through stakeholder engagement: (1) better access to information, knowledge, skills and expertise, (2) improved linkages and cooperation between network members, (3) improved response capacity, (4) reduced risk, moral hazards, information and transaction costs, and (5) improved trust and social cohesion.

*Need to Engage the Whole Living System*

Organizations are living systems that are part of the whole ecology (Shaw, 2002). Organizations are both open and closed systems. An open system is a system with an input throughput, and output that interacts with its external environment, including other systems (Morgan, 1996). A closed system is a system that does not interact with its external environment. Organizations are affected by the natural environment including the availability or resources and knowledge from the external environment. Complexity theory examines the way complex adaptive systems (CASs) function, develop, and interrelate to other systems (Hazy et al., 2007; Morgan, 1996).The most complex adaptive system is a social organization (Capra, 2002; Wheatley, 1999).

The view of living systems theory is that organizations constitute one level of living systems in an evolutionary hierarchy of one living system, that includes all living matter on earth (Miller, 1971). Living systems theory describes organizations as open systems that interact with the environment while making reference to themselves (Maturana, 1978; Morgan, 1996). Gaia theory views the earth as one interconnected living organism that interacts with the atmosphere as part of its self-regulating process (Capra, 1996). Organizations are one level of systems that are dependent on the earth's natural systems in order to survive.

Social systems are considered open and negentropic; they "are open 'internally' as well as externally in that the interchanges among their components may result in significant changes in the nature of the components themselves with important consequences for the system as a whole" (Buckley, 1967, p. 490). Organizations are comprised of social networks and are part of larger social networks. Social networks are soft processes that need development (Shaw, 2002). Social systems are not maps, they are

the actual territory that fosters connections between individuals and organization and between organizations. By developing awareness, the structure of a person changes, enabling an individual to direct his/ her own development while simultaneously co-evolving (McKelvey, 2002a) with the environment.

Due to the complex and soft nature of social networks organizational change requires facilitation and planning. As described in detail in Chapters 2, 4, and 5 key areas to nurture to foster organizational change for sustainability include but are not limited to: leadership buy-in, strategic organizational alignment, communications, stakeholder engagement, organizational restructuring, training, incentives, organizational change facilitation, and developing an organizational change network. In addition to the organizational change considerations, sustainability requires organizations align their operations, products & services, and social responsibility strategy to meet the current and future needs of their customer's. By reducing the operational footprint of organizations resources are conserved and greenhouse emissions are reduced. By creating products and services that are sustainable, the environmental footprint of customers is reduced. Environmental footprint reduction conserves and preserves natural resources for future generations of society.

**Implications for Future Research, Theory and Practice**

This final section discusses the implications of this study for future research, theory and practice. This discussion provides guidance for future research studies and theory development related to the role of organizational change in sustainability, and recommendations for the practice of organizational change for sustainability.

*Implications for Research*

- More research is needed that examines the multi-level nature of organizational change in sustainability. In this study the research focused on the perspective of senior leadership. Additional insight may have been gained by inclusion of middle-level managers and other employees who are not senior leaders. A recommended area for future research is the role and impact of employees who are not senior leaders within the organization when an organization transforms toward sustainability.
- Future studies in organizational sustainability can be made more trustworthy by gathering data from stakeholder organizations to the organization being studied. An additional step to improve both trustworthiness and generalizability is to conduct a multiple case study examining several organizations in one industry, or to examine several organizations from different industries (cross comparison).
- There is a need to understand what the sustainability priorities are for each industry. Some literature indicates there are commonalities, while other literature indicates the differences between industries. In a study of 88 chemical companies, Christmann (2000b) found that integrating environmental policy into best practices enhances competitive advantage. One limitation is that in nonchemical industries, the results may not be the same. Diamond (2005) asserts that the industries involving timber, fishing, coal, and petroleum all face the same core issues—conservation of resources, preventing and controlling environmental pollution, and the need to increase their ability be proactive in risk management.

Performing cross industry studies involving organizations from three or more industries would help address this need.

- Theory indicates there are many benefits to sustainable development initiatives, while research has verified only a few those benefits. For example, the research on the economic benefits of sustainability has a foundation (Christmann, 2000a; Esty & Winston, 2006; Hoffman, 2007a; Sharma et al., 2007; UNEP, 2006). Hall and Vredenburg (2004b) assert that sustainability initiatives contribute to innovation, but research verifying that statement is still forthcoming. Research is needed that examines other benefits of sustainability, e.g., to developing countries, energy efficiency and conservation, education, and other areas.

*Implications for Theory*

- Sustainability theory can be enhanced by defining it as the triad of sustainable operations, sustainable products and services, and social responsibility. Much of sustainability theory is focused on the triple-bottom-line of social, environmental, and economic values, while neglecting to relate these values back to organizational processes (Elkington, 1997).
- There is a disconnect between models and theory for (1) organizational change or performance and (2) business strategy. Theory is needed that can connect these two areas.
- The results of this study lend support to the theory that leaders with more heterogeneity in their social interactions and knowledge sharing are more likely to understand sustainability-related issues.

*Implications for Practice*

- In designing organizational practices, reporting and measures for sustainability it is important to define what sustainability means to each area of the organization. As a starting place, sustainability can be practiced through the triad of sustainable operations, sustainable products and services, and social responsibility.
- The social responsibility aspect of sustainability is critical. When designing a strategy for organizational change for sustainability, the first consideration is the needs of people affected (e.g., customers, employees, and other stakeholders) and the second consideration is the inherent role of, and impact on, the environment.
- Due to the long time frame required for developing products and services, business strategy for sustainability must be considered proactively. As a result, this indicates that when formulating business strategy for the coming year, research and development, and related planning must be more innovative and sustainable than the current customer or market needs.
- Having a change champion for is a key factor for successful organizational sustainability. Additional factors that contributed to DuPont being an effective organization include: support at the executive and board level; engaging stakeholders including NGOs, government organizations, universities, communities, and other organizations; research and development; having capital available; participation in trade organizations; having experience in organizational change due to the 208 year old age of the company; strong core values; making sustainability part of the mission; and having an extensive award systems in place.

