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**AN EMPIRICAL INVESTIGATION: HOW SMALL TO MID-SIZED
ENTERPRISES USE INNOVATION ON THE PATH TOWARD ECOLOGICAL
SUSTAINABILITY**

BY

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DISSERTATION

**Submitted to the University of New Hampshire
in Partial Fulfillment of
the Requirements for the Degree of**

**Doctor of Philosophy
in
Natural Resources and Environmental Studies**

December 2012

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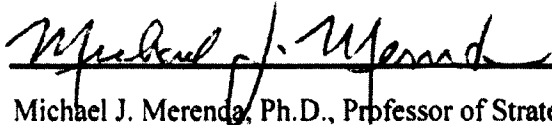
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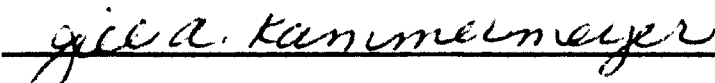
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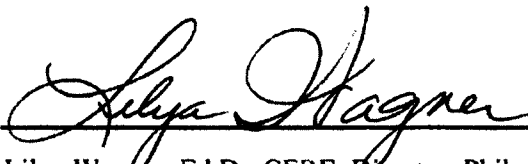
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- ♦ New Chapter: Sara Newmark - Sustainability Manager, Barbie Schulick - Co-Founder, and Kevin Miodonski - Vice President of Operations.

- ♦ Hitchiner Manufacturing Company: John Morison - Chairman, Keith Tuthill - Facilities Manager USA, and Marc Riquelme - Vice President of Sales and Marketing.
- ♦ Monadnock Paper Mills : Richard Verney - Chairman and Chief Executive Officer, David Lunati - Director of Marketing, and Michelle Hamm - Environmental Manager.
- ♦ Casella Waste Systems: Stephen McDonnell - Director of Sales & Marketing, Dr. Dingrong Bai - Senior Process Engineer, Paula Calabrese - Director of Strategy & Intellectual Property, and Abbie Webb - Senior Environmental Analyst.
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DEDICATION

To

John E. Parry III

And

Haley R. Parry

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ABSTRACT

AN EMPIRICAL INVESTIGATION: HOW SMALL TO MID-SIZED ENTERPRISES USE INNOVATION ON THE PATH TOWARD ECOLOGICAL SUSTAINABILITY

By

Shelley F. Mitchell

University of New Hampshire, December 2012

Dependence upon the natural environment is redefining the business relationship between ecological, economic, and social systems. In addition, the major market forces of diminishing natural resources, extreme transparency, and increasing social expectations are reshaping a new sustainability path for companies. This empirical investigation explored the phenomenon of sustainability in small to mid-sized enterprises, focusing on the link between innovation and ecological sustainability. In addressing the research questions, an Eco-Sustainability Conceptual Framework was developed and applied to a sample of small to mid-sized enterprises. In addition, the development and use of an Eco-Scorecard helped to identify key performance indicators for measuring the extent to which companies are sustainable enterprises. Testing the compatibility of the Eco-Sustainability Conceptual Framework and Eco-Scorecard occurred through semi-structured interviews conducted at five small to mid-sized enterprises, which allowed participants to identify strengths and weaknesses in terms of the company's progress toward ecological sustainability.

Overall, key conclusions revealed sustainability is best approached in a multidisciplinary manner and is a long-term process, as observed in the companies. The

Eco-Sustainability Conceptual Framework and Eco-Scorecard blended the natural and social (management) sciences together as a diagnostic tool in showing the significance of small to mid-sized enterprises in implementing sustainable manufacturing processes, products, and services. Based on the case studies, it was possible to track how companies use innovation along the path to ecological sustainability. Small to mid-sized enterprises are an integral part of the ecology of a local community and how they use innovation for sustainability is important to their local community and to other stakeholders. In addition, privately owned firms have an advantage on their path to ecological sustainability because they are better able to balance short-term demands with longer term planning horizons. Although bottom-line profitability is emphasized, environmental and social systems need to be in balance. In addition, based on a small to mid-sized enterprise's sustainability success, global companies are targeting them as acquisitions. Lastly, all the researched firms are identifying and implementing new sustainable processes and products as solutions for their larger company customers in helping them problem-solve sustainability challenges.

CHAPTER 1

INTRODUCTION

More than a decade into the twenty-first century, human induced climate change is a critical threat at the top of a long list of environmental and social challenges affecting both our humanity and the planet Earth. In response to climate change, scientists are calling for environmental changes that include strategic macro-goals in the areas of biodiversity, energy, water, pollution prevention, and waste management (Miller, 2005, pp. 640), indications that a change in how we do business has been long overdue. These environmental macro-goals have corresponding social challenges and solutions, which is why the terms environmental and social are coupled throughout this dissertation and the prefix '*Eco*' is used to denote the ecological and economic systems of sustainability. In 2002, the United Nations set forth the Millennium Development Campaign goals to address economic, environmental, and social challenges and solutions.

Unfortunately, the target for reducing biodiversity loss by 2010 passed resulting in key habitats for threatened plant and animal species to remain at risk. Hence, the number of species facing extinction is increasing, especially in developing countries. While the over exploitation of global fisheries has stabilized, challenges remain to ensure their sustainability which has direct implications for the fishing industry (<http://www.un.org/millenniumgoals/envIRON.shtml>). These challenges include exploitation, pollution, and habitat destruction through climate change or related perturbations of ocean biogeochemistry (Worm et al, 2006).

The risks and opportunities associated with these environmental macro-goals have far-reaching implications for business into the twenty-first century. By deepening an understanding of the connections between organizations and the natural environment, companies can embrace new opportunities, while becoming sustainable enterprises on the path to ecological sustainability. In business, innovation may be the equivalent to adaptation in nature. According to Capra (2002), we can learn valuable lessons from nature, as ecosystems in nature are sustainable communities. This confirms why studying ecological sustainability as it relates to business is critical to the quality of life for all species and the natural environment in which we live and work (Diamond, 2005).

Purpose of the Study

The purpose of this study is to explore the phenomenon of sustainability in small to mid-sized enterprises (SMEs) through a multidisciplinary lens blending the natural and social sciences, focusing on the link between innovation and ecological sustainability in companies located in northern New England. Academics and researchers, such as Porter and van der Linde (1995) have argued that the adaptation of greener business practices is usually a major stimulus for innovation within a firm, giving rise to improvements in products and processes. Their research defined the relationship between innovation and sustainability identifying what factors promote sustainability, including Corporate Social Responsibility. However, the transition from being green to being ecologically sustainable requires that the business activities take place within the carrying capacity of the Earth, at every level, from local to global (Roome, 2004).

Innovation is a critical component for companies to remain competitive in creating long-term value (Dyer, Gregersen, & Christenson, 2011). It is a key discipline

within product development and provides quality customer service. Although many small to mid-sized enterprises recognize its importance, it can be difficult to identify sources of innovation and create a culture for innovation to occur. For the purpose of this research, we define innovation as *the creation, development, and implementation of a new product or process with the goal of improving resiliency, sustainable value, or competitive advantage*. Our study will explore the sources of innovation for products, manufacturing processes, design of an organization linked to knowledge sharing and creativity, including turning new ideas into reality through invention, research, or new services and products leading to ecological sustainability.

Research Questions

This research study will contribute to a better understanding of the organizational factors, activities, systems and processes used by small to mid-sized enterprises to spur innovation for ecological sustainability. The research questions set a priority for data collection and analysis. To answer the research questions, we developed an Eco-Sustainability Conceptual Framework (See Figure 1) and Eco-Scorecard (See Table 3-1). Evaluating the application and compatibility of the Eco-Sustainability Conceptual Framework and Eco-Scorecard as a tool to measure progress is part of the empirical investigation. The Research Questions are:

1. In the Eco-Sustainability Conceptual Framework, how do the four elements of Eco-Advantage Mindset, Eco-Tracking, Eco-Redesign and Eco-Culture contribute to innovation?

2. How do these four Eco-Elements work together as sources of innovation?
Alternatively, can they work independently of one another as a source of innovation?
3. How are innovations managed and evaluated for ecological sustainability?

Background of the Study

Sustainable enterprises improve their image and reputation, reduce costs, and help boost the economy, all of which lead to improved business, and stronger and healthier communities (Landrum & Edwards, 2009). Exploring how enterprises achieve ecological sustainability has sparked the curiosity of several scholars. Academic researchers, Porter and Van der Linde (1995) defined the relationship between innovation and sustainability, arguing that adaptation of greener business practices is usually a major stimulus for innovation within a firm, giving rise to improvements in products and processes.

Fiksel (2006) defined sustainable enterprise resilience as the capacity of an enterprise to survive, adapt, and grow in the face of turbulent change, while simultaneously increasing shareholder value without increasing material throughput. Sustainable enterprise resilience creates multiple business opportunities through clean technologies, reduction of raw materials and energy use, while discovering innovative pathways for recovery and reuse of waste streams in place of virgin resources (Fiksel, 2006).

The business case for sustainability grows stronger every day as managers face a world of constrained natural resources and climate change. Companies that offer solutions to societal and environmental problems will find expanding markets and a competitive advantage (Porter, 2002), while value-centered business leaders and

entrepreneurs are creating companies that are inspiring employees and customers alike (Russo, 2010). Sustainability strategies can create a new way for inspired people - executives, managers, and workers to build companies that are innovative, and contribute a shared value to our society. In addition, these strategies create many synergistic effects for companies working collaboratively, as well as systemic benefits for their home-based communities.

Statement of the Problem

Esty and Winston (2006) make the case for small to mid-sized enterprises to apply a sustainability lens based on:

1. Laws that once only applied to big business now apply to smaller enterprises. Small to mid-sized enterprises from cleaning companies to bakeries to gas stations must comply with clean air regulations.
2. Advocacy groups have no problem demanding small to mid-sized enterprises curtail their environmental impacts.
3. The Information Age has reduced the costs of pursuing smaller-scale companies. Sophisticated types of equipment make tracking pollution and monitoring regulatory compliance convenient and inexpensive.
4. Large corporate customers are putting pressure on small business suppliers to comply with environmental standards.
5. Small companies have an advantage over less nimble larger competitors to take advantage of changing circumstances and meeting niche demands. (Esty & Winston, 2006)

The impact of small to mid-sized enterprises typically represents more than 90% of all private sector firms globally, forming a significant portion of all economic activity. Small to mid-sized enterprises have a key role in sustainability and require a closer examination (Spence, Rutherford, & Blackburn, 1998). Although there is a limited, but growing, number of researchers working in the small to mid-sized enterprise – natural environment field (Hillary, 2000; Russo, 2010; Schaper, 2002; Wolters, 2000), the importance of small to mid-sized firms contributing to best practices for ecological sustainability cannot be overlooked.

A major focus of the literature has been on large companies and multinational corporations' environmental management, sustainability, and innovation, leaving small to mid-sized enterprises underrepresented. Understanding the significant role that small to mid-sized enterprises contribute to sustainability and innovation is critical since they provide essential support for large companies and multinational corporations via their supply chains.

Defining Sustainability

The task to define the concept of sustainability revealed a multitude of definitions based on different disciplines, applications, and sources. In the process to define sustainability, one will discover contrasting dimensions of a complicated and compelling concept. The term sustainability increasingly refers to an integration of social, environmental, and economic responsibilities, appearing in the literature of business disciplines such as management and operations. Organizational sustainability, at the broadest level encompasses three components corresponding to the 3Ps of people, planet, and profit. The 3Ps developed into a business concept called “The Triple Bottom Line,”

originally proposed by Elkington (1998), simultaneously considers and balances economic, environmental, and social performance from a microeconomic standpoint. The Triple Bottom Line suggests that at the intersection of social, environment, and economic performance, there are activities that organizations can engage in that not only serve to positively affect the natural environment and society, but also result in long-term economic benefits and competitive advantage for small to mid-sized enterprises.

Within this context, organizations recognize that sustainability is not simply a matter of Corporate Social Responsibility, sustainability is now a fundamental principle of smart management (Savitz & Weber, 2006, p. xiv). To manage for sustainability means to work in a complex reality with consideration of three major systems (economic, social, and ecological). This challenge requires capabilities at a basic level of ecological and social knowledge, along with sustainability-oriented integrated company strategies, systems, activities, processes, training, programs and leadership (Sharma & Aragon-Correa, 2005). Thus, companies that develop and execute the strategy of a sustainable enterprise, need to take into account every dimension of the business environment: social (cultural), economic, and natural environment (Werbach, 2009). Ironically, the term sustainability has its roots in ecology, as the ability of an ecosystem to maintain ecological processes, functions, biodiversity, and productivity into the future, referred to as *carrying capacity*. To be sustainable, nature's resources must maintain a rate at which they can be replenished naturally. Scientific evidence holds true that humanity is living in unsustainable ways by consuming the Earth's limited natural resources more rapidly than they can be replaced in nature.

Defining a Sustainable Enterprise

For the purpose of this dissertation research, we define a sustainable enterprise as *one that produces profits, while protecting and restoring the environment, and improving the lives of the stakeholders with whom it interacts*. This definition will allow for an empirical assessment consistent with working toward a more complex process, and considering the three major systems of environment, social, and economic performance.

Sustainable Development. In early 1980, Lester Brown, founder of the WorldWatch Institute wrote that a sustainable society is one that can fulfill its needs without diminishing the chances of future generations. When taken up by the United Nation's Brundtland Report (1987), the concept of sustainable development included that a society or community would develop in such a way, not to diminish the chances for future generations. However, defining how to operationalize sustainable development contributed to the confusion surrounding its implementation.

Eco-Advantage Strategy. Environmental challenges have become part of the business landscape, including both social and economic costs, and risks companies must confront. These forces require a sustainability strategy for business success. Esty and Winston (2006) described Eco-Advantage as being able to solve environmental problems and to engage with stakeholders (government regulators, Non-Government Organizations, banks, and insurance companies), while understanding why the environment has emerged as a critical strategic issue for companies of all sizes.

According to Esty and Winston (2006), there are four fundamental elements in their environmental strategy, which include Eco-Advantage Mindset, Eco-Tracking, Eco-Redesign, and Eco-Culture all potential areas for generating innovation. There are also

natural forces influencing companies, including environmental challenges like climate change, water, energy, loss of biodiversity, and land use. In addition, there are players/actors such as primary and secondary stakeholders (consumers, investors, policy-makers, idea generators, business partners, media, and opinion leaders). Although Esty and Winston asserted that an Eco-Advantage strategy could be used in any sized company, their research dealt mainly with larger companies and multinational corporations. Incorporating aspects of this strategy into the Eco-Sustainability Conceptual Framework (Figure 1) enabled the examination of its compatibility with small to mid-sized enterprises. The same four elements of Eco-Advantage Mindset, Eco-Tracking, Eco-Redesign, and Eco-Culture, contained in our framework will be examined as possible sources for innovation linked to ecological sustainability.

Understanding the Role of Innovation in Small to Mid-sized Enterprises. The process of innovation represents the confluence of technological capabilities and market needs within the framework of the innovating firm (Hillary, 2000). In other words, no one factor solely drives innovation. However, the way in which small to mid-sized enterprises perceive environmental challenges is critical since the essential and challenging element is how the business is meeting social and environmental responsibilities while remaining economically competitive. Perception of environmental issues plays a major role in shaping company behavior and influencing strategic outcomes and the pursuit of environmental oriented innovation (Hillary, 2000).

Significance of the Study

Over the last quarter of a century, the term sustainability has evolved from a concept of conservation to a concept of inclusion, ethics, and stewardship that has shaped

a new paradigm that defines sustainability as a journey toward stewardship in all forms of economic, social, and environmental aspects. It involves applying systems thinking by ecologists, social scientists, and business practitioners to provide solutions to the environmental, strategic macro-goals outlined earlier in this chapter. Small to mid-sized enterprises, as the largest private-sector employer, offer some of the best opportunities for sustainable economic vitality, strong social support, and healthy ecological systems.

Organization of the Remainder of the Study

This dissertation began by introducing how environmental and social challenges are changing the business landscape and recognizing the market forces of declining natural resources, radical transparency and increasing expectations that are redefining competition, profit, and growth in every sector of the economy (Laszlo & Zhexembayeva, 2011). After setting forth the business case for sustainable enterprises and considering small to mid-sized enterprises, an overview of the research purpose and justification was covered. In Chapter 2, an in-depth, multidisciplinary literature review created the theoretical framework from which the research questions emerged. A review of the scientific principles and business strategies, frameworks, and scorecards contributing to the Eco-Sustainability Conceptual Framework (Figure 1) and Eco-Scorecard (Table 3-1) are covered. Chapter 3 follows with an overview of the research approach and methodology utilized in addressing the research questions and analyzing the resulting data. The dissertation continues with each of the research case studies in Chapters 4-8. Chapter 9 includes the cross-case analysis, followed by Chapter 10, which will cover the lessons learned and ends with the Bibliography and Appendices.

CHAPTER 2

LITERATURE REVIEW

Sustainability requires approaches that transcend boundaries between academic disciplines, and builds ties between academics with practitioners. Thus, we applied a multidisciplinary approach in this research study that combined the social and natural sciences. Within the social sciences, the multidiscipline areas of strategic management, environmental innovation, sustainability business models and frameworks informed the development of the Eco-Sustainability Conceptual Framework (See Figure 1). Within the natural sciences, principles of energy flow, net primary production, nutrient cycling, and ecological sustainability informed the Eco-Scorecard (See Table 3-1) that incorporated the Eco-Sustainability Conceptual Framework categories as potential sources of innovation. The Eco-Sustainability Conceptual Framework and Eco-Scorecard were developed as research tools for use during the semi-structured interviews conducted at five small to mid-sized enterprises.

The Eco-Sustainability Conceptual Framework examined sources of innovation within the four categories of Eco-Culture, Eco-Redesign, Eco-Tracking, and Eco-Advantage Mindset to understand how companies created and managed sources of innovation for ecological sustainability. We linked natural science principles with social science attributes based on the literature review in providing a theoretical framework to answer the following research questions:

1. In the Eco-Sustainability Conceptual Framework, how do the four elements of Eco-Advantage Mindset, Eco-Tracking, Eco-Redesign and Eco-Culture contribute to innovation?
2. How do these four Eco-Elements work together as sources of innovation?
Alternatively, can they work independently of one another as a source of innovation?
3. How are innovations managed and evaluated for ecological sustainability?

Strategic Management and Organizations

Within the discipline of strategic management, three seminal works emerged around sustainability due to the evolving nature of this phenomenon. Instead of a dominant theory, the field of sustainability has been building on and combining existing theories within the social science domain. They include the Resource-Based View, Institutional Theory, and Stakeholder Theory. An overview of these theories demonstrates how they contributed to the theoretical framework and informed the Eco-Sustainability Conceptual Framework and Eco-Scorecard.

Resource-Based View

The original Resource-Based View (RBV) in the strategy and organization literature by Edith Penrose (1959) conceptualized the firm as a collection of resources, producing services at the request of its administrators, referred to as the creation of “productive opportunity’ of the firm.” Penrose introduced concepts surrounding tangible resources and matter (natural resources) changing to energy (products/services), while relating them to psychological human factors like uncertainty and perceptions of risk. In 1991, Jay Barney and other scholars (Peteraf, 1993; Weinerfelt, 1984) rediscovered and revived the Resource-Based View. Barney (1991)

continued with a focus on resources, recognizing three main sources of physical, human, and organizational-level contributions, defined as the firm's sustainable competitive advantage. This translated into a firm's ability to utilize heterogeneous resources in its own unique way to generate revenues. To accomplish this, resources should be valuable, rare, not easily imitated and specific to the individual organization. Key concepts related to not being easily duplicated included; (a) unique historical conditions that lead to acquisition of unique resources (e.g., see the Monadnock Paper Mills Case Study), (b) causal ambiguity that hinders the understanding of how the resources are linked to competitive advantage, and (c) social complexity that could be related to organizational cultural (Eco-Advantage Mindset), attributes that would be too difficult to replicate (Barney, 1991; Peteraf, 1993; as cited in de Lange, 2011). A Resource-Based View of a firm explains its ability to deliver competitive advantage when resources are managed in a way that competitors cannot imitate the same outcomes, which ultimately creates a competitive barrier.

After criticism of the original Resource-Based View being tautological or self-verifying, it evolved into the Dynamic Capabilities-View (Teece et al., 1997), which refers to a firm's capacity to renew competencies for maintaining a competitive advantage in a changing business environment, where strategic management is key in 'adapting' through innovation. Also included were reconfiguring (Eco-Redesign) internal and external organizational skills, resources, and functional competencies in adapting to challenging markets (Teece et al., 1997). Another implication was that a firm is like a repository with its own distinct technological processes and organizational

knowledge that must be part of a social community, in that knowledge is learned, and applied to product/process development (Foss, 1996; Kogut & Zander, 1992).

Building on the Resource-Based View, Hart (1995) extended it to the firm in its natural environment. Up until this point, the Resource-Based View had an internal focus; now, competitive advantage could come from external factors as well. The strategies Hart considered important as part of his Natural Resource-Based View (NRBV) included pollution prevention, product stewardship, and sustainable development. Hart stated that competitive advantage originates through the firm's relationship with its natural environment (as a stakeholder). He changed the Resource-Based View, with a business competency inclusive of being socially and environmentally responsible as a source of competitive advantage, rather than a separate goal. This evolution of the Resource-Based View holds application to the field of sustainability and links the environment as a source for building sustainable competitive advantage (Hart, 1995). Even Porter and van der Linde (1995) argued, "Companies must start to recognize the environment as a competitive opportunity" (p. 114). Aragon-Correa and Sharma (2003) extend Hart's Natural Resource-Based View in justifying how the business environment plays an important role in the development and effectiveness of a proactive environmental strategy, which paved the way for Esty and Winston (2006).

Perhaps the Natural Resource-Based View holds potential for further development into a Sustainability-Based View. As for now, it does not appear that a sustainability management priority is on theory building, which presents both an

opportunity and challenge for strengthening this field. Thus, pursuing a multi-theoretic approach creates a valuable investigation and application for our research.