- Organizational change toward sustainability can be such a challenge for most organizations that continuous realignment of organizational change process and business strategy may be required for successful change.
- Organizational change facilitation is needed in order to understand organizational change resistance, learn from it, and overcome negative reactions to the organizational change initiative.
- At every level of the organization and in every business unit, there must be accountability for integrating sustainability into the organization, including a board or committee for sustainability at the senior-most level of the organization and working groups within each business unit.

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## APPENDIX A: FOUNDATIONAL SUSTAINABILITY LITERATURE

The following table lists several of the foundational literary sources from 1984 to the present.

| Author, Year | Type of Literature | Focus or Contribution of the Literature |
|---|---|---|
| (Bass & Dalal-Clayton, 2002) | Empirical Research and Theory | This work examines strategies for better research initiatives. |
| (Bendell, 2000) | Theory | This work is a collection of papers discussing how multiple sectors can collaborate for sustainability. |
| (Brundtland Commission, 1987) | Theory | This is the seminal work on sustainability, suggesting directions for approaching this issue. The definition of sustainability from this reference is widely used. |
| (Butler, 2004) | Theory and Practice | Butler examines how five firms leverage sustainability. |
| (Christmann, 2000b) | Theory and Practice | This research shows a positive correlation between asset sharing and profit in environmental management. |
| (Diamond, 2005) | Theory | Diamond theorizes why societies throughout history have collapsed. Two of the main factors have been a depletion of natural resources and an inability of a society's members to see the problems that are occurring until it is too late. |
| (Dunphy, Griffiths, & Benn, 2003) | Practice and Theory | This work describes the role of sustainability at the organizational level. |
| (Elkington, 1997) | Theory and Practice | A classic work on sustainable development, coining the term "triple-bottom line." Elkington describes implications of sustainability for business. Provides models of sustainability and approaches for understanding business issues. |
| (Elkington, 2001) | Theory | Examines the role of the CEO in dealing with sustainability in corporations. |
| (Filho, 2000) | Theory and Practice | Filho describes misconceptions of the sustainability concept in universities. |

| Author, Year | Type of Literature | Focus or Contribution of the Literature |
|---|---|---|
| (Freeman, 1984) | Theory | This is the seminal work on stakeholder issues. |
| (Gupta, 2002) | Practice | This study indicates that corporate social responsibility improves an organization's marketability. |
| (Hall & Vredenburg, 2003) | Theory and Practice | Hall and Vredenburg explain the meaning of sustainable development innovation. Explains why managers are unable to cope with sustainability issues. |
| (Hall & Vredenburg, 2004b) | Empirical Research | This work describes the implications of sustainability for innovation and competitive advantage. |
| (Hart, 1997) | Empirical Research | This study describes how nature's economy and the market economy are intertwined. One of the top five most requested articles in the *Harvard Business Review*. |
| (Hart, 2005) | Empirical Research and Theory | Hart proposes that corporations (but not government or civil society) be equipped to lead us toward a sustainable world because of their technology, resources, capacity, and global reach. |
| (Hart & Christensen, 2002) | Research and Practice | Hart and Christensen present a framework for directing innovations that benefit the least wealthy five-fifths of the world. |
| (Hay, 1996) | Theory and Practice | A study revealing that sustainability is not understood well, nor is it adopted widely by organizations. This study indicates ways to market sustainable development. |
| (Holliday et al., 2002) | Practice, Empirical Research, and Theory | This is a collection of more than 50 case studies on the role of sustainability in Fortune 500 companies, with various implications for practice. |
| (Hopwood, Mellor, & O'Brien, 2005) | Practice | This work presents a classification and mapping of different trends of thought on sustainable development. |
| (McWilliams & Siegel, 2001) | Empirical Research | McWilliams and Siegel provide an overview of corporate social responsibility. |
| (Sharma, 2002) | Empirical Research | This work examines key issues in researching corporate social responsibility. |

| Author, Year | Type of Literature | Focus or Contribution of the Literature |
|---|---|---|
| (Sharma & Starik, 2002) | Theory | This is a compilation of cutting-edge, leading research on what sustainability means to organizations, drawing from the research of the Academy of Management's working group Organizations and the Natural Environment (ONE). |
| (Sharma & Starik, 2004a) | Practice | This is a compilation of research on sustainability and stakeholder issues. |
| (Weaver, Rock, & Kusterer, 1997) | Theory and Practice | This article presents theory on global economic development from 1950 to 1997 and relates key issues to sustainability. |

## APPENDIX B: SECONDARY REFERENCES SUPPORTING FINDINGS

The following table describes the secondary references that were included in this study to support the findings. Each of these references in some way contributes to describing DuPont's shift toward sustainability.

| Author, Year | Relation to This Research Study |
|---|---|
| (Blackburn, 2007) | Overview of sustainability for organizational leaders. Makes reference to DuPont's notion of sustainability. |
| (Chandler, 1962) | Seminal book describing DuPont's corporate strategy in mid-20th century. Establishes connection between organizational form and organizational strategy. |
| (Chandler, 1977) | Provides detailed case studies of the largest companies in oil, heavy machinery, rubber, and chemicals, including DuPont. Describes how DuPont consolidated acquisitions. |
| (Chandler, 2005) | Describes how research and development was applied at DuPont over several decades. |
| (Chandler & Mazlish, 2005) | Describes the international nature of DuPont's board of directors. |
| (Charan, 2009) | Provides insight on how DuPont prepared for the economic recession in 2008. |
| (Dunphy et al., 2007) | Describes DuPont's strategy for incorporating capability related to sustainability into its leadership, including diversity within its organizational structure. |
| (DuPont, 2008a) | Overview of DuPont's performance for 2008. |
| (DuPont, 2009a) | DuPont's environmental footprint goals for 2015. |
| (DuPont, 2009b) | Description of DuPont's sustainability accomplishments. |
| (DuPont, 2009c) | Timeline of DuPont's sustainability accomplishments. |
| (DuPont, 2009d) | Overview of DuPont's company size, mission, and products. |
| (Edwards, 2005) | Describes DuPont's emissions reductions. |
| (Epstein, 2008) | Provides an overview of how DuPont organized for sustainability and its bottom |

| Author, Year | Relation to This Research Study |
|---|---|
| | of the pyramid interests. |
| (Flannery, 2005) | Contains examples of how DuPont, along with other companies, take action to alleviate climate change. |
| (Friedman & Miles, 2006) | Gives examples of how stakeholders have influenced DuPont. |
| (Hagley, 2009) | Describes documentation available at Hagley Museum and Library. |
| (Hart, 2005) | Describes the role that corporations play in sustainability, including examples by DuPont. |
| (Hart, 2009, September 9) | Personal conversation with Stuart Hart regarding this research study. |
| (Hart & Christensen, 2002) | Describes how multinational companies play a role in bottom of the pyramid–related business. |
| (Hoffman, 2001) | Provides several examples of DuPont's accomplishments and shift toward sustainability, focusing on the years 1970 to 2000. |
| (Hoffman, 2007a) | Describes DuPont's activities related to carbon reduction, focusing on 1990 to 2007. |
| (Hoffman, 2007b) | Describes DuPont's work with U.S. Climate Action Partnership (USCAP). |
| (Holliday, 2001) | Describes DuPont's notion of sustainability. |
| (Holliday et al., 2002) | Describes a few dozen case studies of companies working toward sustainability and principles for sustainability. |
| (Hounshell & Smith, 1988) | Describes DuPont's research and development activities from 1902 to 1980. |
| (Kamalick, 2007) | Describes DuPont's work with USCAP. |
| (Kinnane, 2002) | Overall company history of DuPont as it celebrated its 200$^{th}$ anniversary in business. |
| (Murphy & Dee, 1992) | Describes influence of Greenpeace on DuPont. |
| (Senge et al., 2008) | Provides examples of how stakeholders and CEOs influenced DuPont in its path toward sustainability. |
| (Stead & Stead, 2004) | Describes the role of analytical tools in sustainability transformation. |
| (Willard, 2005) | Describes the influence of Greenpeace on DuPont. |

| Author, Year | Relation to This Research Study |
|---|---|
| (Woolard, 1989) | Transcript of landmark speech, marking DuPont's tipping point toward sustainability. |
| (Woolard, 2005) | Describes former DuPont CEO Woolard's values and lessons learned. |

## APPENDIX C: NONMEDICAL RESEARCH CONSENT FORM

You are invited to take part in a research study being conducted by Scot Holliday, Ed.D., ABD, Human and Organizational Learning, George Washington University. You are being asked if you want to take part in this study because [Insert Name] suggested you would be a good person to interview. We ask that you read this form and ask any questions you may have before agreeing to be in this study.

Talk to the research team if you: Have questions, including questions about your rights, have concerns or complaints, or think you have been harmed. You can contact the Principal Investigator, Dr. David Schwandt, Professor of Human and Organizational Learning, at 703-726-3770 or a member of the research team at 202-997-4808. If you want to talk to someone else, call the Office of Human Research at 202-994-2715. Taking part is up to you. You can refuse to take part. You can join now and quit later. Either way, it won't affect how we treat you.

The purpose of this research study is to understand the role of organizational change in sustainability. The total amount of time you will spend in this study is 1 to 3 hours, depending on your availability.

The procedure for participating in this study is as follows:

(1) Review and sign the 'Research Consent Form'

(2) Participate in the interview

(3) 1 to 3 weeks after the interview, a transcript of the interview will be emailed or mailed to you, depending on your preference. Review the transcript and provide any changes or additional comments. No changes or additional comments are required.

There are no expected risks for participating in this study. Participation in this study may further your knowledge and understanding of the role of organizational change in sustainability. Additionally, it is our hope that information gained from this study will help others better understand the role of organizational change in sustainability.

The records of this study will be kept private. In any publication or presentations, we will not include any information that will make it possible to identify you as the subject. Research records will be stored securely, and only the researcher in this study will have access to the records.

Interview Participant:

_____

Printed Name Signature Date

Investigator:

_____

Printed Name Signature Date

## APPENDIX D: RESEARCHER VERSION OF INTERVIEW QUESTIONS

1) This study is about sustainability. In your words, what does sustainability mean to this organization?
   [Is it a strategy, set of values, a marketing tool, innovation, or paradigm shift? How did DuPont develop sustainability? What are DuPont's sustainability principles?]

2) Tell me your story of how DuPont reduced its environmental footprint yet remained profitable.
   [What timeframe or timeframes do you consider? Was there a pivotal moment? What role do stakeholders serve?]

3) How did DuPont communicate sustainability?
   [Internally to senior managers and employees? Externally? Did geography play a role?]

4) How is success measured in this area?
   [Do you measure the triple-bottom line (economic, social, and environmental indicators)? Does DuPont use publicly available or proprietary measures? Is a third party involved?]

5) What role do you serve in DuPont's sustainability efforts?
   [Advocate, leader, communicator? How did you influence others? What roles did senior management, board members, and employees serve?]

6) How do you view your role in relation to others in the organization?
   [Are you a stakeholder? Defensive or offensive?]

7) What events influenced DuPont's decision to reduce its environmental footprint?
   [Was there a tipping point? Did government regulation influence DuPont? How did competitors influence DuPont? What role did the economy serve?]

8) Was there any resistance to change?
   [From leaders, employees, stakeholders, customers, suppliers? Internal vs. external resistance?]

9) If so, tell me about how it was resolved.
   [Third-party mediator? Through a particular process? How did new relationships evolve?]

10) What other things can you tell me about DuPont's sustainability efforts?
    [Was it gradual or sudden? In what way? Were all levels of the DuPont organization involved?]