New direction for future work along these theoretical lines lead by Hart (1995) included studying other phenomena such as the concept of an ecologically sustainable organization by Starik and Rands (1995) and Shrivastava (1995) who addressed the role of corporations in achieving ecological sustainability, which contributed to the focus of this research study. According to Shrivastava, corporations have the knowledge, resources, and power to bring about enormous positive changes in the Earth's ecosystems with the support of government policies and consumer choices. Shrivastava discussed implications for future research to find organizational pathways to ecological sustainability through refining theory and building practical tools for corporate sustainability, which supports the use of the Eco-Sustainability Conceptual Framework and Eco-Scorecard. These implications included; more precise definitions of the internal and external conditions of organizational sustainability; methodological issues, such as measures, monitoring, and reporting of organizational sustainability; identification of what makes organizations ecologically sustainable; and organizational values and ethics connected to sustainability, included in the Eco-Scorecard as key performance indicators.

Sustainability requires an interdisciplinary approach in both application and in the use of language, which is why the Natural Resource-Based View is part of the Eco-Sustainability Conceptual Framework. The Natural Resource-Based View provided an understanding of the connections between business and the natural environment, while demonstrating how competitive advantage originates through a firm's relationship with

its natural environment (as a stakeholder). The strategies Hart (1995) discussed included pollution prevention, product stewardship, and sustainable development as linked to business competency in being socially and environmentally responsible, which can be a possible source of competitive advantage.

Institutional Theory

Institutional Theory delves into the deeper and more resilient aspects of social structure. It considers the processes by which structures, including rules, norms, and routines, become established as authoritative guidelines for social behavior within organizations. It examines how structure is created, diffused, adopted, and adapted and how they fall into decline and disuse. Institutional Theory recognizes the larger sense in which institutional forces shape organizational systems with multiple roots across the social sciences (Smith & Hitt, 2005).

Jennings and Zandbergen (1995) extended Institutional Theory by examining how the concept of ecological sustainability is institutionalized within organizations. The authors used the theory in a descriptive manner to explain how firms and organizations can become sustainable. Thus, institutional theorists find in Jennings and Zandbergen (1995) a seminal work that motivates the business community to describe change that institutionalizes environmentalism. Hoffman (1999) utilized Institutional Theory to research how social choices are shaped, mediated, and channeled by the institutional environment within the chemical industry. An explanation of the evolving conceptions of environmental management examined the cultural and institutional systems in Hoffman's study. He concluded that environmental problems could be solved through changes in the institutional arrangements that govern industry and social

action, (e.g. see the New England Wood Pellet case study; related to the regulative front and alternative energy policy at a state and national level).

From an environmental strategy perspective, Hoffman (2000) addressed the need for organizational transformation as companies move from environmental management to integrating environmental issues (climate change) into the core of their business and sustainability strategies. This requires a supported shift in organizational culture, structure, reward systems, and job responsibilities for managers to understand the power of ecological issues, and a shift in mindset to one focused on environmental strategy. This 'shift' encourages a merger of environmental and economic interests in the decision making of its employees (Hoffman, 2000). That is why 'Eco' is used as a pretext, reflecting this merger in both the Eco-Sustainability Conceptual Framework and Eco-Scorecard.

Stakeholder Theory

Stakeholder Theory describes how organizations operate and try to predict behavior within organizations (Brenner & Cochran, 1991). It views the corporation as an organizational entity through which numerous and diverse participants accomplish multiple, yet not always congruent goals. In addition, Stakeholder Theory can encompass descriptive, instrumental, and normative points of view (Donaldson & Preston, 1995). The normative view portrays how the firm should work on the premise that (a) stakeholders have legitimate interests in the corporation and are defined by their interests in the corporate and not vice versa, and (b) stakeholders' interests have intrinsic value, although not equally distributed. The descriptive version simply illustrates that firms have stakeholders centering on what the corporation is, while the

instrumental version makes the connection between considering all stakeholders and corporate performance in terms of market values, profits, and revenues (Donaldson & Preston, 1995). Thus, when managers pay attention to stakeholders' concerns, the firm will perform well, an important factor in dealing with environmental and social concerns of stakeholders.

Stakeholder Theory is compatible with other organizational theories and works well at all levels of analysis (Hillman & Kein, 2001). The theory's compatibility with Natural Resources-Based View and Institutional Theory broadens the scope of its application by identifying the relationship between primary and secondary stakeholders and the levels of involvement with the firm (Etzion, 2007; Hillman & Kein, 2001). Those with a direct relationship or investment in the firm are at the primary level, whereas secondary stakeholders have an optional involvement with the firm (Etzion, 2007, Hillman & Kein, 2001). Within the Eco-Sustainability Conceptual Framework (Figure 1), the right-sided, curved arrow, labeled "Player/Actors" laid upon the framework's triangle recognizes both primary and secondary stakeholders' influences upon a small to mid-sized enterprise.

Harrison and St John (1994) stated that stakeholder management combines perspectives from other traditional models, such as industrial organization economics, Cognitive Theory, Resource-Based View and the Institutional View of the firm. Here we see the versatility of the Stakeholder Theory as the authors divided the environment into the operating environment inside a company and the broader natural environment outside of the buildings, as Hart (1995) implied. Thus, a stakeholder approach allows management to infuse traditional strategic analysis with the values and direction that

are unique to that organization, including seeing the environment as a stakeholder and embedding sustainability as demonstrated in our research case studies.

In another extension of the Stakeholder Theory, Freeman (1984) established how the theory emphasizes a broad set of social responsibilities for business by defining stakeholders as any group or individual affected by or affecting the achievement of a firm's objectives. Therefore, it is more useful to consider Stakeholder Theory, as a genre as there may be many stakeholder narratives (Freeman, 1994). By acknowledging there are several ways to run a firm and affirming that these various ways ultimately must generate profits to satisfy a set of stakeholders. This management approach actively explores its relationships with all stakeholders including the environment, in order to develop appropriate business/sustainability strategies.

This is particularly applicable when working with global stakeholders who place an emphasis on environmental concerns. As part of larger company supply chains, small to mid-sized enterprises are receiving increased pressure to improve their sustainability performance. This pressure is coming from regulators and non-government watchdog organizations, shareholders/investors, communities and municipalities, the media, employees, and most importantly, from current and potential customers.

From the American perspective, traditional goals of growth, revenue, and profits are stakeholder oriented and American centric. While in other countries, such as Japan, UK, Germany and rest of the European Union, laws and culture presume interdependencies with and responsibilities to several other parties, including employees, customers, creditors, and suppliers (de Lange, 2011). This consensus is that

integrating the voice of employees, local authorities, and interest groups, suppliers, and customers leads to a higher shareholder value.

Environmental Innovation

Within environmental innovation, the subfield of green management studies focused on why, where, and how firms, including small to mid-sized enterprises, incorporate environmental innovation strategies. Several prevalent studies explored the talents, resources, and competencies needed for environmental innovation, including leadership, core competencies, product design, mental models, and mindsets (Chen, 2008; Larson, 2000; Laszlo et.al, 2005; Reinstaller, 2005; Szehely & Knirsch, 2005; Wiklund & Shepherd, 2003). These studies helped to inform the Eco-Sustainability Conceptual Framework and Eco-Scorecard.

The following scholarly articles confirmed key performance indicators to include in the Eco-Scorecard, while giving support to the triangulation of the Natural Resources Based-View, Institutional Theory and Stakeholder Theory as part of the Eco-Sustainability Conceptual Framework. Wiklund and Shepherd (2003) extended the traditional Resource-Based View research (Barney, 1995) to examine the relationship between resources and the way a firm is organized. Their research findings suggest a firm's ability to be innovative, proactive, and risk taking contributed to the knowledge-based resources on performance. In addition to these resources, how a firm is organized to use those resources influenced firm performance (e.g. see the Casella Waste Systems Case Study).

Laszlo et.al. (2005) proposed a new leadership vision and a disciplined approach to creating stakeholder value, based on the economic, environmental, and

social impacts a company has on its diverse constituents. This required a change in the mindset of leaders along with an integration of stakeholder values throughout the business. Laszlo et al. offered a practitioner approach in detailing how stakeholders, from employees to local communities and non-government organizations, can become a new and growing source of business advantage. In addition, Laszlo et al. (2005) expanded upon the theory of mental models (Senge, 1990) by adding how mindset can dictate the range of possibilities used in problem solving and in applying a stakeholder perspective in the process of value creation. From a manager's standpoint, value creation is the creation of shareholder value in terms of solutions the company creates to solve the problems of their clients. From the customer's view, value creation is a set of end benefits and outcomes in the form of a product's functionality and aesthetics, or benefits from services provided by a company.

This work was further developed in a comprehensive manner by Laszlo and Zhexembayeva (2011), featuring a strategic framework and set of principles for integrating sustainability into a company called *embedded sustainability*. Embedded sustainability is the incorporation of environmental, health, and social values into core business activities without a trade-off in price or quality.

Founded on the Resource-Based View Theory of competitive advantage, it frames sustainability as a driver of innovation. Embedded sustainability can improve strategic positioning by strengthening a firm's cost leadership, product differentiation, and focus (Porter, 1996; Porter & van der Linde, 1995). Using a sustainability lens on the economic, social, and ecological aspects, managers find three distinct, yet interconnected current trends: declining natural resources, radical transparency, and

increasing expectations by both shareholders and stakeholders. Combined, these trends are a major force that is redefining the way business creates value; under these trends, it is difficult to find any domain of business unaffected by changes in the external environment (Laszlo & Zhexembayeva, 2011).

Larson (2000) argued the entrepreneurship literature is relevant to sustainable innovation and highlighted sustainability as it relates to the concepts of opportunity, innovation, and future products and processes that occur at the nexus of opportunity and the entrepreneur. In addition, a discussion of applications for sustainable innovation at the core of entrepreneurship was helpful. Through a case study approach about a virtual kayak manufacturing company located in Massachusetts, Larson addressed how small firms engage in innovative environmental practices to achieve success. The paper theoretically aligned with the Resource Based-View and showed how a small firm achieved innovation, environmental management, and sustainability.

Larson (2000) demonstrated the power of a case study in answering research questions in a rich and dynamic way. The author also pointed out pitfalls, which could have benefitted from a better-articulated research design and explanation of the purpose of the paper. Including more than one case study, along with additional interviews would have enriched the data analysis. A lesson used in setting the number of case studies at five for this research dissertation.

The last study reviewed in this subfield of environmental innovation was Horbach (2008). This study confirmed (a) how innovation breeds additional innovation, especially as technological capabilities are improved; (b) that an increase in the expected future demand for new environmental friendly products triggers

innovation; and finally, (c) that environmental regulation, environmental management tools, and organizational improvements help to track information on cost-saving potential that encourage environmental innovation.

Sustainability Business Models, Strategies, and Frameworks

Next, the literature review turned to business models, strategies, and frameworks integrating sustainability into the business core. The journey toward sustainability reflects a unique path taken by each individual business; for some, it is a genesis, and for others, it is an organic process. Embedding sustainability into the core of the business strategy is a deliberate, nonlinear, and iterative process according to Laszlo and Zhexembayeva (2011). In many cases, strategy becomes more relevant once a company harvests low-hanging fruit, engages employees in the practical day-to-day activities, and creates a foundation for transitioning from incremental to deeper change (Laszlo & Zhexembayeva, 2011).

From a practitioner perspective, a thorough review included several books, case studies, and professional associations that provide support, knowledge, and applications in the understanding of how to create and maximize a sustainability strategy for long-term value. For companies just starting on their journey, exploring best practices and frameworks that have proven successful can help minimize pitfalls. Once a blueprint or business model for sustainable value creation emerges, the journey becomes more meaningful to employees, and inspiring to stakeholders. Each company's path to capturing value from sustainability will be unique. While on the journey, leadership plays a critical role in moving sustainability beyond a cost-factor, to opportunities for new competencies, environmental innovation, and knowledge sharing.

Based on extensive experience with large companies and multinational corporations academic researcher, Epstein (1996) developed a Corporate Sustainability Model, which described the drivers of corporate sustainability performance based on the financial and social aspects, and measured the effects on stakeholders. The focus was on better integration of this information into the everyday operational decisions in making social concerns more of a part of the organization. A key take-away applied to the Eco-Sustainability Conceptual Framework was how the corporate culture emphasizes norms critical for innovation, such as openness, autonomy, and initiative. In many cases, risk taking and the role of leadership is critical to embedding sustainability into a company. In addition, Epstein (1996) discussed how small to mid-sized enterprises might not have enough resources to engage in the field of sustainability business modeling and assessment.

Lastly, Stubbs and Cocklin (2008) proposed a conceptual approach that directly connects corporate sustainability issues with a generic business model template, informed by the Ecological Modernization perspective of sustainability. Stubbs and Cocklin (2008) went on to develop a Sustainability Business Model, where sustainability concepts shaped the driving force of the firm and its' decision-making. The authors argued that a business model concept should serve the purposes of sustainable entrepreneurship and sustainability management, instead of shifting paradigms like the neoclassical economic worldview. The Sustainability Business Model featured two case studies on Bendigo Bank and Interface Inc., both global organizations, considered corporate leaders in operationalizing sustainability, which helped to inform our research agenda.

Performance Management, Scorecards, and Certifications

As companies problem solve to reduce their reliance on fossil fuels, lessen energy costs, eliminate waste, and contribute to their local communities, they are doing so by creating new markets that align their innovations with sustainability-framed definitions of utility, price, and cost according to Laszlo and Zhexembayeva (2011). Measuring sustainable organizational performance and identifying activities that spur innovation have direct implications for our research study. Thus, examining examples of key performance indicators used in measuring these aspects was important in developing the Eco-Scorecard.

The Balanced Scorecard is a performance measurement that links operational and nonfinancial activities within a firm's corporate long-term strategy and with its short-term action plan (Kaplan & Norton, 1992, 1996, 2001). Following the adoption of the Balanced Scorecard, many companies saw a growing interest from the public, media, and community groups on the impact business was having on the natural environment and on society. Around this same time, the Triple Bottom Line emerged (Elkington, 1997), which is included in the Eco-Sustainability Conceptual Framework and Eco-Scorecard, because it encompasses local communities, government, media, suppliers, as well as other players/actors. The Triple Bottom Line adds social and environmental measures of performance along with the economic measures. Although, the implementation of the Triple Bottom Line has not been a straightforward task since social and environmental performance are difficult to quantify (Hubbard, 2006). Empirical research has consistently found that firms focus on different measures because their content and issues are different. Some companies have even developed

their own customized social and environmental management systems for measuring operational performance.

Conceptually, the Triple Bottom Line resonates as a philosophy, or a value statement associated with a firm's commitment to environmental and social endeavors. The Triple Bottom Line is a different kind of balanced scorecard in applying a sustainability lens to a firm's economic, environmental, and social performance (Savitz & Weber, 2006). A balance between economic progress, social responsibility, and environmental protection, referred to as the Triple Bottom Line, can lead to competitive advantage (Epstein, 1996), which is why we chose to include it in the Eco-Sustainability Conceptual Framework and Eco-Scorecard.

As a company embarks upon a sustainability journey, linking environmental and social management to strategic factors provides an opportunity to extend its sustainability management. As an example, the Sustainability Balanced Scorecard built upon the Balanced Scorecard (Figge et al., 2002) integrated environmental and social aspects into the implementation of corporate sustainability strategies (e.g., Hart, 1997). The Sustainability Balanced Scorecard could hold potential application for small to mid-sized enterprises, and helped in the conceptualization and development of the Eco-Scorecard.

An alternative taken by companies in meeting the challenge of measuring their environmental and social activities is to adopt internationally recognized industry certified environmental and social management systems as in the International Organization for Standardization (ISO) 14001:2004 environmental management system. The purpose of the International Organization for Standardization

14001:2004 is to provide a framework for a holistic, strategic approach to organizational environmental policy, plans, and actions (www.iso.org).

In addition, the Global Reporting Initiatives supplement sustainability reports based on a Global Reporting Initiatives Framework demonstrate an organizational commitment to sustainable development by comparing organizational performance over time. The Global Reporting Initiatives measures organizational performance with respect to laws, norms, standards, and voluntary initiatives. Global Reporting Initiatives promote a standardized approach in reporting to stimulate a demand for sustainability information, benefitting both reporting organizations and report users. In addition, there is a Global Reporting Initiative specifically for small to mid-sized enterprises (www.globalreporting.org). Both the International Organization for Standardization and Global Reporting Initiatives helped inform the Eco-Sustainability Conceptual Framework and Eco-Scorecard's key performance indicators.

Another available option is the Certified B Corporation, which is a type of corporation that uses the power of business to solve social and environmental problems. B Lab, a nonprofit organization, certifies B Corporations, the same way TransFair certifies Fair Trade coffee or the U.S. Green Building Council certifies LEED buildings. B Corporations, unlike traditional businesses, meet comprehensive and transparent social and environmental performance standards, meet higher legal accountability standards, and build business constituency for "benefit" companies. There are over 550 Certified B Corporations across 60 different industries. From food and apparel to attorneys and office supplies, B Corporations make up a diverse community of companies with the goal to redefine success in business. Through a

company's public B Impact Report, anyone can access performance data about the social and environmental practices that stand behind their products. In northern New England, there are 17 Certified B Corporations, including one of the pilot study companies featured in this research study (W.S. Badger Company).

A Practitioner Perspective

From a practitioner's perspective, incorporating environmental and social aspects into the management system of a company requires a suitable tool for tracking activities and assessing them. Some companies talk about how they integrate environmental and social issues by focusing on their Triple Bottom Line performance or sustainability initiatives. Other terminology includes corporate social responsibility, stewardship, citizenship, environmental health and safety (EHS), or environmental management systems (EMS). Whatever the terms used, the key is the inclusion of this aspect into the business operation. Each company needs to find their own language and organizational structure that works best within its own culture (Esty & Winston, 2006).

In fact, Esty and Winston (2006) did just that in *Green to Gold: How Smart Companies Use Environmental Strategy to Innovate, Create Value and Build Competitive Advantage*. The authors framed sustainability issues from a business strategy perspective, focused on creating sustainable value without trade-offs. Other publications that provided best practices and frameworks included: *Embedded Sustainability: The Next Big Competitive Advantage* by Laszlo and Zhexembayeva (2011), who put forth a new paradigm, business model, and framework for embedding sustainability into business strategy and Stuart Hart's *Capitalism at the Crossroads*:

Next Generation Business Strategies for a Post-Crisis World (2010) covered how to build an organizational infrastructure for sustainability.

The Natural Step for Business by Natrass and Altomore (1999) combined organizational learning with implementation of 'The Natural Step' framework for impact on corporate strategy and operations. From a redesign perspective and use of closed-loop systems, authors offer a science-based foundation for sustainability:

McDonough and Braungart (2002) in *Cradle to Cradle: Remaking the Way We Make Things*. The book is an actual "technical nutrient" that you literally hold in your hands as you read it. Finally, Russo (2010) shifted the focus from large companies and multinational corporations to the rise in small and mid-sized companies, leveraging entrepreneurial strategies for economic, social, and environmental sustainability in *Companies on a Mission*. These books offered both descriptive and analytical practitioner approaches for sustainability.

Having established sustainability as a driver for innovation, we turn to the activities within a sustainability strategy that sow the seeds of innovation. Peter Drucker described innovation as; change that creates a new dimension of performance. To innovate, one must devise a systematic method of identifying opportunities that provide new value for one's customers (Edersheim, 2007). Finally, to quote an old adage, "Necessity is the mother of innovation," refers to innovation as a problem-solving attribute or as a dynamic capability (Teece et al., 1997).

Scientific Principles and Frameworks

Within the social and natural sciences, observations combine with explanatory frameworks whose predictions can be tested and eventually agreed on. Empirically

based logic seeks answers, and only logic can be systematically improved and applied. Logic tries to resolve paradoxes and explain phenomena. Given the issues we face as a society in the economy, environment, and in our health and well-being, a rational, scientific way of thinking could be unifying in solving our environmental macro-goals and corresponding social challenges and solutions (Randall, 2011).

Science is the process of discovering order in the natural world and using that knowledge to describe what is likely to happen in nature. Important outcomes of science are principles that explain what consistently happen in nature (Miller, 2005). The Eco-Sustainability Conceptual Framework incorporates four scientific principles in explaining the link between innovation and ecological sustainability. These four scientific principles include nutrient cycling, environmental sustainability, energy flow, and net primary production.

Nutrient Cycling

Companies applying the principle of nutrient cycling can develop closed-loop systems that recapture resources by recycling wastewater, reusing materials, or stripping valuable gases from exhaust stacks. Small to mid-sized enterprises using closed-loop systems reduce their ecological footprint, improve resource productivity, and incur cost-savings. Other activities that incorporate the principle of nutrient cycling are Design for the Environment (DfE), and green building/LEED (Esty & Winston, 2006).

For example, TerraCycle, based in Trenton, New Jersey, is a small to mid-sized enterprise that produces liquid-plant fertilizer. Their unique process of making fertilizer is comparable to a natural system in that the company uses waste to make a

product. They take organic waste, like composted vegetables and feed it to 250,000 worms that eat their body weight in landfill-bound trash. TerraCycle collects the worm castings and sells it in a liquefied form, quaintly known as 'tea.' Even the packaging is made from waste material (Szaky, 2009).

The planet Earth is a closed system with respect to elements (matter). Elements cycle endlessly between their biotic and abiotic states within ecosystems. Most of the major environmental problems we face can be analyzed using biogeochemical principles and tools. These problems include global warming, acid rain, pollution, waste management, and greenhouse gases that can be addressed in closed-loop systems.

Stonyfield Farm, located in Londonderry, New Hampshire, has reduced its carbon dioxide emissions and ecological footprint by rethinking (Eco-Advantage Mindset) and redesigning (Eco-Redesign) a custom-made, liquid and solid-waste treatment facility. Since 2006, the company has been turning waste yogurt into methane gas. They opted to use bacteria in an oxygen-free, or anaerobic, system known as the "digester." The methane by-product is used as fuel to heat the plant. An added benefit is that the amount of sludge left behind is substantially reduced, compared with an aerobic system, which left behind larger amounts of sludge to be hauled away at an additional cost (Hirshberg, 2008). This is an ideal example of how Stonyfield Farm used innovation on the path toward ecological sustainability (e.g. see the Casella Waste Systems case study that uses the same method with an anaerobic digester).

Environmental Sustainability

Companies that apply this principle will conduct Life Cycle Assessments (LCA) to measure the ecological footprint of a product or process, so goals can be set to reduce any negative effects. Using the Life Cycle Assessments, the company tracks environmental impacts of a product from its raw materials through disposal at the end of its useful life. Through a Life Cycle Assessments, the company also identifies ways to reduce the raw material consumed while lowering costs along the value chain.

Sustainability pertains to a balanced interaction between a population and the carrying capacity of an environment such that the population develops to express its full potential without adversely affecting the carrying capacity of the environment upon which it depends. The scientific principle of environmental sustainability based on studies of natural systems, includes conservation, recycling, renewable resource use, restoration, population control, management and adaptability. These studies explain why natural systems sustain themselves. For example, natural biological systems or ecosystems tend to persist because organisms use what they need with efficiency, called *conservation* (Chiras, Reganald, & Owen, 2002).

There is a saying, “waste is food” because of the ability of life forms to recycle waste for reuse; thus, there is no waste in nature. Natural systems tend to persist due in part to the resiliency of renewable resources. Finally, organisms have the ability to be adaptable to changes. Successfully applying this principle can help human society and organizations use innovation to create solutions for environmental and social challenges (Walker & Salt, 2006).

Energy Flow

To understand what is required to create a sustainable enterprise, it is fundamental to understand the principle that governs the metabolism of cells and organisms. The importance of this scientific background is not always clearly understood, or used in making business decisions. The principle of energy flow covers the following areas:

1. Matter and energy are neither created, nor destroyed according to the laws of energy conservation, known as the *first law of thermodynamics*. The total energy input always matches the total energy output. This means that all material resources we use and transform through human activities must end up somewhere, if not in products, then in the environment. In summary, the Earth is a closed system with respect to matter, meaning nothing disappears, it merely takes on a different form
2. Matter and energy tend to disperse, known as the *second law of thermodynamics* is the underlying mechanism behind our experience that energy and material transformations operate to reduce the available energy in the system and increase the dissipation of matter throughout the system. The second law of thermodynamics is about the availability of energy to perform useful work. It indicates the quantity of energy becomes less available to perform work as it passes through successive transformations. When energy becomes more dissipated and less useful, we refer to it as the “entropy of a system.”
3. Material quality is characterized by the concentration, purity, and structure of matter. Because nothing disappears and everything tends to disperse: a carpet turns to dust and a car turns to rust, but not the reverse. As matter disperses, it loses its concentration, purity, and structure, or its order. Biological and economic value comes from concentration and structure. This spontaneous tendency of energy and matter to dissipate described in the second law of thermodynamics is what changes or diminishes material quality.
4. Sun-driven processes produce the net increase in material quality on Earth. The very existence of continued life on Earth seems to contradict the second law of thermodynamics. Instead of declining into an entropic state, the

Earth flourishes with complex biological organizations. This is made possible through the continuous flow of available energy from the sun. Through the slow process of evolution, the global ecosystem has developed a complex interactive network of material cycles (nutrient cycle) to counteract the tendency of materials to dissipate. To summarize, although the Earth is a closed system with regard to matter, it is an open system with respect to energy (Natrass & Altomare, 1999).

In applying the principle of energy flow, companies can track basic environmental outcomes in terms of the resources used and what it emits, such as energy, water, air, and waste. Basic metrics would include consumed energy, renewable energy used or purchased, greenhouse gas emissions, release of heavy metals and toxic chemicals, emissions of particulates like volatile organic compounds, sulfur oxide and nitrous oxide, hazardous waste, solid waste, and recycled materials, total water used, and any water pollution. Also included is compliance, this metric includes notices of violations, and fines or penalties paid.

Environmental metrics are similar to financial metrics, in what gets measured, gets evaluated. Usually these metrics are industry-specific or based on company size. Three general guidelines for tracking environmental data and metrics include tracking both relative and absolute metrics, capturing data at multiple levels within a company, and collecting the same information for the whole value chain (Esty & Winston, 2006). For example, Timberland, located in Stratham, NH, sets a high industry standard as demonstrated in its Climate Strategy Report for 2006-2010 (<http://www.timberland.com/csr>). The company reports their progress in the four areas of: (a) Timberland's climate strategy, (b) product: grading products by their Green Index® Program, (c) workplace: engaging workers and strengthening communities, and (d) service: engaging employees through their Global Stewards Program.

Net Primary Production

Biodiversity is a vital renewable resource that includes the Earth's variety of genes, species, ecosystems, and ecosystem processes. The biological wealth of natural capital and ecological services helps to keep the Earth's inhabitants alive, while supporting our economies. Biodiversity produces food, wood, fiber, raw materials, chemicals, medicines, and much more. All of these resources funnel billions of dollars into the global economy every year. In addition, biodiversity helps to preserve the quality of our air, water, and maintain soil fertility. The loss of biodiversity can affect human survival in several devastating ways (Miller, 2005):

- As we lose ecosystem processes such as net primary production (NPP), we also lose the ability to create energy from photosynthesis and add new plant biomass to the system.
- Undiscovered organisms and animals that could serve as the basis of needed medicines could perish with the loss of biodiversity. Extinction is forever.
- The same natural qualities that sustain wildlife, forests, fields, clean air and water – ultimately sustain people whether they live in cities or the countryside.
- Saving life on the planet in all forms is the right thing to do and hence becomes a moral obligation. We only have one planet that sustains life, once that capacity is lost, so is survival on Earth.

The term *production* defines the creation of new organic matter. When a plant grows, new organic matter created by the process of photosynthesis converts light energy into energy stored in chemical bonds within plant tissue. This energy fuels the metabolic system of the plant. New compounds and structures are synthesized, cells divide, and the plant grows in size over time. The plant requires sunlight, carbon dioxide, water, and nutrients. Through photosynthesis, the plant produces reduced

carbon compounds and oxygen. When measuring the rate at which photosynthesis occurs, or the rate at which the individual plant increases in mass, determines net primary production (NPP). Over time, primary production results in the addition of new plant biomass to the system, leading some ecologists that have actually recommended that NPP should replace Gross Domestic Product (GDP).

A key performance indicator of a supply chain audit is smart business mapping for identifying upstream or downstream risks and opportunities and calculating the environmental effects of business products or processes. For example, a small to mid-sized furniture maker who conducts a supply chain audit can make sure their standard for not purchasing wood from areas of high conservation value are met, or accepting lumber from illegal logging operations does not occur (e.g. see the New Chapter case study with respect to sourcing their raw materials).

Ironically, the term sustainability has its roots in ecology, as the ability of an ecosystem to maintain ecological processes, biodiversity, and productivity into the future referred to as *carrying capacity*. To be sustainable, nature's resources are maintained at the rate they are replenished naturally and clear scientific evidence indicates that humanity is living in unsustainable ways, by consuming the Earth's limited natural resources more rapidly than they are being replaced by nature (Miller, 2005).

For the purpose of this dissertation research, we define a sustainable enterprise as *one that consistently earns profits, while protecting and restoring the environment, and improving the lives of its employees and communities with whom it interacts*. This

definition sets the parameters to assess a sustainable enterprise within the Eco-Sustainability Conceptual Framework.

Ecological Sustainability

Capra (2002) operationally defined ecological sustainability from the recognition that we can learn valuable lessons from nature, since natural ecosystems are sustainable communities. Therefore, we need to study living networks in nature to understand sustainability, and apply the principles of ecological sustainability by which to operate. For this reason, the first question asked during the semi-structured interview addresses this concept in the Eco-Scorecard.

In an ecosystem, matter continually cycles; it never gets lost. There is no waste; everything is continually recycled. We know ecological cycles are driven by solar energy, or fueled by energy from the sun, and understanding how these cycles are interlinked to form networks (material cycles), which are valuable lessons to apply within a sustainable enterprise.

Design of the Eco-Sustainability Conceptual Framework

Esty and Winston (2006) described an Eco-Advantage Strategy as being able to solve environmental problems (such as climate change, water shortage, energy, loss of biodiversity, and land use) and engage with stakeholders (government regulators, NGOs, banks, and insurance companies) in understanding why the environment has emerged as a critical, strategic issue for companies of all sizes. The Eco-Advantage Strategy's analytical framework helped to inform the Eco-Sustainability Conceptual Framework and Eco-Scorecard from a practitioner perspective.

Esty and Winston (2006) featured the four fundamental elements of Eco-Advantage Mindset, Eco-Tracking, Eco-Redesign, and Eco-Culture as components of an Eco-Advantage Strategy, which serve as potential sources of innovation for ecological sustainability within the Eco-Sustainability Conceptual Framework's equilateral triangle with each side representing the Natural Resource-Based View, Institutional Theory and Stakeholder Theory (See Figure 1). The curved arrow on the left corresponds to natural forces influencing companies that include environmental challenges like climate change, water, energy, loss of biodiversity, and land use. The curved arrow on the right corresponds to players/actors, who include primary stakeholders (employees, investors & customers) and secondary stakeholders (policy-makers, media, business associations & community leaders). Finally, the two vertical arrows placed outside of the triangle; represent how innovation and ecological sustainability can occur throughout the triangle. These arrows represent the potential source for innovation in each eco-element. The Eco-Sustainability Conceptual Framework and Eco-Scorecard were used to explore the phenomenon of sustainability within the context of small to mid-sized enterprises, linking innovation and ecological sustainability.

The Eco-Advantage Strategy is a template for Corporate Executive Officers striving to be good stewards of the Earth, which was applied by Esty and Winston (2006) to a majority of large companies and multinational corporations. This raised the question whether the use and application of the Eco-Advantage Strategy is applicable to small to mid-sized enterprises. Two notable exceptions were Stonyfield Farm and Ben & Jerry's, although both were acquisitions of multinational corporations. In our

research study, the Eco-Advantage Strategy has been adapted and expanded in the Eco-Sustainability Conceptual Framework with links to scientific principles and key performance indicators as shown in Table 3-2 in Chapter 3. Applying the Eco-Sustainability Conceptual Framework will examine its compatibility for small to mid-sized enterprises in determining if the four eco-elements of Eco-Advantage Mindset, Eco-Tracking, Eco-Redesign and Eco-Culture (See Figure 2) are sources of innovation for ecological sustainability.

CHAPTER 3

RESEARCH APPROACH AND METHODOLOGY

The purpose of this study is to explore the phenomenon of sustainability in small to mid-sized enterprises by applying a multidisciplinary lens, that bridges the natural and social sciences, while focusing on the link between innovation and ecological sustainability in companies located in northern New England. A multidisciplinary literature review informed the Eco-Sustainability Conceptual Framework (Figure 1), to understand how small to mid-sized enterprises use innovation on the path toward ecological sustainability.

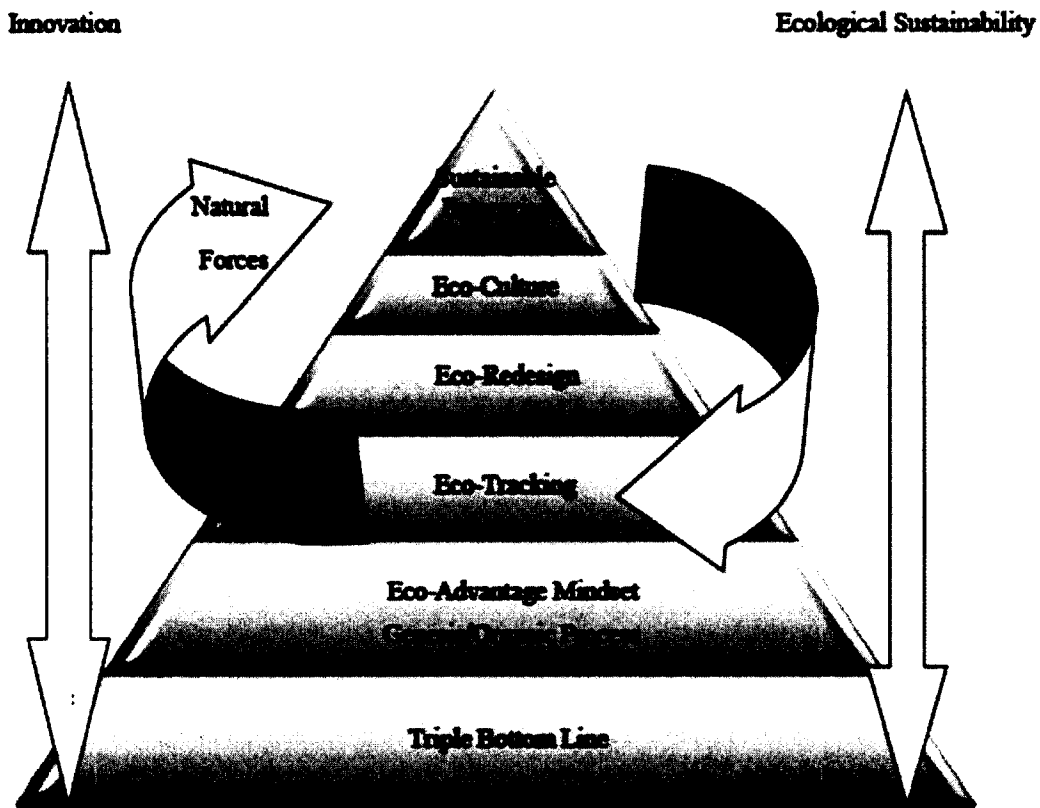


Figure 1. Eco-Sustainability Conceptual Framework

Next, we developed the Eco-Scorecard (see Table 3-1) with key performance indicators within the Eco-Sustainability Conceptual Framework categories of Sustainable Enterprise, Eco-Culture, Eco-Redesign, Eco-Tracking, Eco-Advantage Mindset and Triple Bottom Line to answer the research questions. Interview participants rated the Eco-Scorecard categories on an un-weighted basis with: (1) indicates a weak performance, (2) indicates needs significant improvement, (3) indicates good performance, but could be improved and (4) indicates a strong performance. The Eco-Scorecard rated three consecutive years and the total score a company could receive was 80 points or 100% on an annual basis.

Each company's Eco-Scorecard totals were determined by converting the rating points to percentages. Percentages obtained from interview participant ratings of the Eco-Scorecard (see Table 3-1) were calculated for each company. In addition, results are given graphically across the five case study companies.

Table 3-1

Eco-Scorecard

A.	Key Performance Indicators for Sustainable Enterprise	Baseline 2008	Year 1 2009	Year 2 2010
1.	A sustainable enterprise is one that produces profits, while protecting and restoring the environment, and improving the lives of the stakeholders with whom it interacts.	4 Points ⓪	4 Points ⓪	4 Points ⓪
2.	Company operates within the carrying capacity of the Earth.			
	Maximum Points = 8 SUB-TOTAL			
B.	Key Performance Indicators for an Eco-Culture	Baseline 2008	Year 1 2009	Year 2 2010
3.	Eco-expense reduction to cut environmental costs by not wasting natural resources and by avoiding regulatory burdens due to pollution or waste disposal.			
4.	Company uses Stretch Goals as a driver for innovation and eco-sustainability. *Company applies a sustainability lens to getting things done.			
5.	CEO and Senior Management have a commitment for sustainable practices and environmental stewardship. *Money and incentives tied to eco-accomplishments. *An environmental ethos reflected in the mission/vision/values.			
6.	Storytelling of the eco-successes and lessons learned in CSR/Sustainability/EHS Reports. *Eco-training, a form of knowledge sharing which contributes to innovation is available. *Jobs titles reflect responsibility for sustainability.			
	Maximum Points = 16 SUB-TOTAL			

C.	Key Performance Indicators for Eco-Redesign	Baseline 2008	Year 1 2009	Year 2 2010
7.	Utilizes Design for the Environment (DfE) to help customers reduce their ecological footprints and designs out environmental problems. *Company understands the environmental market drivers.			
8.	Use of Closed-loop Systems			
9.	Green Building and LEED Certification, *Retrofitting existing buildings for energy efficiency.			
10.	Supply Chain Audits			
	Maximum Points = 16 SUB-TOTAL			
D.	Key Performance Indicators for Eco-Tracking	Baseline 2008	Year 1 2009	Year 2 2010
11.	Company uses Life Cycle Assessments to measure ecological footprints and understand environmental impacts and ecological consequences of the products/processes along the value chain. *Supply chain adjustments.			
12.	Develop a Core Set of Environmental Indicators that track energy use, water and air pollution, waste generation and compliance. *Data/Metrics of Inputs and Outputs are used.			
13.	Establish a Materials Database to determine what is in your products or connected to your processes.			
14.	Environmental Management Systems (EMS) for environmental and risk assessment or *Environment, Health & Safety practices.			
	Maximum Points = 16 SUB-TOTAL			
E.	Key Performance Indicators for Eco-Advantage Mindset (Genesis/Organic Process)	Baseline 2008	Year 1 2009	Year 2 2010
15.	CEO's Commitment to Sustainability and Environmental Strategy – top down support. *Doing the right thing that reflects values do matter within the organization.			
16.	Company is using a sustainability lens to ID new opportunities. *Company is placing a focus on Innovation.			
17.	Company establishes dialogue with both friends and foes. *SME engages in local community building. *SME is involved with Stakeholder engagement and eco-activities.			
18.	Leadership makes decisions with the long-term in mind for a tighter regulatory framework, rising customer expectations and market realignment driven by natural constraints. *SME places a value on higher employee retention, stronger customer loyalty and higher brand value. *Leadership looks at the whole value chain from raw materials to suppliers who meet customers' environmental needs, to product end of life.			
	Maximum Points = 16 SUB-TOTAL			
F.	Key Performance Indicators for The Triple Bottom Line (TBL)	Baseline 2008	Year 1 2009	Year 2 2010
19.	The Triple Bottom Line Approach, which encompasses sustainability as the intersection of economic, social and environmental performance is used.			
20.	Corporate Social Responsibility (CSR) is a concept whereby organizations take responsibility for their impact on society and the environment.			
	Maximum Points = 8 SUB-TOTAL			
	Scoring of the Eco-Scorecard Key Performance Indicators (KPIs) is based on an un-weighted rating of 1 to 4 to be determined as follow: (1) Indicates a weak performance, (2) Indicates needs significant improvement, (3) Indicates good performance, but could be improved and (4) Indicates a strong performance			
TOTAL SCORE	Maximum Points = 80 / 100%			

Embedded in the Eco-Sustainability Conceptual Framework is the Eco-Scorecard key performance indicators shown in Figure 2. The four eco-elements of Eco-Culture, Eco-Redesign, Eco-Tracking and Eco-Advantage Mindset serve as potential sources of innovation for ecological sustainability, and were tracked with the Eco-Scorecard.

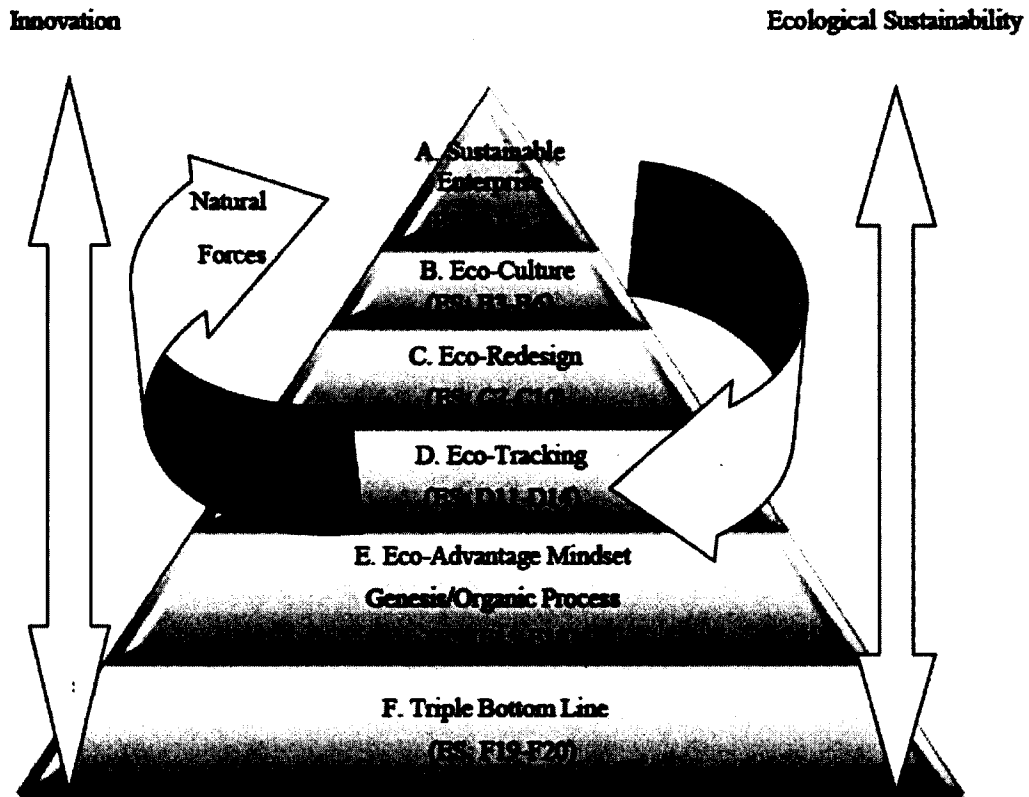


Figure 2. Eco-Sustainability Conceptual Framework with Eco-Scorecard Numbers

In Figure 3, you can see how the key performance indicators are included under each of the Eco-Sustainability Conceptual Framework category headings.