## APPENDIX E: PROVISIONAL LIST OF DATA CODES

| Code | Definition |
|---|---|
| H: DuPont History General | History of DuPont since the inception of the company spanning over 200 years. As background for the study, the researcher will write a 3- to 8-page overview of the history of DuPont to provide a historical context for the organization being studied in this case study. |
| Ha: Environmental Policy History | Relevant history of environmental policy from the U.S. government and international law and policy. This code may include mention of major world events that have affected environmental policy. |
| S1: Sustainability Principles | Principles that guide an organization toward being sustainable and finding a good integration of economic, social, and environmental values. These principles may be specific to DuPont or ones that could be applied more generally to other organizations. |
| S2: Sustainability Business Strategy | Business strategy that leverages sustainability to improve an organization's financial success and survival. Strategies created at DuPont that increase business performance through sustainability. |
| S3 Sustainability Indicators | Indicators used to measure performance in terms of sustainability, environmental performance measures, and measure of carbon footprint. |
| S4 Senior Management/Board | The top 30 executives at DuPont and board of directors. This is the general group targeted for interviews of current or former DuPont employees. |
| S5: Employee | Any person employed by DuPont at any level. |
| S6: Communications | Communications that were written, verbal, or other formats intended for internal or external audiences. This is one of the mechanisms for moving an organization through organizational change. |
| SG: Sustainability General | A general comment, definition, or idea related to sustainability. |
| C7: Stages of Organizational Change | Any data that relates specifically to the process of organizational change. This may include indicators for when a major change occurred at DuPont, tipping points, and sudden or gradual change trends. |
| C8: Internal Resistance | Resistance to change in the context of sustainability within DuPont. |
| C9: External Resistance | Resistance to change in the context of sustainability by stakeholders or events external to DuPont. This may relate to customers, communities, government, other companies and |

| Code | Definition |
|---|---|
| | additional areas. |
| C10: External Influencing Events | This includes events that occurred outside of DuPont that influence DuPont's sustainability story. |
| C10a: Internal Influencing Events | Events within DuPont that influenced DuPont's sustainability story. This may include reorganization, new leadership, new products, or other initiatives. |
| CG: Change General | This is a code to capture any comments or information related to DuPont's organizational change process that do not specifically fit into another category that relates to change. Also, data points that specifically related to change are linked to this code so that all of the change-related data points can be compared to or integrated with one another later on. |
| R11: Other Organizational Influences | The following subcodes were created for "Other Organizational Influences": R11a: Stakeholder Engagement, R11b: Government Relations, R11c: Role of NGOs, R11d: Role of Consultants, R11e: Customer Influence, and R11f: Competitor Influence. After all the data for this study are coded, depending on the trends, some of these subcodes may become codes or code parents with their own subcodes. |
| R12: Using Existing Resources | Solving problems or creating sustainability initiatives using existing capital, materials, and intellectual capital. |
| R13: Organizational Level | Data related to the role of organizational level, top-down or bottom-up strategies, or similar concepts involving organizational levels. |
| R14: Organizational Structure | Structure that is conceptually or physically related to organizations (e.g., role of specific job types, organizational structure change, or new buildings). |
| RG: Restructuring General | Restructuring of social structures or processes. This may include business or organizational realignment. |

## APPENDIX F: FINAL LIST OF 90 DATA CODES

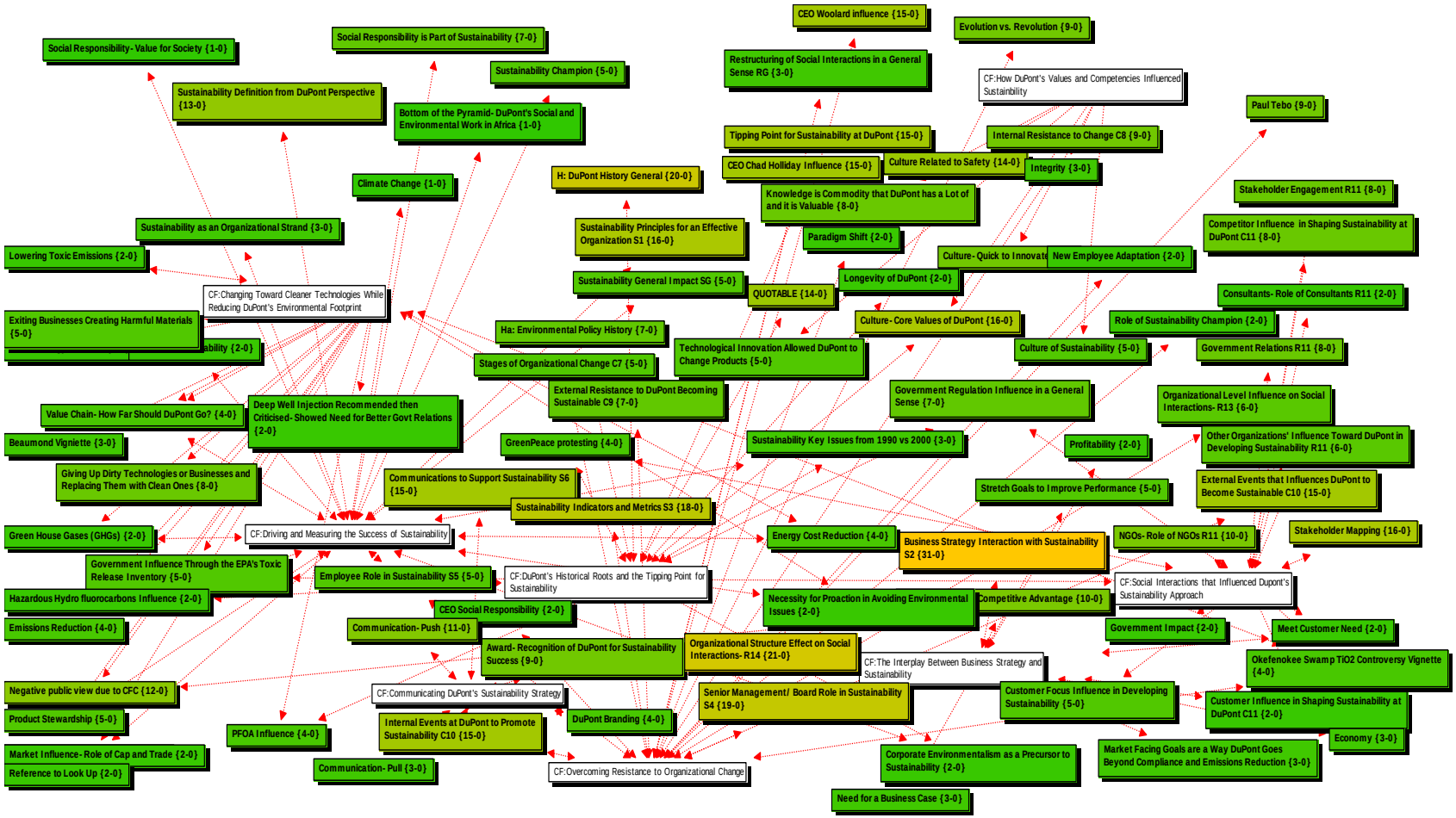
Note: The numbers in parentheses indicate the number of quotations linked to each code.