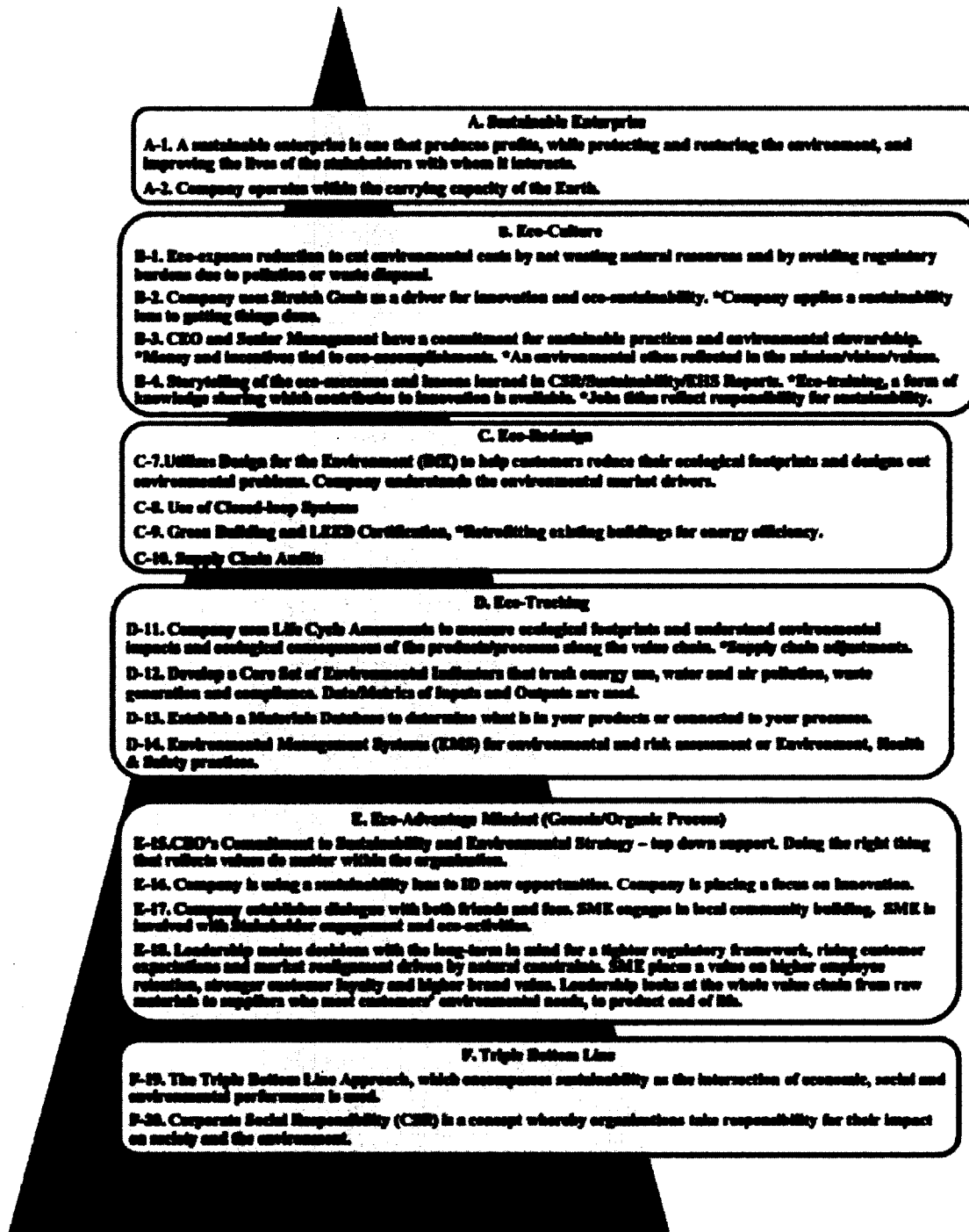


Figure 3. Eco-Sustainability Conceptual Framework with Eco-Scorecard Key Performance Indicators (A-1 thru F-20)

Research Questions

The Eco-Sustainability Conceptual Framework and Eco-Scorecard were used to answer the following research questions:

1. In the Eco-Sustainability Conceptual Framework, how do the four elements of Eco-Advantage Mindset, Eco-Tracking, Eco-Redesign and Eco-Culture contribute to innovation?
2. How do these four Eco-Elements work together as sources of innovation? Alternatively, can they work independently of one another as a source of innovation?
3. How are innovations managed and evaluated for ecological sustainability?

In the Eco-Sustainability Conceptual Framework, we define a sustainable enterprise as *one that produces profits, while protecting and restoring the environment, and improving the lives of the stakeholders with whom it interacts*. This definition set the parameters for tracking a company's progress on their path toward ecological sustainability. In the Eco-Sustainability Conceptual Framework, the highest level of sustainability an organization can achieve is to be a sustainable enterprise (Roome, 2004), which is indicated by each company's Eco-Scorecard total percentage score.

The four scientific principles covered in Chapter 2 are linked to the Eco-Scorecard key performance indicators and with the Eco-Sustainability Conceptual Framework, shown in Table 3-2. We assume that an organization cannot achieve ecological sustainability unless it understands and incorporates the scientific principles into its sustainability strategy, core principles, culture, and eco-elements. This is how the Eco-Scorecard is used to construct and interpret how a company implemented key

performance indicators within each eco-element. For example, closed-loop systems (Eco-Scorecard: C8) in the Eco-Redesign category support the scientific principle of nutrient cycling, and life cycle assessment (Eco-Scorecard: D11) and in the Eco-Tracking category the scientific principle of environmental sustainability and net primary production are supported. Integrating the scientific principles demonstrates an understanding of ecological sustainability from a natural sciences discipline, and valuable lessons applied within sustainable enterprises.

Table 3-2

The Linkage between the Eco-Sustainability Conceptual Framework, the Eco-Scorecard and Scientific Principles on the Path toward Ecological Sustainability (Please refer to Figure 3 to follow the links below)

Eco-Sustainability Conceptual Framework (eco-elements that are potential sources for innovation B-E)	Eco-Scorecard (ES) (identified by eco-element and key performance indicator #)	Scientific Principles
B. Eco-Culture	ES: B3; Eco-expense reduction to cut environmental costs by not wasting natural resources and by avoiding regulatory burdens due to pollution or waste disposal.	Nutrient Cycling
		Energy Flow
		Net Primary Production
C. Eco-Redesign	ES: C8; Use of Closed-loop Systems ES: C10; Conducts Supply Chain Audits	Nutrient Cycling
		Net Primary Production
		Energy Flow
D. Eco-Tracking	ES: D11; Company uses Life Cycle Assessment to measure ecological footprints and understands environmental impacts and ecological consequences of products /processes along the value chain. Supply Chain adjustments	Environmental Sustainability
		Net Primary Production
E. Eco-Advantage Mindset	ES: E18; Leadership makes decisions with long-term in mind for a tighter regulatory framework. Leadership looks at the whole value-chain from raw materials to a product's end of life. ES: E16; Company is using a sustainability lens to ID new opportunities. Company is placing a focus on innovation.	Environmental Sustainability
		Energy Flow
		Net Primary Production

Research Design

Design of the research study utilized a qualitative, multiple case study combined with a phenomenological approach. Yin (2009) defined case study as “an empirical inquiry that investigates a contemporary phenomenon within real-life context” (p. 13), which brought insight, clarity, and interpretation to this study. The intent of the research agenda was to produce a rich description of the phenomenon of sustainability in small to mid-sized enterprises focusing on the link between innovation and ecological sustainability.

Phenomenology refers to how an individual or group of people, attach meaning, structure and essence to their experience related to a phenomenon (Moustakas, 1994). The task of the researcher is to depict the essence or basic structure of an experience in order to find meaning through interpretation of the “text” of the experience (Merriam, 1998). Utilizing the interview transcripts, statements made by interview participants that are relevant to the subject under investigation are termed *Invariant Constituents*, and are essential to the interview participants’ experiences and perceptions (Moustakas, 1994). These invariant constituents’ generated themes associated with the Eco-Sustainability Conceptual Framework that are representative of each company and were grouped into the thematic categories for each of the eco-elements.

An advantage in utilizing a case study is it offered one of the best plans for answering the “how” and “why” questions associated with this study. In addition, the case study offered a way to investigate the compatibility of the Eco-Sustainability Conceptual Framework and usefulness of the Eco-Scorecard to track a firm’s progress with the key performance indicators. Knowing that case study has proven useful in

studying educational innovations, for evaluating programs, and for informing policy (Merriam, 1998) confirmed its research merits. The limitations associated with case studies include, (a) oversimplifying a situation through a narrow view as opposed to seeing the whole picture, (b) the sensitivity and experience of the investigator can be a limiting factor, and (c) issues of reliability, validity, and generalizability to wider populations are limitations.

Research Phases and Tasks

During Phase 1, the theoretical framework identified the research questions, while the literature review informed and contributed to the development of the Eco-Sustainability Conceptual Framework and Eco-Scorecard. These research instruments were utilized during semi-structured interviews with the case study companies for data collection and analysis. Next, the selection criteria for the case studies was determined primarily on the company's long-term financial performance (≥ 15 yrs.). To sustain profits over the long-term was an important criterion reflecting the ability of the small to mid-sized enterprise to balance the economic sphere. A screening process defined the parameters for inclusion in the research study (See Appendix A: Small to Mid-sized Enterprise Sample List). It was determined the case studies would be five small to mid-sized enterprises located throughout northern New England. This geographic region offered a rich sampling of diversity within company sectors and kept travel expenses to a minimum.

In Phase 2, establishment of the interview protocol included the development of an interview guide, introductory script, and interview questionnaire with 25, open-ended questions correlated to the Eco-Scorecard (See Figure 4). In addition, a glossary

of terms included definitions for the Eco-Scorecard key performance indicators and an overview for interview participants to see how the Eco-Sustainability Conceptual Framework, Eco-Scorecard, and scientific principles were linked (See Table 3-2). Application to the University of New Hampshire's Institutional Review Board took place once the interview protocol was completed. Approval came within the following week, which paved the way for the multi-case site visits and data collection to occur within the limitation set forth by the Institutional Review Board (see Appendix B). During Phase 2, a pilot study conducted at Epoch Homes and W.S. Badger Company, helped to inform the interview protocol and Eco-Scorecard, covered in the 'Pilot Study' section found later in this chapter.

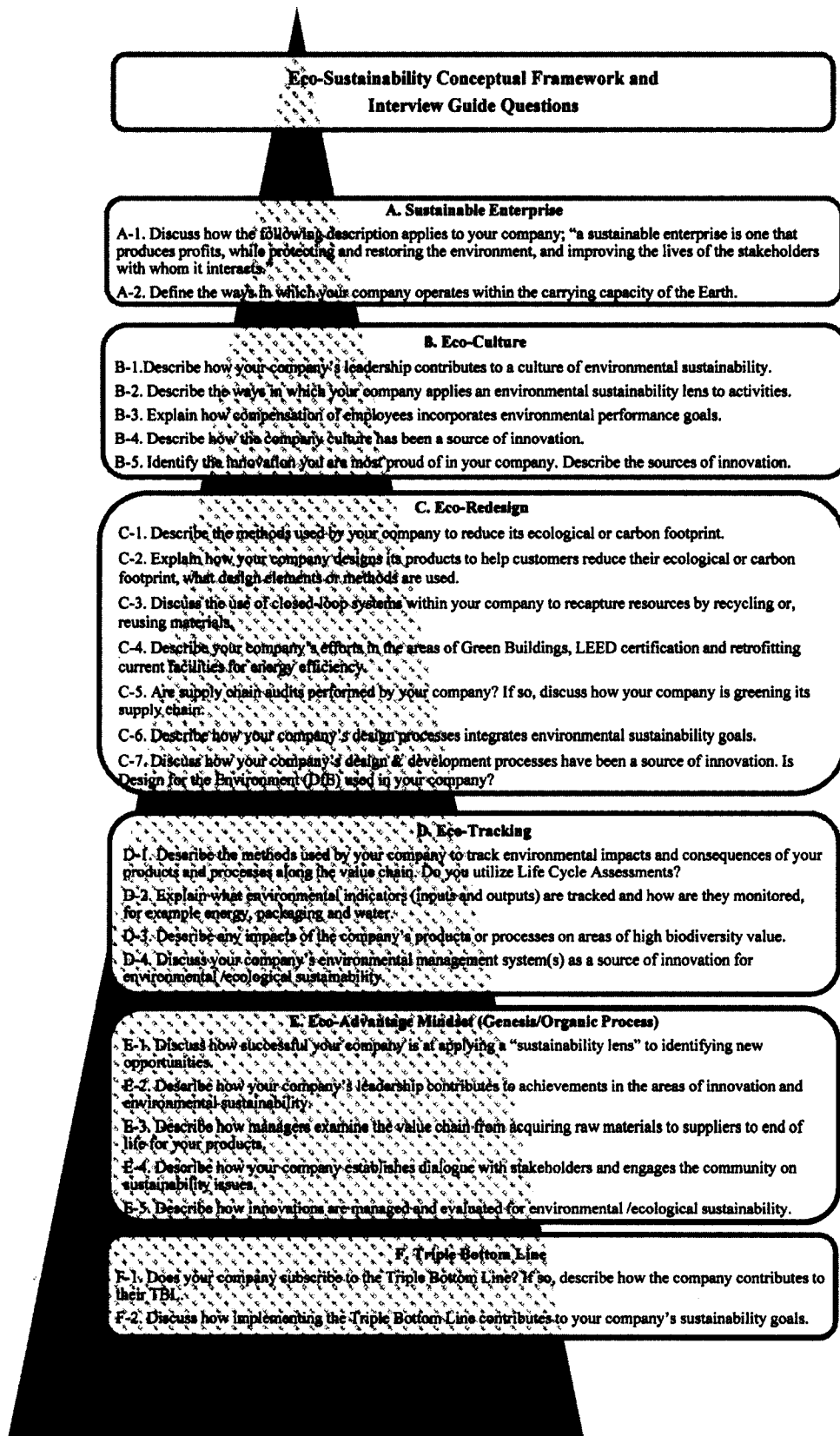


Figure 4. Eco-Sustainability Conceptual Framework with Interview Guide Questions

In Phase 3, face-to-face interviews were conducted with three interview participants at each of the five researched companies. Prior to the interviews, subjects received a packet including a letter of introduction and the interview instruments for their perusal. At the beginning of each interview, a short introduction and explanation of the research took place, consent forms were signed and any questions were addressed before proceeding with the semi-structured interviews.

During Phase 4, coding of the data continued with interview scripts averaging 15-20 pages in length. In addition to the primary data, secondary data were collected and analyzed. The nature of the secondary data provided company history, company websites, annual reports, patents, financial information and media coverage. The analysis and synthesis of the data was utilized to evaluate the use and compatibility of the Eco-Sustainability Conceptual Framework and to determine if the Eco-Scorecard proved to be a useful tool to track a company's progress as a sustainable enterprise. The rich textual statements and expressions from the interview participants provided the content for the case studies. The proposed research tasks and anticipated outcomes for each research phase were identified along with a Dissertation Research Timeline and Task Organization (See Appendix C).

Pilot Study

The interview protocol along with the Eco-Sustainability Conceptual Framework and Eco-Scorecard were pilot studied upon receipt of approval from the University of New Hampshire Institutional Research Board. From the pilot study, the data collection protocol was assessed in a real interview sequence with participants to

ensure that statements and questions used in the Eco-Scorecard and the interview guide questions were clear and concise.

Interview participants in the pilot study were not eligible for inclusion in the primary study. The participants chosen for the pilot study represented Presidents & CEOs of companies from the same list that contained other prospective participant companies for the study (Appendix A). After receipt of the consent form for review, the pilot study participants were electronically sent the Eco-Sustainability Conceptual Framework, Eco-Scorecard and interview guide questions for review prior to their semi-structured interview. A time, date, and location were scheduled with the pilot participants. Pilot study interviews lasted between 75 to 90 minutes in total.

Interviews included using the Eco-Sustainability Conceptual Framework, Eco-Scorecard and interview questions in the same manner as the primary study. In addition to the interview questions, pilot study participants answered questions related to their perception of the process, use of the Eco-Sustainability Conceptual Framework, Eco-Scorecard and the clarity and ease of comprehension of the interview questions. These questions served to provide feedback and improve upon the interview protocol and Eco-Scorecard. After careful examination of the responses, with particular interest in issues of clarity of questions and responses that fit or not with the goal of each question, it was determined if any questions or statements required revision.

Pilot Study Interview 1: Epoch Homes

John Ela, President and CEO of Epoch Homes participated in a pilot study interview on Friday, April 9, 2010. Mr. Ela purchased Epoch Homes, founded in 1983 in 2006. The company mission is:

To build the best quality custom homes, combining the finest materials and old world artisanship with the efficiencies and economies of *modular* construction – a term that describes a *construction approach*, rather than any particular style of home. As part of this goal, Epoch Homes has been offering green building options since the beginning. To our way of thinking, the strategies and tactics used to achieve sustainable buildings are all part of our longstanding approach to custom building. (www.epochhomes.com)

The company describes green building as:

A new way to think about home building that considers more than just a floor plan, elevations, and required building code. Green Building raises considerations of; lot design, prep, and development; resource efficiency, energy efficiency; water efficiency; indoor environmental quality; operation, maintenance and owner education. (www.epochhomes.com)

An interview with Mr. Ela from Epoch Homes served as the first pilot study for the Eco-Sustainability Conceptual Framework, Eco-Scorecard and interview questions. During the interview, Mr. Ela made several comments on the interview process, and on certain terms and/or questions. Mr. Ela noted on the applicability of the Eco-Sustainability Conceptual Framework that many times people (and companies) incorporate eco-sustainability into their processes, while failing to realize they have done so. He described the process from his perspective and his feelings of the effectiveness of the system:

Almost every category covered are things people may be doing but probably aren't calling it by these terms and probably aren't thinking about it that way. For most questions asked, I had to stop and think; well forget the words being used here to describe things and think about the intent, what are you doing in these areas? We certify for green building and think about that in every product we build. If you had said, 'do you have an Eco-Scorecard where you measure your environmental performance,' my first thought would have been no, we do not. Yet, in fact, we do something exactly like that but we do not call it an Eco-Scorecard. I think the dialog surrounding the question and the intent of the question was where we were able to communicate. I think it was effective.

Similar to the second pilot study participant, Mr. Ela also questioned the use of the term "Triple Bottom Line." He stated:

When I first read it, I thought, “Oh, this is a bunch of muck.” This is not how the real world works. Nobody really thinks of it this way, but then I went back and thought about what is really the intent behind the question. Maybe there is a better term to use rather than Triple Bottom Line. That term just puts me off.

The recommendations and feedback from Mr. Ela were used in conjunction with those of the second pilot participant, Mr. Whyte of W.S. Badger Company to draw conclusions with respect to the ease of comprehension and clarity of the Eco-Sustainability Conceptual Framework, Eco-Scorecard and interview questions. It served to assist in the development of a data collection process to provide accurate and detailed results.

Pilot Study Interview 2: W.S. Badger Company

The W.S. Badger Company, founded in 1995 is a family run business that formulates, manufactures, and ships soothing and healing balms from their facility in Gilsum, New Hampshire around the globe. The mission of the company is:

To create fabulously pure and effective products of the highest natural quality, based on simplicity and thoughtful preparation, with the intention to soothe and heal. All the while running a business that is fun, fair, and profitable; where money is fuel, not a goal; and where our vision for a healthier world finds expression through the way we work and through the way we treat one another and the people we serve.
(<http://badgerbalm.com>)

Bill Whyte, CEO and ‘Head Badger’ was interviewed on Monday, May 10, 2010. Mr. Whyte described the company business philosophy as being based in “love and kindness and extending that to social, economic, and environmental realms.” This aligns with the stated core principles of the company, including elements of individual respect and teamwork; caring; and supporting organic, sustainable, agriculture through purchasing practices. Their business environment is respectful and supportive of all employees, and of the people they serve; personal and social healing through their

charitable giving; environmental responsibility; honesty and integrity in their business practices; and generosity.

During the interview, Mr. Whyte shared remarks about rating the Eco-Scorecard. In addition to responding to the various interview questions related to the Eco-Sustainability Conceptual Framework and Eco-Scorecard, Mr. Whyte provided his perceptions of each section of the Eco-Sustainability Conceptual Framework, Eco-Scorecard and interview questions. This process was an important aspect of the pilot study, to identify problem areas or questions in need of revision.

Mr. Whyte was able to answer the questions appropriately and provided interview feedback based on his experience. First, Mr. Whyte commented on the real life impossibility in terms of living within the carrying capacity of the Earth in our current environment. He noted, "Living within the carrying capacity of the Earth is really someone in Africa, making a home out of clay and dun, living in an area where there is enough rainfall they can actually grow the food they need that would actually be a [rating of 3] 75%. Whereas, here (in the U.S.) where it is impossible to do so, I would say a 30%." He discussed how his company tries, nevertheless, in small ways to be within the Earth's carrying capacity, such as "We try to buy at the local market or farmer's market for our organic lunches."

The next point made by Mr. Whyte was some concern over the term "Triple Bottom Line," expressing that the term implies a corporate mentality, reflecting a "mindset of economics." When asked if the term "gets in the way" and if it should be replaced it with "environmental responsibility or corporate citizenship, Mr. Whyte responded, "I think you have it there, but it does not have a spiritual light surrounding

it. When you say Triple Bottom Line, it sounds like something a banker would say. I think the energy of the statement or the linguistics makes it sound like a banker's terms." Mr. Whyte offered an alternative question of "What is your philosophy that allows your business to fulfill its potential in the areas of economic, environmental, and citizenship? If you ask it like that, it takes away some of that bottom-line word."

Mr. Whyte also suggested an alternative related to the term 'stretch goals:'

I think you could say something like goals and visions as a driver for innovation and sustainability, because I feel like the most important thing that you can do in this business is to have a wholesome vision. When you say stretch goals, it is almost not stretchy enough. Companies use their vision and for many people their vision may be; I want to make things better for people and that vision may evolve over time.

Finally, Mr. Whyte commented on the importance of the interview process over merely rating the key performance indicators on the Eco-Scorecard.

Pilot Study Results

Results from the pilot study revealed perceptions of an effective interview process and Eco-Scorecard instrument that was clear and easy to complete. However, both participants identified improvements for the use of certain terms in questions. Both participants noted that the eco-elements discussed in the Eco-Sustainability Conceptual Framework are things done by companies, although people do not think about these elements in that light. They both expressed concern over the term "Triple Bottom Line" and recommended the use of other descriptors to evaluate the company philosophy with regard to economics, environment, and citizenship. Finally, the pilot study revealed a possible advantage, noted by Mr. Whyte in the description of stretch goals as drivers for innovation.

These suggestions were used in the formulation of the Eco-Sustainability Conceptual Framework, Eco-Scorecard and interview questions with specific revisions made to the interview questions and the Eco-Scorecard reflective of the feedback. Because of the pilot study, the Triple Bottom Line was explained as encompassing sustainability as the balancing of economic, social, and environmental aspects, and stretch goals were discussed as drivers for innovation. The feedback from the pilot study served to enhance the understanding and accurate measurement of the Eco-Sustainability Conceptual Framework, Eco-Scorecard and interview questions.

Data Collection

The data collection protocol included a one day, site visit to each company headquarters to collect field data and conduct semi-structured interviews for the case study. Selection criteria for the interview participants included senior to mid-level managers qualified to assess sustainability in their company, who represented different departments, job functions and backgrounds in knowledge and experience. The purpose of the semi-structured interviews was to obtain data from the application of the Eco-Sustainability Conceptual Framework and use of the Eco-Scorecard.

Upon arrival at each company, we started with an orientation and informative tour of the facility, followed by the interview sessions. The site visits occurred in the following order:

1. New England Wood Pellet site visit was conducted at their headquarters in Jaffrey, NH on Thursday, May 27, 2010. The qualified interview participants included:
 - Steve Walker, Founder, President and Chief Executive Officer

- Charlie Niebling, General Manager of Sales & Procurement
 - Norwood “Woody” Keeney, Operations Sales Rep for New England
2. New Chapter site visit was conducted at their headquarters in Brattleboro, VT on Friday, May 28, 2010. The qualified interview participants included:
- Sara Newmark, Sustainability Manager,
 - Barbie Schulick, Co-Founder and
 - Kevin Miodonski, Vice President of Operations.
3. Hitchiner Manufacturing site visit was conducted at their headquarters in Milford, NH on Monday, June 14, 2010. The qualified interview participants included:
- John Morison III, Chairman,
 - Keith Tuthill, Facilities Manager, USA and
 - Marc Riquelme, Vice President of Sales and Marketing
4. Monadnock Paper Mills site visit was conducted at their headquarters in Bennington, NH on Thursday, June 24, 2010. The qualified interview participants included:
- Richard Verney, Chairman and Chief Executive Officer,
 - David Lunati, Director of Marketing, and
 - Michelle Hamm, Environmental Manager
5. Casella Waste Systems site visit was conducted at their headquarters in Rutland, VT on Monday, October 4, 2010. The qualified interview participants included:
- Stephen McDonnell, Director of Sales & Marketing

- Dr. Dingrong Bai, Senior Process Engineer and
- Paula Calabrese, Director of Strategy & Intellectual Property.

One week in advance of the site visits, interview participants received an interview packet containing a University of New Hampshire Institutional Review Board Consent Form, Glossary of Terminology, and Interview Guide with 25; open-ended questions, an Eco-Scorecard, and the Eco-Sustainability Conceptual Framework (see Figure 4). The semi-structured interviews included a discussion of the Eco-Sustainability Conceptual Framework and Eco-Scorecard developed for this study. Each interview participant offered their perceptions and experiences about the company, with particular attention to the Eco-Scorecard. In addition to open discourse, each participant offered an un-weighted rating of 1 to 4 under each category that was converted to a percentage score. The Eco-Scorecard results are representative of the responses of the interview participants and found in their respective chapters.

Each of the interview participants was extremely generous with their time and each exhibited a curiosity for the other case study companies by asking questions about their identity and sustainable business practices. The interviews ran between 90 to 120 minutes in length and between interviews, there was time to review company related products, packaging and written materials. A full day was spent at each case study company, which proved to be a productive day on-site for research purposes.

Data Triangulation

The data triangulation protocol utilized primary data consisting of transcripts from the semi-structured interviews conducted with three senior managers at each of the five case study companies based on applying the Eco-Sustainability Conceptual

Framework and use of the Eco-Scorecard. In addition, recorded observations during our on-site visit and company tours served as primary data. Secondary data included annual reports, brochures, websites, and product information from each company. Rational explanations were formed by comparing, contrasting and crosschecking between the different primary and secondary data sources within each company, as well as across the five companies for the Cross-Case Analysis in Chapter 9. Addressing validity and reliability for the study occurred through triangulation and member checking (Yin, 2009). Each interview participant reviewed their transcript and gave final approval. A second approval opportunity occurred when subjects reviewed and approved their final case study containing categories and themes identified to ensure accuracy of the data provided by them. Any edits, revisions and corrections from the interview participant were included in the final case study.

The analytical approach of triangulation helped to understand the phenomenon of sustainability within the context of small to mid-sized enterprises and strengthened our examination, interpretation and level of certainty by utilizing multiple, independent sources of data. We were careful to understand each data source and what it represented so we did not introduce bias into the analysis. Triangulation occurred in the areas of theory, data and methodology.

Theory triangulation involved the use of multiple perspectives to interpret the data. Beginning with the equilateral triangle shape of the Eco-Sustainability Conceptual Framework, each leg of the triangle represented a theory (Institutional Theory, Stakeholder Theory and Natural Resource-Based View) that informed the theoretical

framework and contributed to the development of the Eco-Sustainability Conceptual Framework and Eco-Scorecard as research tools.

Data triangulation involved using different sources of information in order to increase the validity of the study. Primary data sources included onsite observations at each company, tours of their facilities, semi-structured interviews, audio tapes of the tours and transcribed interviews; approved by all interview participants (member checking). Secondary data sources utilized company websites and associated links, annual reports, brochures, media articles, records of company history, patents, trademarks and financial reports. Casella Waste Systems was the only publicly traded company, thus their financial records and investor information was accessible online.

Methodological triangulation involved the use of qualitative methods to research the case studies. Results from the Eco-Scorecards and semi-structured interviews were compared to see if similar results and/or inconsistencies occurred with the three interview participants within each company and across all five companies. We found corroboration did exist between the interview data sets within and across the five enterprises. The interview participants rated three consecutive years in the Eco-Scorecard that was cross-referenced with their interview scripts. Utilizing all of these triangulation methods increased validity.

In summary, triangulation proved to be a useful tool to deepen our understanding of the researched case studies, maximize confidence and provide validity by comparing, contrasting and crosschecking the research data from multiple sources.

Data Analysis

The Data Analysis protocol utilized qualitative analysis of the transcribed interviews to identify themes as they related to the Eco-Sustainability Conceptual Framework and Eco-Scorecard. The interview participants' verbal responses revealed relevant statements that are essential to their experience and perceptions, termed *Invariant Constituents*, which were used to generate themes representative of the company as a whole (Moustakas, 1994). An invariant constituent is defined as an essential component of the phenomenon and represents the experiences and perceptions of the participants given through their words, statements, and feelings with regard to the research questions (Moustakas, 1994). Invariant constituents mentioned by participants were used to reveal themes from the data. Invariant constituents may be tied to only one participant or more than one participant.

The Invariant Constituents were then grouped into thematic categories according to the Eco-Sustainability Conceptual Framework (See Figure 4), along with the frequency of occurrence among the three interviews in each case (within-case analysis), as well as across all cases (cross-case analysis). The analysis process was assisted by the use of the NVivo9® qualitative software program to code the transcribed text of the interviews, note the location and frequency of each relevant occurrence (invariant constituents) within the transcribed texts, and group the invariant constituents into categories. Common invariant constituents (i.e., those mentioned by more than a single interview participant) within thematic categories were used to identify themes in the data among interview participant experiences at the company.

These “key” invariant constituents are provided in Tables for each individual case study and in the cross-case analysis as they relate to the Eco-Sustainability Conceptual Framework. Textual, verbatim examples from the interviews are also included for clarity of each invariant constituent. The thematic categories, as presented for each case study, follow the Eco-Sustainability Conceptual Framework as follows:

- **Sustainable Enterprise:** The key performance indicators for Sustainable Enterprise include the perceptions of interview participants in terms of the company’s ability to produce profits while protecting and restoring the environment, improving the lives of others, and operating within the carrying capacity of the Earth.
 - **Eco-Culture:** The key performance indicators for Eco-Culture include the company’s efforts to reduce eco-expenses, such as environmental costs (not wasting natural resources), use of stretch goals to drive innovation, CEO and Senior Management commitment and support of sustainable practice, all of which is reflected in the company culture and vision, as well as knowledge sharing and innovation.
- **Eco-Redesign:** The key performance indicators for Eco-Redesign include the company’s understanding of the environmental market drivers with the ability to assist customers in reducing their ecological footprints, use of design for the environment (DfE), as well as internal redesign, such as the use of closed-loop systems, supply chain audits, and obtaining green building and LEED certification.
- **Eco-Tracking:** The key performance indicators for Eco-Tracking include the various mechanisms and procedures used to track energy use, pollution, waste, and compliance as well as to measure the ecological impacts and consequences of the products and processes along the value chain. These mechanisms and processes include life cycle assessments, environmental indicators, materials database, and environmental management systems.
- **Eco-Advantage Mindset:** The key performance indicators for Eco-Advantage Mindset includes the concepts of CEO commitment to sustainability, looking through a lens of sustainability to identify new opportunities with a focus on innovation, community and stakeholder involvement, decisions made considering the long-term, and value placed on customer loyalty, employee retention, and brand value.
- **Triple Bottom Line:** The key performance indicators for the Triple Bottom Line (TBL) include implementation and support of an approach, which

serves to balance the economic (financial), social, and environmental aspects of the business, and the leadership and cultural commitment to corporate social responsibility.

However, other themes within these categories not captured in the framework may have emerged from the data. The full variety of interview participant responses, inclusive of the single responses, was used in the cross-case analysis in Chapter 9.

The qualitative software program, *NVivo 9*® was utilized to code and categorize the data and to assist with the development of themes from the interview data. The *NVivo 9*® software helped to manage the data by classifying, sorting, and arranging information, as well as noting the frequency and location of occurrences. Coding of qualitative data as an iterative process, occurred mainly within the four eco-elements of the Eco-Sustainability Conceptual Framework and served as a guide for identifying categories and themes from the data. The data collection and analysis techniques for the study were used to identify categories and themes, while providing in-depth context to the research (Creswell, 2003).

CHAPTER 4

NEW ENGLAND WOOD PELLET

RESEARCH CASE STUDY

New England Wood Pellet, founded in 1992 with its headquarters in Jaffrey, New Hampshire, is the largest manufacturer of high quality, premium-grade wood pellets in the northeast United States. Clean wood for their three facilities comes from local sawmills, low-grade timber and wood product manufacturing (furniture, flooring, cabinetry, etc.) facilities. New England Wood Pellet is able to secure sufficient green and kiln-dried wood resources to run their plants at the full production rate of 220,000 tons annually. New England Wood Pellet will continue to expand as the market for environmentally friendly, biomass fuels continues to increase. This company is the youngest of the five case studies at 20 years-old, and is in a young and fast-growing industry. As a case study, New England Wood Pellet offers valuable insight into the application of the Eco-Sustainability Conceptual Framework.

Company Overview

The company overview section utilized secondary data from the New England Wood Pellet website, associated web links, and other published documents. This overview includes background information on New England Wood Pellet that was important in reaching conclusions discussed in Chapter 10.

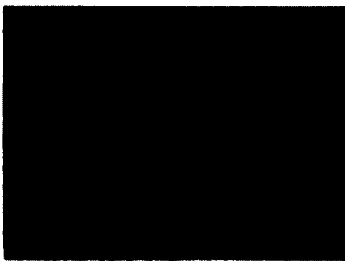
The company mission for New England Wood Pellet states:

New England Wood Pellet is a leading producer and distributor of quality pellet fuels for use in residential, commercial and industrial heating throughout the northeast United States. We believe that pellet fuels made from sustainably produced biomass

can play a major role in reducing demand for fossil heating fuels. We believe our region has the opportunity to develop this renewable resource as a significant contributor to meeting regional energy demands, thereby strengthening our economy and positioning the northeast as a national leader in sustainable, low carbon clean energy. (www.pelletheat.com)

The New England Wood Pellet website does not include a sustainability statement; however, interview participants inferred that sustainability is implied because they produce wood pellets made from a renewable natural resource (sustainably produced biomass), providing value as an alternative in reducing the demands of non-renewable fossil fuels.

New England Wood Pellet employs 84 people at three manufacturing plants, and is the largest manufacturer and distributor of wood pellet fuel in the northeast United States. Through innovative technologies, distribution partnerships, and a commitment to continuous improvement in process engineering, New England Wood Pellet offers a certified alternative energy source to their customers, which was examined in terms of the development of new competencies, new processes and practices on their path to ecological sustainability.



Jaffrey, NH Manufacturing Facility

Schuyler, NY Manufacturing Facility

Deposit, NY Manufacturing Facility

Figure 5. Three sites of New England Wood Pellet Manufacturing.
(Photo Courtesy of New England Wood Pellet)

Company History

New England Wood Pellet is a privately owned company founded in 1992 by Steve Walker, President & CEO, with three manufacturing plants. The Jaffrey, NH facilities include their headquarters, a manufacturing plant, and research and development facility, where new equipment and technology in pellet manufacturing are designed, tested, and brought into production. In an effort to keep pace with an increasing demand for wood pellet fuel, the company recently expanded to a state-of-the-art facility in Deposit, NY, the other New England Wood Pellet manufacturing plant is located in Schuylerville, NY. Within their short history, New England Wood Pellet has strategically positioned itself in prime locales based on availability of wood sources and access to key transportation and delivery routes.

In 2008, New England Wood Pellet started a subsidiary called 'Propell Energy' to market commercial and industrial pellet boilers for heating schools, office buildings, apartment complexes, and other large buildings. Propell Energy also provides economical bulk pellet delivery to large commercial accounts. In April 2010, New England Wood Pellet and the 'Sandri Company' announced a formal strategic partnership between the two companies, as well as the acquisition by Sandri of New England Wood Pellet's commercial pellet boiler business. In addition, the two companies collaborated in securing a \$3.2 million dollar grant from the Massachusetts Department of Energy Resources to install numerous commercial pellet boilers in western Massachusetts to increase the use of high-efficiency pellet boilers on a residential scale. Both of these partnerships serve as innovative approaches and key performance indicators under the Eco-Advantage Mindset category.

New England Wood Pellet produces premium grade pellets with 100% wood byproducts and sustainably harvested, low value timber without any additives, chemicals, or binding agents. Pellet fuel is considered carbon neutral by the United States Department of Energy and Environmental Protection Agency (EPA) only when it comes from a forest that is sustainably managed and harvested. Under these conditions, heating with pellets releases roughly the same amount of carbon dioxide that wood releases during its natural decaying process. The low carbon emissions, combined with low ash output, results in a clean, environmentally friendly source of fuel, thus contributing to its sustainability. A comparison of different types of fuels is provided in Appendix D for reference.

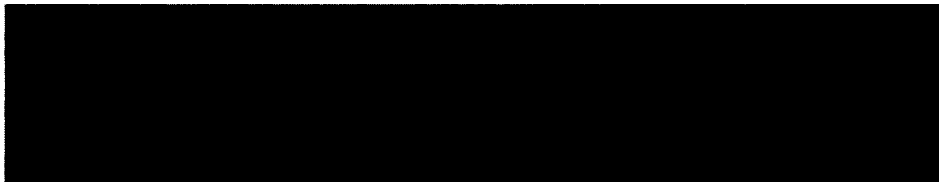


Figure 6. Heat Indices for the Product of New England Wood Pellet (www.pelletheat.com)

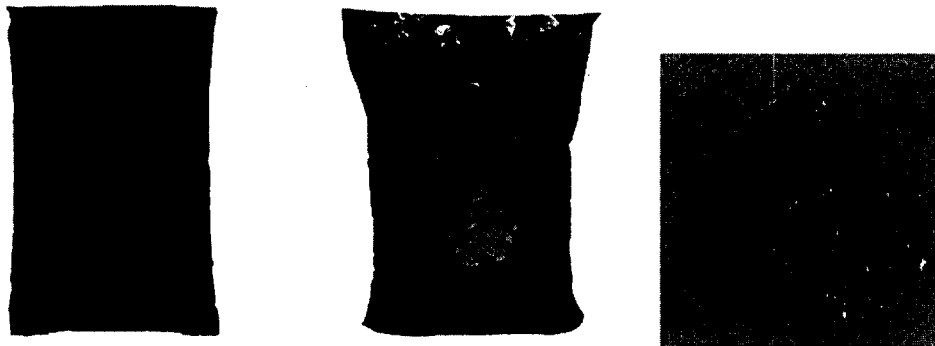


Figure 7. New England Wood Pellet Products (www.pelletheat.com). (Photo Courtesy of New England Wood Pellet)

New England Wood Pellet suppliers provide clean materials generated by a variety of operations, such as wood planing and moulding facilities, flooring

manufacturers, furniture manufacturers, and other wood products through which sawdust or woodchip residue is generated for producing pellets. Another source comes from the debarking and chipping of whole logs. Materials are tested, dried, blended and pressed into wood pellets, generally constituted from an 80% hardwood to 20% softwood blend.

New England Wood Pellet has received several awards and recognitions listed on their website, reflecting a mix of entrepreneurship, and environmental stewardship accomplishments (www.pelletheat.com). They confirm New England Wood Pellet as a fast-growing, small business on the rise and recognized as an outstanding forest industry. Two of the awards were bestowed upon Steve Walker, Founder, President and CEO for his leadership and entrepreneurship, reflected as an invariant constituent of “CEO definitely committed to environmental practices and stewardship” with a frequency rate of n=3.

Individual Interview Narratives

The following selected responses from the interview data collected provide an in-depth look at the interviews with each individual participant. The data provided examples in support of the themes identified during the analysis. As noted, interview data were collected from three senior representatives from New England Wood Pellet.

Interview with Steve Walker, President & Chief Executive Officer

Mr. Walker is the founder and senior member of the management team. During his 20-year tenure, he has been instrumental in the leadership, manufacturing, design, and engineering initiatives of the company. In response to the Interview Guide question regarding sustainable enterprise (A-1), Mr. Walker replied:

Our mission is to develop a product manufactured locally; that is economical and environmentally better for our customers. Our target market is here in New England where I want to live and work. There is a real economic need right here

in the northeast United States, where 80% of all heating oil in the country is consumed.

Mr. Walker went on to discuss energy as a primary focus especially in the redesign of their newest plant in Deposit, NY. When discussing engineering and design aspects, he said they are showing the equivalent of about \$1 million in energy savings (B-3), including a protective cover over the wood supply to decrease run-off and drying time. All of the building vents are aerodynamic and strategically located to reduce the need for fans to ventilate the entire building (B-3). He felt these innovative designs give New England Wood Pellet an advantage over other pellet manufacturers. Another initiation discussed by Mr. Walker was a power plant at the Jaffrey, NH location (B-3). He conducted a tour of the facility during our interview and shared how the power plant would permit New England Wood Pellet to produce its own thermo-energy, from 100% renewable resources thus enabling the manufacturing plant to sell extra electricity as opposed to presently purchasing carbon credits to offset their business operations.

When asked to define ways in which New England Wood Pellet operates within the carrying capacity of the Earth (A-2), Mr. Walker replied, "We are leaders in the northeast U.S. in promoting sustainable forestry practices and we want to make sure our wood suppliers are maintaining these practices. We are going to environmental groups and alerting them to the fact that if and when this country gets serious about renewable energy, New England Wood Pellet is here." Walker referred to the use of wood boilers and pellets for thermo-energy in Europe. Walker said, "Such reliable systems have had rapid growth and success in Europe. New England Wood Pellet's goal is to become the leader in commercial-scale pellet heating systems in the northeast United States, from New England to New York, New Jersey, and Pennsylvania."

“Proven in Europe for more than 15 years, pellet boiler systems cost less per unit of energy compared to average oil boilers” according to Walker, and in his opinion:

Sweden and Denmark are absolute leaders. Not far behind them is Austria and Germany, both are doing a good job within their economies. Sweden is a highly industrialized nation and serves as an excellent example of what is possible with renewable energy. They have proven in a growing economy [that] eliminating emissions including CO₂, which is a big driver, is achievable.

Mr. Walker is among others at the company who credit Europe as being 10 to 15 years ahead of the U.S. in terms of sustainability; this further contributes to his frustration about a lack of U.S. government support concerning U.S. renewable energy policies. On the Eco-Scorecard, Mr. Walker gave his highest rating to (E) Eco-Advantage Mindset, followed by the categories of (D) Eco-Tracking and (A) Sustainable Enterprise; his lowest ratings went to the (B) Eco-Culture and (C) Eco-Redesign categories.

Interview with Charlie Niebling, General Manager of Sales & Procurement

Mr. Niebling has worked at New England Wood Pellet since 2006 and serves on the management team. He is responsible for marketing, wood procurement for the company’s three plants, corporate communications, and government and public affairs.

When asked to describe New England Wood Pellet as a sustainable enterprise (A-1), Mr.

Niebling replied:

Fundamentally, we are an energy company. We produce a product, which provides for an essential need, fuel to make heat. It gets to the absolute core of quality of life for the consumer. New England Wood Pellet is completely dependent on the productive capacity of the Earth in that we manufacture our product from wood. For the wood suppliers, it provides a better market for residual byproducts that otherwise would have little value in the marketplace. In the case of retailers who sell our products and for our employees, it is providing a stable, secure, reasonably well compensated and attractively benefited employment. As New England Wood Pellet has grown, so have the benefits to our stakeholders grown. For our customers, New England Wood Pellet allows them to use an environmentally friendly fuel as an alternative to non-renewable fossil energy and do so economically.

Mr. Niebling continued answering questions as to sustainable enterprise (A-1) by saying:

I would say society as a whole is a stakeholder in what we do because we are addressing some fundamental public interests by what we do. For instance, how supply and demand for foreign fossil fuel impacts our energy independence, national security, jobs and the economy, reducing greenhouse gases, reducing certain air emissions are a number of public benefits achieved by what we do as well.

Related to the Eco-Redesign questions (C 7-10), Mr. Niebling discussed the production of wood pellets with a focus on efficiency of the manufacturing process and constantly striving to increase production with a reduction in energy consumption and resources per unit of production. He stressed these are economic-based motivations with tangible implications to sustainability:

We are becoming much more mindful of the impact on the market that our wood purchases have and the responsibility we incur to ensure the wood and materials provided by our suppliers are produced in a sustainable fashion. Therefore, we exert influence on the people who supply us. We are now formalizing a corporate policy to be in place within the next several months.

In terms of the Eco-Sustainability Conceptual Framework, Mr. Niebling identified the Eco-Redesign category (C) as a source of innovation for New England Wood Pellet:

I think the integration of the manufacturing systems in an efficient, safe way is an innovation for us. We are better at that than anyone in our industry. It is how all the pieces of the plant fit and work together with a constant focus on improved systems and processes, controls, automation (with robots) and reduction in energy consumption. There is continuous improvement from our adaptive management learning from mistakes, not being afraid to change things, to spending money if there are better ways to do it.