1) Award—Recognition of DuPont for Sustainability Success (4-0)
2) Beaumond Vignette (3-0)
3) Biotechnology Entrance (2-0)
4) Bottom of the Pyramid—DuPont's Social and Environmental Work in Africa (1-0)
5) Business Strategy—Competitive Advantage (10-0)
6) Business Strategy Interaction with Sustainability S2 (31-0)
7) CEO Chad Holliday Influence (15-0)
8) CEO Social Responsibility (2-0)
9) CEO Woolard influence (15-0)
10) Climate Change (1-0)
11) Communication—Pull (3-0)
12) Communication—Push (11-0)
13) Communications to Support Sustainability S6 (15-0)
14) Competing with Customers (3-0)
15) Competitor Influence in Shaping Sustainability at DuPont C11 (8-0)
16) Consultants—Role of Consultants R11 (2-0)
17) Corporate Environmentalism as a Precursor to Sustainability (2-0)
18) Culture—Core Values of DuPont (16-0)
19) Culture—Quick to Innovate (9-0)
20) Culture of Sustainability (5-0)
21) Culture Related to Safety (14-0)
22) Customer Focus Influence in Developing Sustainability (5-0)
23) Customer Influence in Shaping Sustainability at DuPont C11 (2-0)
24) Deep Well Injection Recommended then Criticized—Showed Need for Better Gov't Relations (2-0)
25) Driver for Sustainability (2-0)
26) DuPont Branding (4-0)
27) Economy (3-0)
28) Emissions Reduction (4-0)
29) Employee Role in Sustainability S5 (5-0)
30) Energy Cost Reduction (4-0)
31) Evolution vs. Revolution (9-0)
32) Exiting Businesses Creating Harmful Materials (5-0)
33) External Events that Influences DuPont to Become Sustainable C10 (15-0)
34) External Resistance to DuPont Becoming Sustainable C9 (7-0)
35) Giving Up Dirty Technologies or Businesses and Replacing Them with Clean Ones (8-0)
36) Government Impact (2-0)
37) Government Influence Through the EPA's Toxic Release Inventory (5-0)
38) Government Regulation Influence in a General Sense (7-0)
39) Government Relations R11 (8-0)
40) Greenhouse Gases (GHGs) (2-0)
41) Greenpeace protesting (4-0)
42) H: DuPont History General (21-0)
43) Ha: Environmental Policy History (7-0)
44) Hazardous Hydro fluorocarbons Influence (2-0)
45) Integrity (3-0)
46) Internal Events at DuPont to Promote Sustainability C10 (15-0)
47) Internal Resistance to Change C8 (10-0)

48) Knowledge is Commodity that DuPont Has a Lot of and It Is Valuable (8-0)
49) Lack of Reward for Sustainability (2-0)
50) Longevity of DuPont (2-0)
51) Lowering Toxic Emissions (2-0)
52) Market-Facing Goals are a Way DuPont Goes Beyond Compliance and Emissions Reduction (3-0)
53) Market Influence—Role of Cap and Trade (2-0)
54) Meet Customer Need (2-0)
55) Necessity for Proaction in Avoiding Environmental Issues (2-0)
56) Need for a Business Case (3-0)
57) Negative public view due to CFC (13-0)
58) New Employee Adaptation (2-0)
59) NGOs—Role of NGOs R11 (10-0)
60) Okefenokee Swamp $TiO_2$ Controversy Vignette (4-0)
61) Organizational Level Influence on Social Interactions—R13 (6-0)
62) Organizational Structure Effect on Social Interactions—R14 (21-0)
63) Other Organizations' Influence on DuPont in Developing Sustainability R11 (8-0)
64) Paradigm Shift (2-0)
65) Paul Tebo (9-0)
66) PFOA Influence (4-0)
67) Product Stewardship (5-0)
68) Profitability (2-0)
69) QUOTABLE (14-0)
70) Reducing the Carbon Footprint (3-0)
71) Reference to Look Up (2-0)
72) Restructuring of Social Interactions in a General Sense RG (3-0)
73) Role of Sustainability Champion (2-0)
74) Senior Management/Board Role in Sustainability S4 (19-0)
75) Social Responsibility—Value for Society (1-0)
76) Social Responsibility Is Part of Sustainability (7-0)
77) Stages of Organizational Change C7 (5-0)
78) Stakeholder Engagement R11 (8-0)
79) Stakeholder Mapping (16-0)
80) Stretch Goals to Improve Performance (5-0)
81) Sustainability as an Organizational Strand (3-0)
82) Sustainability Champion (5-0)
83) Sustainability Definition from DuPont Perspective (13-0)
84) Sustainability General Impact SG (5-0)
85) Sustainability Indicators and Metrics S3 (18-0)
86) Sustainability Key Issues from 1990 vs. 2000 (3-0)
87) Sustainability Principles for an Effective Organization S1 (20-0)
88) Technological Innovation Allowed DuPont to Change Products (5-0)
89) Tipping Point for Sustainability at DuPont (15-0)
90) Value Chain—How Far Should DuPont Go? (4-0)

## APPENDIX G: ATLAS TI 5.5 CODE NETWORK MAP

Note: The numbers in parentheses indicate the number of quotations linked to each code. Clusters have a white background. Codes have a colored background.