Next, Mr. Niebling talked about how New England Wood Pellet is recapturing resources by reusing materials and recycling as part of their Eco-Culture (B-3), "We recycle all our bag film that we do not use. We recycle pallets, cardboard, and metal. Much of our procured wood is a residual from other wood product manufacturing. In the old days, it was waste product and much of it got put in a landfill, now we buy it and

reuse it.” When asked about recycling New England Wood Pellet waste products (B-3), Mr. Niebling responded, “There is not a lot of stuff that leaves this plant in the form of waste. The stretch wrap cannot be reused or recycled, otherwise we recycle just about everything that we can and we minimize the consumption of materials in the first place. If we are wasting stuff, it costs us money.”

We concluded our interview addressing how New England Wood Pellet applies the Triple Bottom Line approach (F-19). Mr. Niebling commented:

This is a very mission driven company, it is about getting this region off oil and providing consumers with an affordable, environmentally responsible heating fuel alternative to fossil energy. Everything we do is within the law. It is not always about making money, although we have to make money in order to succeed. To be in a position to advance our mission (for me) is the one thing about this company I appreciate the most, and working for our President & CEO who is all about the mission. I believe what we do provide public benefits. We still have a huge challenge educating people and enlightening them to understand why and sometimes people disagree with us. Everything we do here is to achieve that result. Growth is not a means to future profitability, although it is in a sense because the investors are looking to make money on their investment. Although, the growth is all about getting more fuel out into the market and increasing the demand for our fuel and reducing the region’s reliance on heating oil, propane and natural gas. It is social; it is economic and environmental. You wait until the next bout of \$4.50 or \$5.00 a gallon for heating oil, and watch what happens in New England.

Interview with Norwood “Woody” Keeney, Operations Sales Representative

Mr. Keeney has been with New England Wood Pellet since 1999 and is responsible for sales throughout New England. He previously worked as the Assistant Director at the New Hampshire Governor’s Office of Energy and Community Services. During his 13 years at New England Wood Pellet, he has gained a deep appreciation for the industry and events shaping the world of wood pellets, including the constantly changing dynamics of each heating season.

When asked to describe New England Wood Pellet as a sustainable enterprise (A-1), Mr. Keeney replied, “We make a product that makes a difference in people’s lives because we are selling an alternative product which is renewable, environmentally friendly and offers some economic freedom for consumers to save money as well.”

Mr. Keeney discussed the biomass facility under construction adjacent to the manufacturing plant in Jaffrey (B-4):

We reached out to collaborate with a company to generate electricity, which is the biggest component of our manufacturing process. The electricity will be generated from forest resources; providing a green source of electricity as opposed to paying for it from the utility, which is generated from coal. We are ready and able to take full-advantage of the biomass-generated electricity when the technology comes on line.

“If delivery of bulk pellets could occur similar to the standard method of delivering home heating oil it would be the best-case scenario versus using plastic bags and stretch wrapping,” according to Mr. Keeney. “We are constantly pushing our cover bag and film supplier to provide us with a product that meets our quality standards with less plastic. They aren’t there yet, but are working on a cornstarch plastic with the strength characteristics of what we currently use.”

When asked to describe how the company’s leadership contributes to the culture of environmental sustainability (B-5), Mr. Keeney answered:

Our President and CEO sets the tone, he is an inspiring person because he thinks about the big picture and the long-term. He has an outstanding ability to make the points for what we do, whether it is to our employees or speaking to industry and consumer groups. If you take the visionary out of a company, it can run, but after a while, it gets away from its true intent. Pure number crunchers when running a business can lose the original inspiration and focus. Fortunately, we have our President and CEO who has a strong presence.

During this part of the discussion, Mr. Keeney spoke about New England Wood Pellet’s environmental sustainability influence on the community at large (E-17) via

employees and the President and CEO. Mr. Keeney said, "I think it [company mindset] comes through our President and CEO down to everybody, down to the plant level and production folks; they know they are making a difference and that means something. We are not just coming into work and making a pencil or a widget of some sort. We are making a product that heats somebody's home and since we all have homes to heat that is important." When asked, "Do your employees own wood pellet stoves," Mr. Keeney responded, "Yes, it is very noticeable here in Jaffrey, people have the pellet stoves, they have the product, and they are using them. Employees socialize with friends who get interested in what they are doing, and then their friends go out to buy stoves and wood pellets. Our employees are invested in the quality of our product because their friends are going to buy our fuel." Mr. Keeney continued, "We certainly see that in terms of one major dealer that sells several thousand tons (pellets) on an annual basis. Dealers about half an hour away did a special this spring, and they sold well over their usual annual sales. The market within the shadow of this plant and throughout the Monadnock Region is influenced enormously by our presence."

Over the past 20 years, New England Wood Pellet has experienced both tremendous growth and growing pains brought about by a transition from an informal company structure to a more formalized corporate structure and feel. This came up during each interview and Mr. Keeney addressed it:

You can be an entrepreneur, you can be an innovator and you can be all these wonderful things but if you are not making money, you will not have a business. I think this is something that happens in companies, when they get going with a great idea and sometimes the owners can't make the changes to bring in the right people to run it like a real business. Our company was experiencing 40-50% growth every year. Another danger for a company is too much growth, too fast. That is what we were experiencing.

Due to the growth of New England Wood Pellet and profitability factor, a new COO was hired. Mr. Keeney said, "I wasn't that familiar at that point with the inner workings of how things were going, but as we know now, there were some things that were not in very good shape, simply because nobody understood what the books were all about and how things were before the new COO came. For a couple of years, his job was to sort things out with auditors, banks and position the company for future growth."

This explanation provided us with a better understanding of the company history and the need to establish parameters to ensure future growth and sustainability. This combined with the fact that New England Wood Pellet is in a young industry may have contributed to low ratings in the areas of (B) Eco-Culture and (C) Eco-Redesign, yet higher scores in the (E) Eco-Advantage Mindset and (A) Sustainable Enterprise categories as strength areas for New England Wood Pellet. In concluding the interview, Mr. Keeney shared his opinion on renewable energy, and biomass as a young industry seeking acceptance and validation:

The volatility of the market does not allow manufacturers of wood-burning appliances or the fuel to be able to plan very well. Add in the uncertainties of regulations at the Federal level and the whole industry is not on sound footing. Case in point, there is an onerous proposal regarding pellet boilers that produce over 150,000 BTUs known to be in draft form at the EPA. That is more than a residential pellet application might need, and is more pertinent to commercial applications. Those requirements would be tough to meet even for the best European models in order to attain EPA air pollution requirement. The question is who is promoting this? Where is it coming from? Whose fingerprints are on this? This is total speculation on my part since I have no proof, yet rumor has it, it was the Natural Gas Industry because natural gas meets the EPA air pollution requirement and oil cannot beat it, nor can the wood pellet world attain that level. Obviously, you can draw conclusions based on an industry out there that has everything to gain by causing our young, growing industry not to be able to grow. Some may call it competition and that is fine. However, should policy makers pick winners and losers in the fuel business, as opposed to letting technology dictate where we go?

Eco-Scorecard Results

The results of the participant evaluations on the Eco-Scorecard were compiled and presented on the following Eco-Scorecard. The ratings offered by participants were converted to percentages, as noted in the methodology.

New England Wood Pellet Eco-Scorecard Results

A.	Key Performance Indicators for Sustainable Enterprise	Baseline 2008	Year 1 2009	Year 2 2010
1.	A sustainable enterprise is one that produces profits, while protecting and restoring the environment, and improving the lives of the stakeholders with whom it interacts.	75%	83%	83%
2.	Company operates within the carrying capacity of the Earth.	66%	83%	83%
	SUB-TOTAL	71%	83%	83%
B.	Key Performance Indicators for an Eco-Culture			
3.	Eco-expense reduction to cut environmental costs by not wasting natural resources and by avoiding regulatory burdens due to pollution or waste disposal.	66%	75%	75%
4.	Company uses Stretch Goals as a driver for innovation and eco-sustainability. *Company applies a sustainability lens to getting things done.	50%	50%	50%
5.	CEO and Senior Management have a commitment for sustainable practices and environmental stewardship. *Money and incentives tied to eco-accomplishments. *An environmental ethos reflected in the mission/vision/values.	75%	75%	75%
6.	Storytelling of the eco-successes and lessons learned in CSR/Sustainability/EHS Reports. *Eco-training, a form of knowledge sharing which contributes to innovation is available. *Jobs titles reflect responsibility for sustainability.	58%	58%	58%
	SUB-TOTAL	63%	64%	64%
C.	Key Performance Indicators for Eco-Redesign			
7.	Utilizes Design for the Environment (DfE) to help customers reduce their ecological footprints and designs out environmental problems. *Company understands the environmental market drivers.	75%	75%	75%
8.	Use of Closed-loop Systems	58%	58%	66%
9.	Green Building and LEED Certification, *Retrofitting existing buildings for energy efficiency.	42%	50%	50%
10.	Supply Chain Audits	33%	42%	50%
	SUB-TOTAL	52%	56%	60%
D.	Key Performance Indicators for Eco-Tracking			
11.	Company uses Life Cycle Assessments to measure ecological footprints and understand environmental impacts and ecological consequences of the products/processes along the value chain. *Supply chain adjustments.	58%	58%	58%
12.	Develop a Core Set of Environmental Indicators that track energy use, water and air pollution, waste generation and compliance. *Data/Metrics of Inputs and Outputs are used.	66%	75%	75%
13.	Establish a Materials Database to determine what is in your products or connected to your processes.	66%	75%	75%
14.	Environmental Management Systems (EMS) for environmental and risk assessment or *Environment, Health & Safety practices.	75%	75%	83%
	SUB-TOTAL	67%	71%	73%
E.	Key Performance Indicators for Eco-Advantage Mindset (Genesis/Organic Process)			
15.	CEO's Commitment to Sustainability and Environmental Strategy – top down support. *Doing the right thing that reflects values do matter within the organization.	92%	92%	92%
16.	Company is using a sustainability lens to ID new opportunities. *Company is placing a focus on Innovation.	75%	75%	83%
17.	Company establishes dialogue with both friends and foes. *SME engages in local community building. *SME is involved with Stakeholder engagement and eco-activities.	83%	83%	83%
18.	Leadership makes decisions with the long-term in mind for a tighter regulatory framework, rising customer expectations and market realignment driven by natural constraints. *SME places a value on higher employee retention, stronger customer loyalty and higher brand value. *Leadership looks at the whole value chain from raw materials to suppliers who meet customers' environmental needs, to product end of life.	83%	92%	92%
	SUB-TOTAL	83%	85%	88%
F.	Key Performance Indicators for the Triple Bottom Line (TBL)			
19.	The TBL Approach, which encompasses sustainability as the intersection of economic, social and environmental performance is used.	58%	67%	75%
20.	Corporate Social Responsibility (CSR) is a concept whereby organizations take responsibility for their impact on society and the environment.	75%	75%	75%
	SUB-TOTAL	67%	71%	75%
	TOTAL SCORE	67%	71%	73%

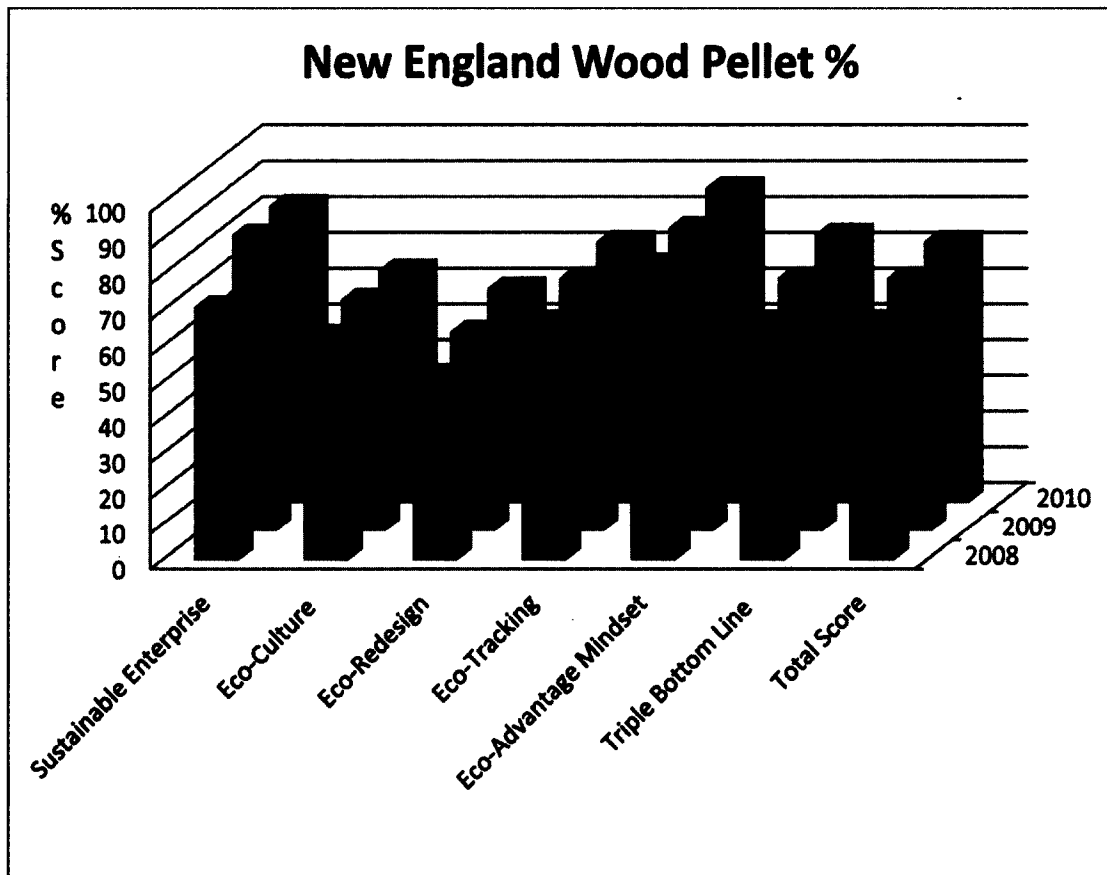


Figure 8. New England Wood Pellet Eco-Scorecard Percentage Scores

Analysis of Interview Data

Qualitative analysis of the New England Wood Pellet transcribed interviews were used to identify themes as they relate to the Eco-Sustainability Conceptual Framework and Eco-Scorecard as described in the data analysis process in Chapter 3. The key invariant constituents are provided in Table 4-1 as they relate to the Eco-Sustainability Conceptual Framework. Tables' 4A-4F in Appendix E represents the full variety of participant responses, inclusive of the single responses, used in the cross-case analysis in Chapter 9.

Table 4-1

Key Invariant Constituents of the Eco-Sustainability Conceptual Framework by Category: New England Wood Pellet

Themes and Key Invariant Constituents	# participants to offer this experience (n=3)
<i>A. Key Performance Indicators of Sustainable Enterprise</i>	
(A-1) New England Wood Pellet as an energy company that is processing wood pellets for an essential need of fuel and heat	2
(A-1) Product makes a difference as an alternative; there is a public benefit to what we do (innovation for improvement)	2
<i>B. Key Performance Indicators for an Eco-Culture</i>	
(B-5) Leadership committed to environmental practices and stewardship	2
(B-3) Optimizing efficiency	2
(B-4) A culture of challenging conventional wisdom or knowledge for sustainability	2
(B-5) Culture of employees understanding the company makes a difference and therefore on public awareness, potential benefits, and public interests	2
(B-5) Leadership driving the creativity of the people and the company/ leadership involved with employees, seeking ideas and thoughts	2
<i>C. Key Performance Indicators for Eco-Redesign</i>	
(C-7) Helping customers reduce ecological footprint	2
(C-7) Do not use EPA program Design for the Environment	2
<i>D. Key Performance Indicators for Eco-Tracking</i>	
(D-14) Invested in responding to Occupational Safety and Health Administration (OSHA) issues through informal environmental management system	2
<i>E. Key Performance Indicators for Eco-Advantage Mindset</i>	
(E-1) CEO definitely committed to environmental practices and stewardship	3
<i>F. Key Performance Indicators for the Triple Bottom Line (TBL)</i>	
No common invariant constituents found among interview participants*	

**Note: The lack of common invariant constituents does not convey that the company is not covering aspects of the TBL, only that no common, invariant constituents were revealed among the three interview participants (see appendix E for all single mention invariant constituents related to this category).*

Following the study design, textual, verbatim examples from the interviews are also included for clarity of each invariant constituent. The thematic categories, as presented, follow the Eco-Sustainability Conceptual Framework; however, other themes within these categories not captured in the Eco-Sustainability Conceptual Framework may emerge from the data. The following bold headings correspond to the Eco-Scorecard sections A thru F.

A. Sustainable Enterprise

Within this theme, interview participants offered several different statements representing the company's performance indicators for sustainable enterprise. Common statements among interview participant perceptions included that New England Wood Pellet is an energy company that is manufacturing an essential need (fuel/heat) (2 of 3 participants), and that the product makes a difference as an alternative fuel in that there is a public benefit to what we do (innovation for improvement) (2 of 3 participants). In addition to these commonly mentioned statements, interview participants offered insights into this thematic category, which included the impact of the customer in terms of knowledge, opinion, and current global conditions on the business. There were two invariant constituents commonly noted by the participants at New England Wood Pellet. For example, Mr. Niebling stated, "Fundamentally, we are an energy company. We produce a product, which is an essential need, heat or fuel to make heat. So it gets to the absolute core of quality of life for the consumer." Further, Mr. Keeney described the product as making a difference in the lives of their customers. He asserted, "We make a

product that makes a difference in people's lives because we are giving them an alternative product that is renewable, that is environmentally friendly, and offers some economic freedom, and consumers can save money as well."

New England Wood Pellet strives to create a balance in which production increases with reduced consumption of energy and resources. Mr. Walker highlighted this, along with other invariant constituents. According to Mr. Walker:

We focus on efficiency of our own manufacturing process. We are constantly striving to increase production with a reduction of energy and resources per unit of production. We are trying to get better at what we do. That is purely an economical thing, with very tangible implications to sustainability. We are trying to produce more pellet fuel to meet a growing demand to allow consumers to switch to a sustainable (homegrown) renewable fuel. In that respect, we focus on growth, we are trying to make it possible for more people to do the right thing in our view. We are becoming much more mindful of the impact on the market that our wood purchases have, and the responsibility that we have to make sure the wood and material provided to us are managed in a sustainable fashion. Therefore, we exert influence on our wood suppliers.

B. Eco-Culture

The data demonstrated the common invariant constituents of (a) leadership that is committed to environmental practices and stewardship (2 of 3 participants), (b) company striving to optimize efficiency (2 of 3 participants), (c) a company culture of challenging conventional wisdom/knowledge for sustainability, (d) culture of employees understanding that the company makes a difference with a focus on public awareness, potential benefits, and public interests (2 of 3 participants), and (e) leadership who are driving the creativity of the people and the company/ leadership involved with employees, seeking ideas and thoughts (2 of 3 participants). Pertaining specifically to the Eco-Culture, five themes were identified. Interview participants commented on the leadership commitment to environmental sustainability and practices, along with a

company focus on energy and economics. The following statement best describes this perception from Mr. Walker:

Our whole focus at New England Wood Pellet is about energy. I don't tell people "you should turn out your lights and make sure you are conserving energy," which I agree is important. If we want economic sustainability for this country, we have to be able to get a sustainable energy policy in place and start using it. We have exactly the opposite right now.

The culture and focus on renewable energy at New England Wood Pellet drives ideas to optimize efficiency and challenges conventional practices and wisdom in order to achieve sustainability. The following quote is indicative of this Eco-Culture theme from Mr. Niebling; "Probably the single most important thing we do is optimize the performance of all our equipment by maximizing the output for production and minimizing the energy necessary to product pellets through the optimal performance and integration of all the mechanical systems." Mr. Niebling went on to share:

I would say our culture is one that encourages people and does not penalize them for putting ideas out there, unconventional thinking, and breaking outside of the normal ways of doing things if there is a better way of doing things. That is true of most companies; you encourage your employees to strive to find new ways of doing things. To test conventional assumptions and really challenge the way things are done today to see if there is a better way for tomorrow.

As part of the Eco-Culture, Mr. Niebling noted that the company recycles almost everything because waste generates costs. This falls in line with the push for high efficiency and minimal waste products. Mr. Niebling said, "There is not a lot of stuff that leaves this plant in the form of waste. I think the stretch wrap cannot be reused or recycled, because it is a certain kind of plastic. We recycle just about everything that we can and we minimize the consumption of materials in the first place. If we are wasting stuff, it costs us money."

C. Eco-Redesign

Common themes emerged from the data within this category; included helping customers to reduce their ecological footprint and not using an EPA specific program for the Design for the Environment (DfE). The concepts of Eco-Redesign commonly shared by interview participants included specifics in terms of the redesigns used to support helping customers and other community members to reduce their own carbon footprint. Mr. Keeney noted, “We point out the environmental benefits of using our product, this helps to educate people.” In addition, a common statement that seems to run through many of the interviews, including those of the other case studies, is that of a focus on recycling and reuse. New England Wood Pellet has retrofitted existing buildings in efforts to reduce energy usage and expenditures, which has met and exceeded LEED requirements. According to Mr. Walker:

There is a downside for New England Wood Pellet with LEED. We have a very energy efficient manufacturing plant in Deposit, NY, far above the average, far above code. For instance, we could not use the best insulation because it could not handle the intense heat inside the factory. The reason it cannot handle the heat inside the factory is that I am putting all of the machinery into one room, instead of putting it outside. Therefore, we are going to have ducts going up to the ceiling, which I intend to manage at about 125 to 135 degrees up towards the ceiling. We have a very tall building with natural venting because all of our machinery is in there. LEED does not recognize things like that, and with that one change, I could probably heat 30 buildings with the energy I am saving by moving my equipment inside.

D. Eco-Tracking

Themes emerged from the data related to the continuous development of life cycle assessments, described in terms of the company’s response to Occupational Safety and Health Administration (OSHA) issues and an informal environmental management system. The only common statement with regard to this category is that of a company response to OSHA, although it was noted the environmental management system was felt

to be informal (1 participant) at best, not present (1 participant) at the worst. Mr. Keeney said, “Since Occupational Safety and Health Administration (OSHA) required us to do some different things, we spent \$1 million plus implementing it. We have done a lot here.” In addition, Mr. Niebling described the informal nature of the Environmental Management System (EMS) in the company. “Do we have any EMS in a formal sense? No, not that I am aware, it may be in there, but by a different name and not formally identified.”