## APPENDIX H: COMPLETE LIST OF CODES WITHIN EACH CLUSTER

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HU: Holliday Dissertation
File: [C:\Program Files (x86)\Scientific Software\ATLASti\Program\Holliday Dissertation.hpr5]
Edited by: Super
Date/Time: 10/08/2009 11:31:16 PM

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Cluster: DuPont's Historical Roots and the Tipping Point for Sustainability
Created: 08/17/2009 08:30:21 PM (Super)
Codes (12): [Corporate Environmentalism as a Precursor to Sustainability] [Culture—Core Values of DuPont] [Government Regulation Influence in a General Sense] [Greenpeace protesting] [H: DuPont History General] [Ha: Environmental Policy History] [Hazardous Hydro fluorocarbons Influence] [Longevity of DuPont] [PFOA Influence] [QUOTABLE] [Sustainability Key Issues from 1990 vs 2000] [Tipping Point for Sustainability at DuPont]
Quotation(s): 83

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Cluster: How DuPont's Values and Competencies Influenced Sustainability
Created: 08/17/2009 08:32:05 PM (Super)
Codes (7): [Culture—Core Values of DuPont] [Culture—Quick to Innovate] [Culture of Sustainability] [Culture Related to Safety] [Integrity] [Knowledge is Commodity that DuPont has a Lot of and it is Valuable] [Technological Innovation Allowed DuPont to Change Products]
Quotation(s): 54

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Cluster: Drivers, Measurements and Social Interactions Contributing to Sustainability
Created: 08/17/2009 08:31:46 PM (Super)
Codes (37): [Bottom of the Pyramid—DuPont's Social and Environmental Work in Africa] [Climate Change] [Corporate Environmentalism as a Precursor to Sustainability] [Driver for Sustainability] [Emissions Reduction] [Employee Role in Sustainability S5] [Energy Cost Reduction] [Greenhouse Gases (GHGs)] [Lack of Reward for Sustainability] [Necessity for Proaction in Avoiding Environmental Issues] [Product Stewardship] [Reducing the Carbon Footprint] [Social Responsibility—Value for Society] [Social Responsibility is Part of Sustainability] [Sustainability as an Organizational Strand] [Sustainability Champion] [Sustainability Definition from DuPont Perspective] [Sustainability General Impact SG] [Sustainability Key Issues from 1990 vs 2000] [Sustainability Principles for an Effective Organization S1] [Competing with Customers] [Competitor Influence in Shaping Sustainability at DuPont C11] [Consultants—Role of Consultants R11] [Customer Focus Influence in Developing Sustainability] [Customer Influence in Shaping Sustainability at DuPont C11]

[Government Impact] [Government Influence Through the EPA's Toxic Release Inventory] [Government Regulation Influence in a General Sense] [Government Relations R11] [Greenpeace protesting] [Meet Customer Need] [Negative public view due to CFC] [NGOs—Role of NGOs R11] [Okefenokee Swamp TiO2 Controversy Vignette] [Other Organizations' Influence Toward DuPont in Developing Sustainability R11] [Stakeholder Engagement R11] [Stakeholder Mapping]
Quotation(s): 178

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Cluster: Changing Toward Cleaner Technologies While Reducing DuPont's Environmental Footprint
Created: 08/17/2009 08:31:04 PM (Super)
Codes (19): [Beaumond Vignette] [Biotechnology Entrance] [Deep Well Injection Recommended then Criticized—Showed Need for Better Gov't Relations] [Emissions Reduction] [Energy Cost Reduction] [Exiting Businesses Creating Harmful Materials] [Giving Up Dirty Technologies or Businesses and Replacing Them with Clean Ones] [Government Influence Through the EPA's Toxic Release Inventory] [Greenhouse Gases (GHGs)] [Hazardous Hydro fluorocarbons Influence] [Lack of Reward for Sustainability] [Lowering Toxic Emissions] [Necessity for Proaction in Avoiding Environmental Issues] [Negative public view due to CFC] [Okefenokee Swamp TiO2 Controversy Vignette] [PFOA Influence] [Product Stewardship] [Reducing the Carbon Footprint] [Value Chain—How Far Should DuPont Go?]
Quotation(s): 73

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Cluster: The Interplay Between Business Strategy and Sustainability
Created: 08/17/2009 08:29:55 PM (Super)
Codes (10): [Business Strategy—Competitive Advantage] [Business Strategy Interaction with Sustainability S2] [Customer Focus Influence in Developing Sustainability] [Customer Influence in Shaping Sustainability at DuPont C11] [Economy] [Market-Facing Goals are a Way DuPont Goes Beyond Compliance and Emissions Reduction] [Meet Customer Need] [Need for a Business Case] [Profitability] [Stretch Goals to Improve Performance]
Quotation(s): 60

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Cluster: Overcoming Resistance to Organizational Change
Created: 08/17/2009 08:31:31 PM (Super)
Codes (20): [CEO Chad Holliday Influence] [CEO Social Responsibility] [CEO Woolard influence] [Employee Role in Sustainability S5] [Evolution vs. Revolution] [External Events that Influences DuPont to Become Sustainable C10] [External Resistance to DuPont Becoming Sustainable C9] [Internal Events at DuPont to Promote Sustainability C10] [Internal Resistance to Change C8] [New Employee Adaptation] [Okefenokee Swamp TiO2 Controversy Vignette] [Organizational Level Influence on Social Interactions—R13] [Organizational Structure Effect on Social Interactions—R14] [Paradigm Shift] [Paul Tebo] [Restructuring of Social Interactions in a General Sense

RG] [Role of Sustainability Champion] [Senior Management/ Board Role in Sustainability S4] [Stages of Organizational Change C7] [Sustainability Indicators and Metrics S3]
Quotation(s): 151

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Cluster: Communicating DuPont's Sustainability Strategy
Created: 08/17/2009 08:31:59 PM (Super)
Codes (6): [Award—Recognition of DuPont for Sustainability Success] [Communication—Pull] [Communication—Push] [Communications to Support Sustainability S6] [DuPont Branding] [Internal Events at DuPont to Promote Sustainability C10]
Quotation(s): 52