E. Eco-Advantage Mindset

A single common statement (invariant constituent) among all of the New England Wood Pellet interview participants described the commitment of the leadership of the company in a positive way. The leadership commitment is critical to the company culture and attitude. In this case, the leadership demonstrates a commitment to sustainability, although the three perspectives are slightly different. For example, Mr. Niebling noted, “It is certainly true of [the President & CEO].” The frustrations of the company’s President and CEO were evident in Mr. Walker’s words when discussing government fees:

For example, if I have a stack on my plant with emission particles coming out of it, we would pay out \$7,500 (I think) a year in state penalties. The state mandates penalty fees, but it is actually under EPA law to regulate equipment requirements. Let us say I have a great idea to make the stack CO₂ neutral, and eliminate the pollution. Nevertheless, if it does not meet EPA equipment requirement, they will impose a \$25,000 fine for trying to make it cleaner. Even if I go to zero emissions, which is nearly impossible, I will be fined-regardless. With that kind of EPA regulatory action, you are not going to see cleaner technologies when it is cheaper to pollute than to meet EPA equipment requirements.

Mr. Niebling described the company as pushing for more sustainable options, by applying a sustainability lens approach:

We are monitoring our energy consumption very carefully trying to make sure, when something is going awry why it is happening. We are constantly pushing our bag-film supplier to provide us with a product that meets our quality standards with less plastic. It is not unlike all the effort the bottled water and beverage industry has gone through to reduce the amount of plastic in beverage bottles.

F. Triple Bottom Line

This thematic category failed to reveal a common invariant constituent among the interview participants, although New England Wood Pellet does reach out to the local community and promotes sustainable practices with its clientele. By nature of the product, the company takes on a certain level of corporate social responsibility. Mr. Keeney stated, “We already make a product, which puts us in that category (sustainable). The only reason I am thinking somewhat of a negative on this question is simply that we are not going out with a playbook on Corporate Social Responsibility when we just make it a part of who we are as the New England Wood Pellet.

Mr. Niebling offered a detailed description of how he sees the company, its mission, responsibilities and future for the business:

Everything we do, as a mission driven company, is about getting this region off oil and providing consumers with an affordable, environmentally responsible heating fuel alternative to fossil energy. It is not always about making money, although we have to make money to succeed financially. The one thing about New England Wood Pellet is that it is all about the mission, and what we do has public benefit as well. I believe we still have a huge challenge educating people and enlightening them as to why this so important. Sometimes people disagree with us, yet everything we do here is for achieving results. Growth is not [merely] a means to future profitability, the growth is all about getting more fuel out into the market and increasing demand for that fuel while reducing the region’s reliance on heating oil, propane, and natural gas. It is social; it is economic and environmental. Wait until we experience another \$4.50 or \$5.00 a gallon bout for heating oil and watch what happens here in New England.

Summary of Findings and Conclusions

Analysis of the interview transcripts identified the invariant constituents related to each thematic category A-F of the Eco-Sustainability Conceptual Framework and

revealed several key themes. These themes are further combined to represent the experiences of the interview participants as a whole for each of the companies (Creswell, 2009). These overarching themes, which represent overall commonalities of the perceptions and experiences of the senior managers, were used to reveal how the interview participants perceived and described the experiences at this company, specific to the eco-elements of the Eco-Sustainability Conceptual Framework. Therefore, the following themes and corresponding experiences provide overall conclusions of the case study data analysis, and were used to answer the research questions. These conclusions are:

Theme 1: New England Wood Pellet is an alternative energy company and therefore, by nature, sustainable, in terms of providing a product that makes a difference, is an alternative fuel source (public benefit) and is part of the essence of the business.

Theme 2: The company leadership demonstrates a commitment to environmental practices while instilling a company-wide focus on optimization of efficiency, a company culture of understanding the environmental significance of their product, and a concomitant focus on public awareness and education.

Theme 3: The company seeks to reduce not only their own carbon footprint, but also that of their clients/customers through providing a sustainable and renewable product, responding to Occupational Safety and Health Administration (OSHA) and developing life cycle assessments, as well as providing related public knowledge and education.

Theme 4: Triple Bottom Line contributes to economic sustainability of the company through attention to detail and the impact of the business in different ways. The company makes a sustainable product and aligns sustainability with the company products and goals.

New England Wood Pellet provides a product that is a sustainable alternative to fossil fuels. The company's commitment to sustainable practices encompasses its products, and its manner of conducting business. The Triple Bottom Line aligns with the product, the company goals, and contributes to the success of the business, despite the claim they do not prescribe to the Triple Bottom Line. Innovation in reducing energy expenses through recycling and reuse of materials, and general energy reduction, has enabled the company to reduce their own carbon footprint, while at the same time reducing that of their customers.

The analysis of three interviews with senior management professionals at the company revealed a leadership and company culture centered on the significance of the product to environmental sustainability and a commitment to local community communication, understanding, and education. The three interviews provided four themes that served to allow insight into a company focused on providing a sustainable, renewable energy alternative to high priced, both monetarily and environmentally, nonrenewable fuels. The company leadership demonstrates commitment to its environmental practices, promoting company-wide efficiency and a corporate culture of the significance of the impact on the environment, extended through supporting public awareness and education in environmental sustainability. Finally, the Triple Bottom Line appears to contribute to economic sustainability of the company through the company's

attention to detail and the impact of the business on the environment in different ways.

As a manufacturer of a sustainable product, sustainability aligns with the company products and goals.

CHAPTER 5

NEW CHAPTER

RESEARCH CASE STUDY

New Chapter is a manufacturer of organic whole-food vitamin, mineral, and herbal supplements for health, inflammation, immune support, prenatal care, stress and energy, heart health, bone and joint health. The company offers multi-vitamins, and targeted vitamins and nutrients; and herbal therapeutics, fish oil, probiotics, and mushrooms. Founded in 1982, New Chapter is the fourth oldest research case study at 30 years-old. New Chapter has the distinction of being the herbal supplement industry's first certified organic manufacturer to produce vitamins and minerals made with organic ingredients. They are also committed to supporting and protecting the environment. Their Costa Rican farm is a global model for organic sustainable farming practices and is a designated seed sanctuary for the protection of endangered tropical rainforest species. New Chapter will offer insight into using the Eco-Sustainability Conceptual Framework for reaching conclusions in Chapter 10.

Company Overview

New Chapter founded in 1982, is a privately held company that formulates and manufactures organic whole-food vitamin, mineral, and herbal supplements, with distribution networks through natural pharmacies, medical professionals, and health food stores. New Chapter products extend into Asia and throughout Europe, and the company is considered one of the finest supplement manufacturers. At their

headquarters in Brattleboro, Vermont, they bring together and bottle ingredients from around the world to create *Supplemental Food*®.

New Chapter has a strong concern for the planet as expressed through their business activities and thus, provides a valuable case study in applying the Eco-Sustainability Conceptual Framework and Eco-Scorecard. Their ecological focus is on everything from recycled pens and used office furniture to closed-loop systems, reducing their carbon footprint, and the ethical sourcing of botanicals. They are conscious of the fact that business, by its very nature, can run counter to the planet's well-being, noting that if the business is manufacturing products and shipping them, it is going to do some harm. That is why New Chapter is continually assessing their transportation, packaging, sourcing practices, and working towards ever-evolving improvements. Their motto is "sustainability begins with intention," and from the beginning, their intention has been to produce the most environmentally conscious product possible. Their mission states:

We are committed to using organic ingredients whenever possible, living an organic lifestyle and working toward an organic, sustainable world. More than simply a company philosophy, supporting organics has been the heart and soul of who we are since our inception in 1982. Simply put, organic is agriculture without the use of hormones, antibiotics, chemical fertilizers, pesticides or otherwise.

This mission statement and the following guiding principles are found on their website (<http://www.newchapter.com>):

Guiding Principles. In addition to the organic mission statement, the company promotes the following guiding principles to sustain growth and the sense of purpose to:

- Deliver the wisdom of nature thus relieving suffering and promoting optimal health;
- Advance the organic mission, nourishing body and soul with the healing intelligence of pure whole foods and herbal supplements;
- Nurture and sustain Mother Earth, the source of natural healing; and
- Honor and reward personal growth, for enlightened teamwork depends on the vitality of every member of the New Chapter family.

These guiding principles demonstrate the New Chapter commitment to nature, health, and ecological sustainability. From these guiding principles, the company defines policy with regard to sustainable agriculture, sourcing, environmental integrity, and social responsibility as follows:

Sustainable agriculture. “We are proud of our certified organic products. In addition, we are equally proud to work with our organic partners to further the mission of sustainable agriculture. You will love discovering Luna Nueva, our own biodynamic farm in Costa Rica.”

Sustainable sourcing. “We are the first and only vitamin and supplement company to have at least 75% of its products Non-GMO Project Verified. We are deeply committed to maintaining a socially responsible, environmentally conscious supply chain throughout our business.”

Environmental integrity. “From packaging and shipping to procurement and energy use, we strive to reduce our entire carbon footprint; it comes naturally to everyone who works here.”

Helping by doing. “We try to help those in need. We support and participate in the causes that are true to our hearts.”

Company History

Barbi Schulick, Co-founder of New Chapter shared the company history, as she described how they began as a small home-based operation to becoming a global manufacturer of organic, whole food vitamins and supplements focused on making a difference. Ms. Schulick's story describes a company devoted to sustainability and environmental integrity. In her own words:

Originally, we owned a natural food store that we bought in 1979. We were there for seven years and in the later years of our proprietorship of the store; my husband; Paul Schulick become intensely interested in herbalism and started creating products. We were still in the store when we produced our first line. Very few herbal companies were around at the time and he felt strongly that herbs were being overlooked as a source of alternative mechanisms for wellness. That in itself was an innovation, to create an herbal extract line. Furthermore, we followed the systems and cycles of nature in producing, a line called 'New Moon Extracts,' using traditional methods of extraction according to the cycles of the moon. In this method, the herb is set on the new moon then drawn off on a full moon. The herbs are set in either an alcohol base or a water base and you wait the cycle out until the full moon to draw off the liquid and press the herb with a hydraulic press; what remains is the liquid herbal extract. We went to all that trouble to do this when many companies were not, based on our firm adherence from the beginning on the wisdom of nature, that nature knows best how to do things. All of our products from the very beginning were always respectful of wholeness and purity. Several companies produce excellent products in their own right, yet do not adhere to this principle of wholeness. From the start our system of formulation always held regard for the fact that nature does it right. If a plant has all these different constituents that naturally arise from nature itself, you do not want to extract, isolate, or only use certain constituents while removing the others due to the natural synergistic effect from using the whole plant that we may not even know is going on. If we honor nature in our production of mechanisms for wellness, we will always benefit. That has been at the foundation of all our formulation. By using products of nature, we produce healing products using what nature is offering, at the same time receiving the energetics of the Earth in the actual mechanism for healing. In turn, we give back with gratitude expressed in our commitment to organics, to sourcing and our programs supporting plant sustainability. It is a cycle of give and take. We are not traditional business people; we do not have business degrees. We were meditation teachers when we got started. For us it was a passion from the beginning, a calling, a way to make a livelihood and be true to our hearts. It was always a way of giving

to people through nature and giving back to nature through people, recognizing that we ourselves are nature. Why would we want anything other than the creatures who know what to choose when they go forging in the forest? For some reason, humans have forgotten a whole lot and so our whole purpose was to see if we could be “rememberers” and learn from teachers who deeply understood this process throughout time and produce a product having nature reflected within it. Thus, the name ‘New Chapter’ came from a commitment to keep wholeness and purity in our products, and to be truly innovative.

The intention shown by the Schulicks in providing something useful that was produced to be whole and to respect nature’s wisdom remains strong to this day.

Accordingly, they felt that if these requirements prevailed their products could be produced.

In the beginning years, it was somewhat hodge-podge because each product was a result of the passion that drove it. It was kind of like a novelist who says I want to write about this, and then the next book is about something completely different.

The business, according to the co-founder, represents a “New Chapter” in consumer wellness, as the New Chapter products were like none before them.

As a result, they sold the food store in order to focus on the development of New Chapter, the company and the couple moved to Vermont from the Boston suburbs, attracted to the country atmosphere. Feeling at home among several natural food channel companies in Brattleboro, Vermont, they built a house with enough room to accommodate the new business, starting with the launch of the vitamin and mineral line, which was named “New Chapter,” and which soon became the namesake of the company. From that point on, each product produced was “a New Chapter in its category.” According to the co-founder, the company grew quickly, but maintains the family feeling of its roots:

At first, it was just my husband and me with one or two employees and it grew from there. Within the first three years, we had 10 people working in the house every day. Then we started having locations in town and it continued to grow through the years. When Tom Newmark our CEO came on about 12 years ago, he brought tremendous energy and skill in helping us to manage the company, and shared with some of the weighty executive decisions we were starting to have. The company started growing exponentially at that point. There is a family feeling at New Chapter we hold dear. The company has grown in a way that people feel like they are a part of a community. It's something we have worked hard to maintain and will continue to keep no matter how big we get. We are careful about whom we hire and we really want to keep our spirit intact. The beauty of it is that all these people start to feel like owners and founders as well. That has really worked into the values, and each person wants to feel a part that way. I think the reason my husband Paul and I have been successful as founders, is that we are able to let go. We are able to celebrate talents in other people and to know when it is time to pass something on to someone else. That is why we are careful in our hiring practices, which allows us to focus on what we know best and can do best.

The founders believe that maintaining and integrating their commitment, and being an active part of the decision-making at the executive level ensures they are making conscious decisions that remain rooted in their passion.

Individual Interview Narratives

The following selected responses from the interview data collected provide an in-depth look at the interviews with each individual participant. The data provided examples in support of the themes identified during the analysis. As noted, interview data were collected from three senior representatives from New Chapter.

Interview with Sara Newmark, Sustainability Manager

Sara Newmark, Sustainability Manager is a member of the management team and has worked at New Chapter for seven years. She manages the environmental and social platforms for New Chapter, which encompasses their impact on the Earth and carbon footprint reduction. In addition, she oversees efforts in the areas of

packaging, procurement, and philanthropy. When asked to describe New Chapter as a sustainable enterprise (A-1) she replied:

It is the second most important mission of New Chapter. The first mission is healing through herbs because we are an herbal company. If you look at our guiding principles, protecting nature is in the top three, and we are a Triple Bottom Line company, so people, planet, and profits. You have to make a profit in order to help people and the planet, and this is part of our day-to-day decision-making. Number one, we do no harm and we are here to heal. The healing mission is first, but never at the expense of the environment.

Proceeding through the Eco-Scorecard, the ratings given by Ms. Newmark showed steady improvements from the baseline year of 2008 to 2010. When asked if she is following a strategic plan, Ms. Newmark replied:

Yes, we had a matrix of all of our impacts and identified ways in each area to make improvements. First, we focused on the low hanging fruit then planned for bigger projects and decided on future goals. We examined everything from our waste stream to packaging to employee benefits; every step in our day-to-day business operations for every department, we went micro to macro. New Chapter was the first company to have their entire product line certified 'made with organic ingredients.' Creating eco-friendly products that are beneficial for people is at the core of who New Chapter is as a company. I would say that while we have had issues and places in need of improvement, we have made great strides. We are doing an excellent job in caring for and respecting the natural environment, and our collective home for as long as New Chapter has been in business.

In describing how the company leadership contributes to a culture of innovation and sustainability (B-5, E-15), Ms. Newmark discussed the critical influence of the leadership:

Our leadership is the reason we have a culture of sustainability; it comes from the top down. I do not think I can effectively do my job without buy-in from leadership, but in our case, it is more than buy-in. Leadership is at the heart and soul of our environmental and healing missions for both people and planet. If you were to walk into a meeting with our CEO, who happens to be my father: Tom Newmark, he would probably be sitting in lotus position on the floor, talking about healing the oceans. Our Co-Founder and Chairman of the Board, Paul Schulick is a beautiful steward for the environment and promoter for human health. They discuss these issues at all points of their on-going conversation. New

Chapter is growing fast, and we are growing strong. Leadership wants to make sure the business is staying healthy, but at no time will that happen at the expense of the environment.

All three-interview participants at New Chapter demonstrated a deep concern and connection to people and the planet as part of their Triple Bottom Line approach. They acknowledge that being profitable affords New Chapter the means by which to fulfill their mission, vision, and values. This juxtaposition poses both challenges and opportunities amidst their fast growing company as observed in the other case studies in balancing people, planet, and profit decisions. New Chapter has been successful in hiring a CFO and VP of Operations along with other key personnel in a manner that has strengthened the company culture. As the Sustainability Manager, Ms. Newmark described the scope of her job responsibilities:

I manage our environmental and social platforms for New Chapter, which encompasses our impact on the Earth and how we give back, philanthropy wise. I oversee where we procure our herbs according to an environmentally and socially conscious platform. That is why I was in India, meeting with our farmers, making sure they are fairly treated, paid fair wages, verifying sources of raw materials, and evaluating our supply chain. I was also working on the philanthropic side, developing programs, setting up schools and water catchment facilities within the communities we work and source from. In addition, I focus on how we package products and what materials we use in calculating our carbon footprint. For example, I work with a company that does a baseline of our carbon impacts. Also, we are using the Global Reporting Initiative (GRI) standards, and have decided to focus on Scope 1 and Scope 2, which includes a methodology of tracking and evaluating our carbon footprint.

Another important aspect of Ms. Newark's job responsibilities is working on interdisciplinary teams. She works with the supply chain group on sourcing, with IT on purchasing and with marketing on promotional efforts. On several occasions, she

serves as either a project manager or a researcher based on the needs of each specific project.

When asked to identify an innovation (B-4) Ms. Newmark is the most proud of, she replied:

For me personally, sourcing was my focus, coming in, knowing where our raw materials were coming from. It is difficult finding sources of organic materials and figuring out how to manage the entire system. Having a large supply chain reaching across the world coupled with a fast growing company, we lost some control. Now, we are focusing on regaining control while developing an internal system of checks and balances. It was more about the specific source. Who is farming it? What is happening on the ground? We source mainly from India, China, and Europe.

New Chapter has a biodynamic farm located in Costa Rico called Luna Nueva, and is certified organic by the National Organic Program standards and it holds the distinction of being a Demeter-certified Biodynamic® spice estate. It was at Luna Nueva that New Chapter perfected the cultivation of organic turmeric and ginger, which are prized ingredients of many of their formulations. Employees hold Luna Nueva in high regard, especially by those having spent a couple weeks visiting and working on the farm. This opportunity is available to staff after their second year of working at New Chapter.

In getting more specific on sources of innovation within New Chapter, Ms. Newmark discussed the Science and Innovation Team, which is a part of Product Development. The team works hand-in-hand with Paul Schulick, Chairman and Co-Founder, Tom Newmark, CEO and Vice Chairman, and Dr. Taryn Forrelli, Director of Science and Innovation. Schulick and Newmark developed Zyflamend® for inflammation, and it is one of multiple patents awarded to New Chapter for their herbal formulations. In addition, Tom Newmark is the co-author of *Beyond Aspirin*

(2000 Holm Press), *The Life Bridge* (2002 Herbal Free Press), and was instrumental in the publication of *Plants of Semillas Sagradas: An Ethnobotanical Garden in Costa Rica* (2009).

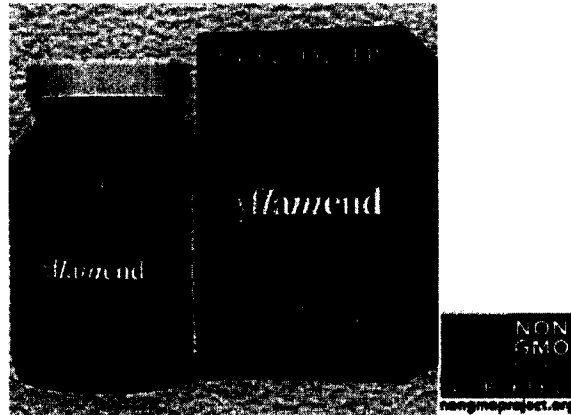


Figure 9. New Chapter Zyflamend® (Photo Courtesy of New Chapter)

New Chapter credits Zyflamend® as the number one selling herbal in the U.S. for healthy inflammation response. Clinically tested and doctor recommended, Zyflamend promotes healthy inflammation response, normal cardiovascular and joint function. New Chapter's Zyflamend formulation claims to represent a “scientific breakthrough in promoting a healthy inflammation response.”

THE DIFFERENCE IS CLEAR

	Wholemega Fish Oil				"Purified" Fish Oil
Wholemega® Fish Oil	✓	✓	✓	✓	NO
"Purified" Fish Oils	NO	NO	NO	NO	YES

Figure 10. New Chapter Whole-food Approach to Fish Oil (Photo Courtesy of New Chapter)

Finally, Ms. Newmark shed light on the Triple Bottom Line approach and the company's belief system (F-19):

I do believe conscious capitalism is an amazing way to affect real change. I used to work in the non-profit sector before coming to New Chapter. I believe in some ways we have an opportunity here to change the current system considering how our society is set up. If a company can be conscious and use a Triple Bottom Line approach to business, we can affect major change in a real way; I just try to remember that. It is our legacy at New Chapter; we believe what we are doing here is our gift to the local community and beyond.

In terms of the Eco-Sustainability Conceptual Framework Ms. Newmark rated New Chapter's strongest source of innovation in the Eco-Advantage Mindset and Eco-Tracking categories.

Interview with Barbi Schulick, Co-Founder

Barbi Schulick, Co-Founder and a senior member of the management team has worked at New Chapter since 1982. In her 30-year tenure, she has been instrumental in the leadership, strategic decision-making and sustainability initiatives. When asked to describe New Chapter as a sustainable enterprise (A-1) she replied:

I would say that it describes our mission. In addition, what is interesting is your use of the word innovation. When it comes to New Chapter, innovations are what have been at the groundwork of everything we have done. It was an innovative impulse that created the company and our name. The whole drive behind New Chapter had to do with giving people choices in the supplement category that simply were not available, choices that were whole, pure, and respectful of nature. When we started the company, we began with a line of herbal extracts. At the time, there were very few herbal companies in existence.

Discussing how New Chapter operates within the carrying capacity of the Earth (A-2), Ms. Schulick referred to its latest launch of a fish oil product called 'Wholemega.' Fish oil is an important market in their industry, yet they waited a long time before entering this category in order to make sure they could deliver a

product that was truly sustainable. They use a source, which Ms. Schulick referred to “as one of the only sustainable options on the planet,” which is 100% wild Alaskan Salmon oil. It comes from fisheries recognized for ocean stewardship and sustainability. Wholmega’s wild-caught, Alaskan Salmon is pressed immediately after harvest, much in the same as extra-virgin olive oil and is delivered from a ‘food grade’ government inspected facility.