# APPENDIX I: MAPPING OF THEMES TO DATA CLUSTERS AND RESEARCH QUESTIONS

**Mapping of the Themes to the Data Clusters and Research Questions**

| Symbol Legend | |
|---|---|
| ❖ | = Significant correlation |
| ♦ | = Small to moderate correlation |
| X | = No correlation |

| | | | Data Clusters | | | | | | Themes |
|---|---|---|---|---|---|---|---|---|---|
| | | | (1) DuPont's Tipping Point for Sustainability | (2) Drivers, Measurements and Social Interactions Contributing to Sustainability | (3) The Interplay Between Business Strategy and Sustainability | (4) How DuPont's Values and Competencies Influenced Sustainability | (5) Over-coming Resistance to Organizational Change | (6) Communicating DuPont's Sustainability Strategy | (7) Changing Toward Cleaner Technologies While Reducing DuPont's Environmental Footprint | |
| Research Questions | Sustainability Principles | 1) What principles guided DuPont in reducing its environmental footprint? | ♦ | ❖ | ♦ | ❖ | ♦ | ♦ | ♦ | (Theme 2) Principles for Effective Organizational Sustainability |
| | | 2) How did DuPont's business strategy influence its approach to sustainability? | ❖ | ♦ | ❖ | ♦ | ♦ | ♦ | ❖ | (Theme 1) The Role of Sustainability in Developing a Business Strategy |
| | | 3) What indicators did DuPont and its stakeholders use to measure DuPont's improvement at reducing its environmental footprint, and what was measured? | ♦ | ❖ | ♦ | ♦ | ♦ | ♦ | ♦ | |
| | | 4) What role did senior management and the corporate board serve in DuPont's transformation? | ♦ | ♦ | ❖ | ♦ | ♦ | ❖ | ❖ | (Theme 4) Role of Senior Management in Sustainability Transformation |
| | | 5) What role did employees serve in DuPont's transformation? | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | |
| | | 6) What methods were used to communicate with employees? | ♦ | ♦ | ♦ | ♦ | ♦ | ❖ | ♦ | |

## Mapping of the Themes to the Data Clusters and Research Questions

| Symbol Legend | |
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| ❖ | = Significant correlation |
| ♦ | = Small to moderate correlation |
| X | = No correlation |

| | | | Data Clusters | | | | | | Themes |
|---|---|---|---|---|---|---|---|---|---|
| | | | (1) DuPont's Tipping Point for Sustainability | (2) Drivers, Measurements and Social Interactions Contributing to Sustainability | (3) The Interplay Between Business Strategy and Sustainability | (4) How DuPont's Values and Competencies Influenced Sustainability | (5) Over-coming Resistance to Organizational Change | (6) Communicating DuPont's Sustainability Strategy | (7) Changing Toward Cleaner Technologies While Reducing DuPont's Environmental Footprint | |
| Research Questions | Stages of Change | 7) What were the stages of organizational change DuPont progressed through in developing its current approach toward organizational sustainability? | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ❖ | |
| | | 8) What resistance to change did DuPont have to overcome internally, and how was it overcome? | ❖ | ♦ | ♦ | ♦ | ❖ | ♦ | ♦ | (Theme 3) Resistance to Organizational Change for Sustainability |
| | | 9) What resistance to change did DuPont have to overcome externally, and how was it overcome? | ♦ | ♦ | ♦ | ♦ | ❖ | ♦ | ♦ | |
| | | 10) What were the key external events that influenced DuPont's decision to reduce its environmental footprint, and how did each event shape DuPont? | ❖ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | |

## Mapping of the Themes to the Data Clusters and Research Questions

| Symbol Legend | |
|---|---|
| ❖ | = Significant correlation |
| ♦ | = Small to moderate correlation |
| X | = No correlation |

| | | | Data Clusters | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | (1) DuPont's Tipping Point for Sustainability | (2) Drivers, Measurements and Social Interactions Contributing to Sustainability | (3) The Interplay Between Business Strategy and Sustainability | (4) How DuPont's Values and Competencies Influenced Sustainability | (5) Over-coming Resistance to Organizational Change | (6) Communicating DuPont's Sustainability Strategy | (7) Changing Toward Cleaner Technologies While Reducing DuPont's Environmental Footprint | Themes |
| Research Questions | Restructuring Social Interactions | 11) How have other organizations influenced DuPont in its path toward developing and executing sustainability strategies? | ❖ | ❖ | ♦ | ♦ | ❖ | ♦ | ❖ | (Theme 5) Influence of Stakeholders |
| | | 12) In what ways does restructuring the social interactions within an organization maximize use of existing resources and knowledge? | X | X | X | X | X | X | ♦ | |
| | | 13) Do organizations require isomorphism across organizational levels to achieve sustainability? | X | X | X | X | X | X | X | |
| | | 14) How did DuPont's organizational structure change to support its focus on sustainability? | X | ♦ | X | X | X | X | ♦ | |

## APPENDIX J: DUPONT'S 2015 REDUCING FOOTPRINT GOALS

**Greenhouse Gas Emissions**: Since 1990, we have reduced our global greenhouse gas emissions, measured as $CO_2$ equivalents, by 72%. By 2015, we will further reduce our greenhouse gas emissions by at least 15% from a base year of 2004 (DuPont, 2009a).

**Water Conservation**: We commit to reducing water consumption by at least 30% over the next 10 years at our global sites that are located where the renewable freshwater supply is either scarce or stressed as determined by the United Nations analysis of river basins globally. For all other sites, we will hold water consumption flat on an absolute basis through the year 2015, offsetting any increased demand from production volume growth through conservation, reuse, and recycle practices (DuPont, 2009a).

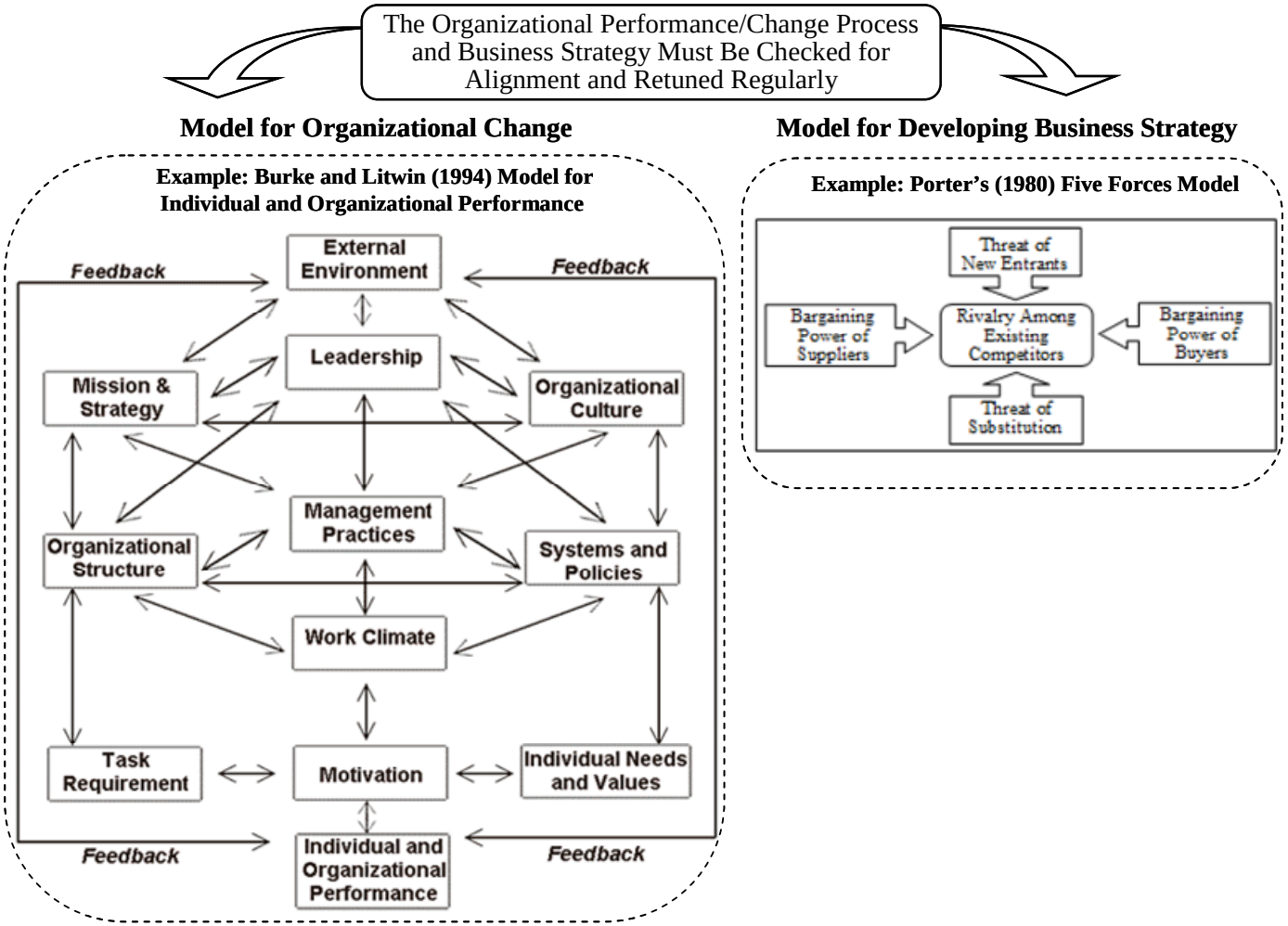
**Fleet Fuel Efficiency**: Effective immediately, we will introduce fleet vehicles that represent the leading technologies for fuel efficiency and fossil fuel alternatives. By 2015, we will ensure that 100% of our off-site fleet of cars and light trucks meet these criteria. We will continue to ensure that these vehicles are safe as well as fuel efficient, and we will track and report on our fuel efficiency improvements (DuPont, 2009a).

**Air Carcinogens**: Since 1990, we have reduced our global air carcinogen emissions by 92%, well beyond legal requirements. By 2015, we will further reduce our air carcinogen emissions by at least 50% from a base year of 2004. This will bring our total reductions since 1990 to 96% (DuPont, 2009a).

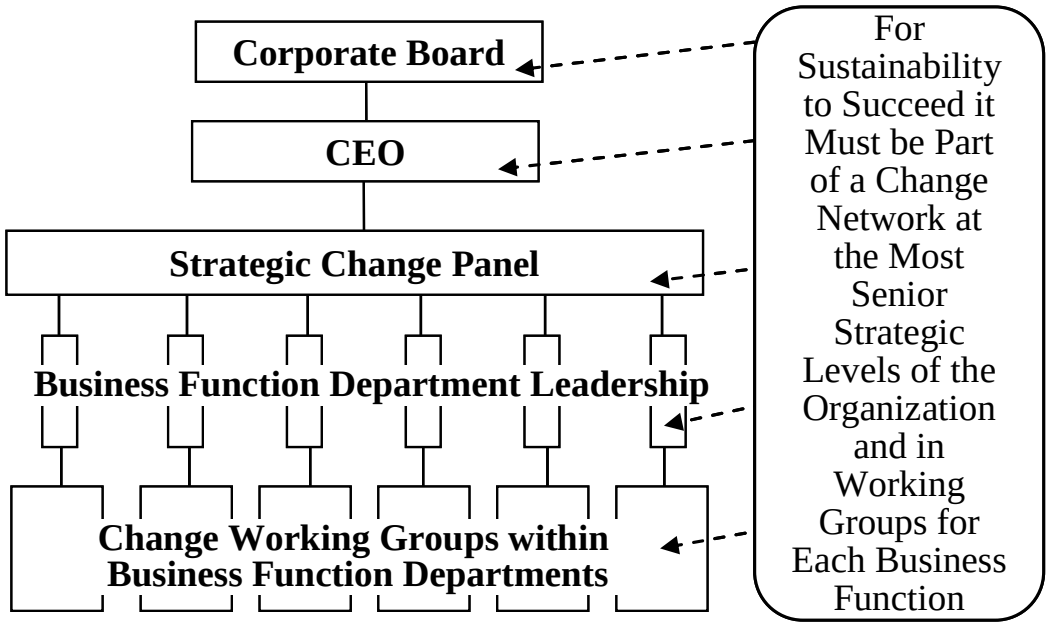
**Independent Verification**: By 2015, we will ensure that 100% of our global manufacturing sites have successfully completed an independent third-party verification of the effectiveness of their environmental management goals and systems. We will make this information publicly available and communicate it to our local communities (DuPont, 2009a).

## APPENDIX K: ADDRESSING THE GAP BETWEEN ORGANIZATIONAL CHANGE AND BUSINESS STRATEGY

This figure depicts the need for continual realignment of organizational change strategy to business strategy in order to improve the likelihood of success organizational change.



## APPENDIX L: SUSTAINABILITY STRATEGY AND CHANGE NETWORK




(based on Wade, 2009)