When asked about the company’s ability to apply a sustainability lens to their work (B-4, E-16), Ms. Schulick responded:

That is something we work very hard at. Several years ago, I officially created a sustainability department with our Sustainability Manager. Now she works with our CEO in extending sustainability throughout the company. Prior to that, we did not have a department in the company specifically focused on sustainability; it was a given within the values of New Chapter. As the company grew, we realized our efforts needed to be made official and we needed language, policies, and systems in place to ensure everything we do aligns with those values and is fully integrated into all departments. As a company gets bigger, you can lose connection and you have to make sure it is there. I would say we are doing very well, but we are still growing.

Although the only specific job title with the word ‘sustainability’ in it is the Sustainability Manager, employees’ job functions reflect sustainable practices (B-6).

Ms. Schulick gave an example:

You will see when you meet with our VP of Operations, he is relatively new in his position, but during his job interview, it was clear that he was an intelligent fellow who was genuine. We decided we would be able to work well with him even though he did not come from a background where he had to be concerned with sustainability. We made it very clear that we wanted him to get seriously up to speed on these issues and to infuse eco-matters into everything he is doing. We probably drive him crazy with that, but he is doing it. It may not be in his job title, but it certainly is in his job function. When it comes to our concern about waste and what we produce here, we put a tremendous amount of effort into recycling. Through the years, we have gotten better and better, including our compost system. Our waste audit and the compost system are good examples of how the company culture is infused with that awareness. People know when they

are emptying their own trash at the end of the day that they have to put it into different bins.

The discussion on senior management's commitment to sustainable practices and environmental stewardship (B-5, E-15) brought forth a strong affirmative answer with several examples in support of their actions. Ms. Schulick said,

There is so much that we do, especially with the rainforest and our biodynamic farm in Costa Rica. We probably spend more time on it than is even healthy business practice on some level. Therefore, I would have to give us a high (100%) rating. We have a vegetable garden in the back of our building where people can join that committee and grow food for their families. Right now, we bring in organic fruit every day for the staff and on a monthly basis serve an organic luncheon with locally produced food. Currently, we are looking for a way to deliver a daily organic lunch program. Being in a small town has made it hard to find the right vendor to provide some kind of subsidized healthy and organic lunch program.

As the interview turned to the last category of activities under the Triple Bottom Line (F), Ms. Schulick shared her thoughts:

We do not make any decision without considering the people, planet, and profit balance. I guess what I want to put out there is what any company knows: it is not easy. We take responsibility for our impact on society and the environment. One area where I focus on is our community culture, as well as the contributions we make to the Brattleboro area and Vermont communities. We are focused so intently here; in years to come, we should be even better. We look at ourselves as having a healing product and want our workplace to be a healing place to work. Our commitment to sustainable agriculture and the protection of endangered plant species has a lot to do with our farm in Costa Rica and its neighboring rain forest. There is a seed sanctuary at our farm, and we have a goal for producing additional seed sanctuaries throughout the world.

In addition, Ms. Schulick reported that at least 10% of their after-tax profits supports "sustainable farming practices, conservation of tropical rainforests, and the sacred seed sanctuary that sustain all herbal traditions." Indeed, the New Chapter Costa Rican farm has a biodynamic facility and educational facility. She also noted that

New Chapter supports local families in Costa Rica providing jobs and housing and donating to the local schools.

The company accepts its Corporate Social Responsibility (F-20), seeking to give back on a global scale as well as to local communities. According to Ms.

Schulick:

We are proud to support prenatal clinics in Indonesia through a foundation called Bumi Sehat International. There are two extraordinary midwives; one is a Vermont midwife who devotes her time to malnourished women and the other midwife works with women in need during their pregnancies. They needed donations of prenatal vitamins, so we are providing them to their clinics. We also support many other wonderful initiatives locally- here in Brattleboro, VT. We give product to a walk-in clinic here in town and we are supporting two youth programs that grow organic gardens as part of their educational programs. In addition, we are going to start a sacred seed sanctuary at a Vermont school and our Sustainability Manager initiated a biodiversity tree planting campaign through a local food co-op and school partnership, which was very successful and touched many area schools.

Ms. Schulick asserted that throughout the years, many great companies have demonstrated compassion for their employees, “treating people right,” but they have not necessarily used a Triple Bottom Line (TBL) approach. They might treat people right but destroy the environment, you have to balance all of that and business should be thinking in this way (TBL).” Ms. Schulick shared their Sustainability Booklet (New Chapter, 2011) and throughout the interview, it was apparent New Chapter has a genesis Eco-Advantage Mindset (E) reflected in both intention and business operations. Ms. Schulick embraces her role as ‘keeper of the culture,’ recognizing its importance in navigating the company on its path toward sustainability, rooted in an essence of family and community spirit.

Interview with Kevin Miodonski, Vice President of Operations

Kevin Miodonski, Vice President of Operations is the newest member on the senior management team and had been on the job for nine months at the time of our interview. Prior to his arrival at New Chapter, he had worked in the pharmaceutical and chemical industries, specifically in the areas of manufacturing and operations for 25 years. His contribution offers a unique perspective along with his ability to compare and contrast differences between a pharmaceutical, multinational corporation and an organic whole-food vitamin, and herbal supplements company. When asked to discuss New Chapter as a sustainable enterprise (A-1), he answered:

There are parts of what we do that take full-advantage of existing technology and cost efficiency. For example, we use plastic caps; obviously, they are not a sustainable way to go. Our printed labels use soy-based inks and we use glass, which is completely recyclable, but adds to our transportation costs. I just returned from India, where we are trying to work with farmers using organic methods, which is a step in the right direction. We have to perform operations whereby we must interact with other companies and use raw materials in order to be profitable, while supporting the business including our employees and suppliers, and some business aspects are not completely sustainable. However, we are looking for better approaches.

Here, Mr. Miodonski expressed a real tension, whereas present technology has not caught up to sustainability needs. Other case study interview participants acknowledged this tension in terms of what is realistic and doable vs. what future technologies might be available. In complexity terms, sustainability capabilities have scientific, technological, organizational, and social dimensions. Developing and combining them together in a unique set of competencies can establish a valuable competitive position that would be difficult for competitors to imitate (Laszlo & Zhexembayeva, 2011, pp. 70).

In terms of New Chapter operating within the carrying capacity of the Earth (A-2), he thought the company was in the top 10% of organizations and referred to the ways New Chapter recycles and purchases eco-friendly materials from organic apples to office furniture. According to Mr. Miodonski, in many cases, the technology is not available to accommodate 100% sustainable practices:

I have worked in an industry where we dealt with very harsh and nasty chemicals that we burned at waste facilities or disposal plants, not the most eco-friendly work environment. We made drugs that saved lives granted, but how we got there was not good. The intent and goal was to make drugs that helped people live better lives, cure diseases like cancer and help heal. How we got there from an ecological standpoint was not important.

When asked to describe how the company leadership contributes to a culture of sustainability (B-5, E-15) while making decisions for the long-term (E-18), Mr. Miodonski replied:

When I came to New Chapter, what I found is in fact everybody's intent is very good. They want to be ecologically friendly, sustainable, and organic, the best possible intent while being healthy and profitable. There is an example of a product we are trying to develop right now, where those two attributes completely clash. We make a fish oil pill and what people want on our innovation team is to make a liquid version of it. It is interesting because we want a liquid version, but cannot have oxygen contact it because that will degrade the product. At the same time, the product container has to be recyclable (glass). The two are not interchangeable per se because in order to get oxygen permeability down to zero you need a barrier that is probably not recyclable. It is going to be a mixture of plastic and aluminum foil and other things that will go to the landfill. If you want recyclable you are going to have oxygen leaking in. These lessons are hard to learn sometimes. Which one are you going to give up on first?

In explaining an innovative approach in solving this problem, Mr. Miodonski replied:

Innovation and technology sometimes are not congruent. It takes a while for technology to catch up or innovation through technology to catch up. We may

have an idea of how we want to go about doing it, but the technology is not quite there yet. There are some plastics out there right now, made from cornstarch. They do not work very well, they spring leaks, but the concept is in R&D and eventually the technology will catch up.

Our discussion on reducing eco-expenses by not wasting natural resources revealed how New Chapter does this successfully (B-3). Mr. Miodonski said; “I would rate them a 100%, I think they are doing the right thing. New Chapter is pretty darn good at looking at every aspect of the business.” Then Mr. Miodonski shared an example of an initiative he is working on. It involved examining botanicals such as turmeric, which contains oil-based and water-based compounds. At one factory, oil-based extractions are performed to get the required materials out, and leftovers are composted. At another factory, water-based extractions are performed with leftovers composted. With this knowledge, Mr. Miodonski realized he could send the turmeric to an oil-based factory first, skip the composting then move it to the water-based facility for extraction and what remains is the same exact material you can get from a raw herb since it does not come out in the oil extraction. Now instead of using 150,000 kilos of turmeric, the amount can go to 75,000 or 80,000 kilos. This exemplifies how New Chapter uses the whole product, without wasting any raw materials (B-3).

From the interview, it was apparent a priority for the new VP of Operations was on vendors and strengthening their supply chain (D-11), which was central to his recent trip to India. According to Mr. Miodonski:

We need to be working with vendors that have the same ideals as we have and who can meet the New Chapter criteria. My intent was to find a way to meet with farmers directly. At a trade show, we found organizations that worked with local farmers in a Cooperative to bring them all together and produce raw materials for sale. They set up our trip; they showed us the farms, and we met

the farmers. We also toured the processing factories to see all the steps and meet the people coordinating these activities. These coordinators also provide organic certified seeds used to grow the herbs like turmeric. That was worth a trip to India, to find out where our raw materials come from and how they are grown. Learning about the treatment of our farmers, to everything about the process, including all aspects affecting our raw materials was important. Our goal is to have a pure organic, using organic fertilizers rather than manufactured chemical fertilizers.

In closing, Mr. Miodonski said, "I think one way to give you a view into the world here in my little office, is that I report to the President and CFO. The trip to India is a step in the right direction for working directly with farmers, and using our relationship with them to build schools and hospitals, it is a way for New Chapter to give back. I certainly didn't do that in the pharmaceutical business." For Mr. Miodonski, his trip to India was at the crossroads of sustainability and supply chain management (D-11). He shared that it was a life changing experience and a rewarding trip; next stop is China.

Eco-Scorecard Results

The results of the participant evaluations on the Eco-Scorecard were compiled and presented on the following Eco-Scorecard. The ratings offered by participants were converted to percentages, as noted in the methodology.

New Chapter Eco-Scorecard Results

A.	Key Performance Indicators for Sustainable Enterprise	Baseline 2008	Year 1 2009	Year 2 2010
1.	A sustainable enterprise is one that produces profits, while protecting and restoring the environment, and improving the lives of the stakeholders with whom it interacts.	71%	83%	96%
2.	Company operates within the carrying capacity of the Earth.	75%	79%	92%
	SUB-TOTAL	73%	81%	94%
B.	Key Performance Indicators for an Eco-Culture			
3.	Eco-expense reduction to cut environmental costs by not wasting natural resources and by avoiding regulatory burdens due to pollution or waste disposal.	66%	83%	92%
4.	Company uses Stretch Goals as a driver for innovation and eco-sustainability. *Company applies a sustainability lens to getting things done.	66%	79%	92%
5.	CEO and Senior Management have a commitment for sustainable practices and environmental stewardship. *Money and incentives tied to eco-accomplishments. *An environmental ethos reflected in the mission/vision/values.	83%	96%	100%
6.	Storytelling of the eco-successes and lessons learned in CSR/Sustainability/EHS Reports. *Eco-training, a form of knowledge sharing which contributes to innovation is available. *Jobs titles reflect responsibility for sustainability.	75%	83%	88%
	SUB-TOTAL	73%	85%	93%
C.	Key Performance Indicators for Eco-Redesign			
7.	Utilizes Design for the Environment (DfE) to help customers reduce their ecological footprints and designs out environmental problems. *Company understands the environmental market drivers.	83%	83%	100%
8.	Use of Closed-loop Systems	75%	83%	83%
9.	Green Building and LEED Certification, *Retrofitting existing buildings for energy efficiency.	83%	92%	92%
10.	Supply Chain Audits	66%	75%	83%
	SUB-TOTAL	77%	83%	90%
D.	Key Performance Indicators for Eco-Tracking			
11.	Company uses Life Cycle Assessments to measure ecological footprints and understand environmental impacts and ecological consequences of the products/processes along the value chain. *Supply chain adjustments.	75%	83%	83%
12.	Develop a Core Set of Environmental Indicators that track energy use, water and air pollution, waste generation and compliance. *Data/Metrics of Inputs and Outputs are used.	75%	75%	83%
13.	Establish a Materials Database to determine what is in your products or connected to your processes.	75%	83%	83%
14.	Environmental Management Systems (EMS) for environmental and risk assessment or *Environment, Health & Safety practices.	50%	50%	50%
	SUB-TOTAL	69%	73%	75%
E.	Key Performance Indicators for Eco-Advantage Mindset (Genesis/Organic Process)			
15.	CEO's Commitment to Sustainability and Environmental Strategy – top down support. *Doing the right thing that reflects values do matter within the organization.	77%	92%	100%
16.	Company is using a sustainability lens to ID new opportunities. *Company is placing a focus on Innovation.	79%	83%	92%
17.	Company establishes dialogue with both friends and foes. *SME engages in local community building. *SME is involved with Stakeholder engagement and eco-activities.	83%	87%	92%
18.	Leadership makes decisions with the long-term in mind for a tighter regulatory framework, rising customer expectations and market realignment driven by natural constraints. *SME places a value on higher employee retention, stronger customer loyalty and higher brand value. *Leadership looks at the whole value chain from raw materials to suppliers who meet customers' environmental needs, to product end of life.	79%	83%	87%
	SUB-TOTAL	82%	86%	93%
F.	Key Performance Indicators for the Triple Bottom Line (TBL)			
19.	The Triple Bottom Line Approach, which encompasses sustainability as the intersection of economic, social and environmental performance is used.	79%	83%	77%
20.	Corporate Social Responsibility (CSR) is a concept whereby organizations take responsibility for their impact on society and the environment.	92%	96%	100%
	SUB-TOTAL	86%	90%	94%
TOTALSCORE		76%	83%	89%

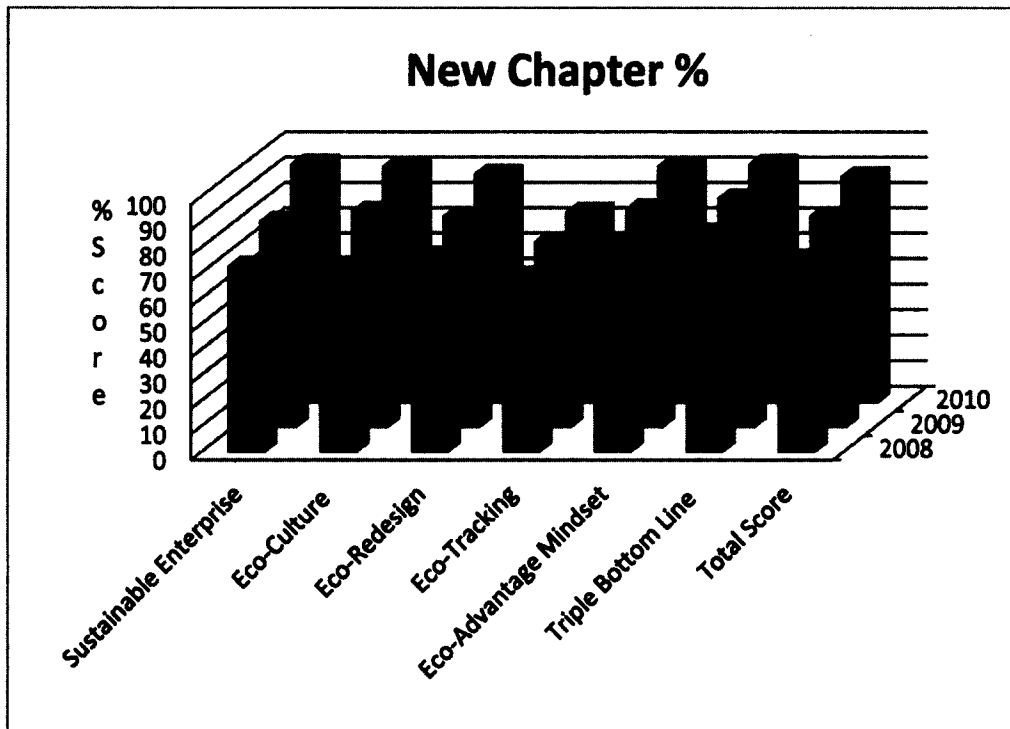


Figure 11. New Chapter Scorecard Percentage Scores

Analysis of Interview Data

Qualitative analysis of the three New Chapter transcribed interviews was used to identify themes as they relate to the Eco-Sustainability Conceptual Framework and Eco-Scorecard as described in Chapter 3. The key invariant constituents are provided in Table 5-1 below as they relate to the Eco-Sustainability Conceptual Framework. Tables 5A-5F in the Appendix F represents the full variety of participant responses, inclusive of the single responses, used in the cross-case analysis in Chapter 9.

Table 5-1

Key Invariant Constituents of the Eco-Sustainability Conceptual Framework by Category: New Chapter

Invariant Constituent	# participants to offer this experience (n=3)
<i>A. Key Performance Indicators for Sustainable Enterprise</i>	
(A-1) Commitment to sourcing that supports sustainability	2
<i>B. Key Performance Indicators for an Eco-Culture</i>	
(B-5) CEO and leadership committed to sustainable practices	3
(B-4) Waits in order to develop truly sustainable product (continuous improvement in sustainability efficiency)	2
(B-5) Culture comes from the top down	2
(B-6) Sense of community/family in which employees take ownership of sustainability efforts	2
(B-5) Awareness of sustainability and practices infused in culture	2
(B-4) Innovation is part of the culture, not really a stretch goal; have our own goals	2
(B-6) Job titles, created sustainability department and science and innovation team	2
<i>C. Key Performance Indicators for Eco-Redesign</i>	
(C-7) Recycling efforts	2
(C-9) Retrofitting building to meet LEED	2
(C-10) Find the sources of raw materials to ensure pure organic	2
<i>D. Key Performance Indicators for Eco-Tracking</i>	
(D-11) Life cycle assessments: From the source to the product and waste created in the process	2
<i>E. Key Performance Indicators for Eco-Advantage Mindset</i>	
(E-15) CEO commitment	3
(E-15) Culture comes from the top down	2
(E-15) Consistent CEO and leadership commitment to sustainable practices	2

Invariant Constituent	# participants to offer this experience (n=3)
<i>F. Key Performance Indicators for Triple Bottom Line (TBL)</i>	
(F-19) Do not make decisions without considering the people, planet, and profit	2
(F-19) Take responsibility for our impact on individuals, society, and environment	2
(F-20) Philanthropy: rain forest sustainability	2
(F-20) Assist in improvements in lives of the farmer suppliers etc.	2
(F-20) A primary focus of the company: doing as much as can to improve wherever possible	2

A. Sustainable Enterprise

A single common statement was revealed among interview participant perceptions, which included a commitment to sourcing that supports sustainability (2 of 3 participants). However, other key invariant constituents that were essential to the character and culture of the company included a company-wide respect for nature and natural processes, upon which the company was founded, as well as an awareness of the impact of the business on people and the environment.

The single invariant constituent that was commonly noted by the interview participants related to the company commitment to sourcing that supports sustainability and natural processes was reflected in the discussion with Ms. Schulick, who stated, “We give back with our gratitude, our commitment to organics and to programs and sourcing that support plant sustainability. It is a give and take. It is a cycle of give and take.” Ms. Newmark in an in-depth description communicated the company efforts at sustainability:

I think at New Chapter, in terms of striving to be a sustainable enterprise, it [rating] is very high. Now actually doing it, in terms of all aspects of the organization, I would say more like a rating of 3 (75%) because there are parts of what we do that we have to take advantage of existing technology, which is cost efficient. Some of the aspects that we take advantage of, like plastic caps obviously are not sustainable. Our labels, use soy-based inks, we use glass, which is completely recyclable. I just got back from a trip to India where we are trying to work with farmers and organic farming methods, which is a step in the right direction; overall, we have the right intention. I think culture, in my experience, always comes from the top down. As long as the CEO and Founders lead with those principles, then your senior management has to implement those beliefs and policies as part of their daily job. I have the support of the organization, so for me it is easy to follow through on the initiatives of recyclability and sustainability. I was in India to find eco-friendly farms that were treating their people right, were environmentally friendly, that were organic and not using pesticides. We are going to work with those people to help them, while at the same time they will provide us with the raw materials we will use in our products. This will make quality products because we know exactly where the raw materials come from and what goes into them. (Ms. Newmark)

Although only one of the interview participants actually described the sense of respect for nature, this perception was essential to the company, as expressed by Ms. Schulick:

From the beginning, [the] system of formulation always had regard for the fact that nature does it right. If a plant has all these different constituents that naturally arise from nature itself, you do not want to extract certain constituents or discard others since there is a natural synergistic effect from using the whole plant. If we honor nature in our production of mechanisms for wellness, we will always benefit. That has been at the foundation of all the formulation. By using products of nature, we produce healing products. By using what nature is offering, we are getting the energetics of the Earth in the actual mechanism for healing. It is a cycle of give and take. (Ms. Schulick)

Innovation is at the heart of the organization. Ms. Schulick noted:

I would say that it describes our mission. In addition, what is interesting is your use of the word innovation. When it comes to New Chapter, innovation is what has been at the groundwork of everything that we have done. It was really an innovative impulse that created New Chapter and the name "New Chapter." The whole drive behind New Chapter had to do with giving people choices in the supplement category that simply were not there and choices that were whole, pure, and respectful of nature. When we started the company, we

began with a line of herbal extracts. At the time, there were very few herbal companies in existence. The name New Chapter came from a commitment to keep wholeness and purity in the product, and to be truly innovative. If it was worthy of the name New Chapter, it had to be an innovation in its category, it had to be whole, and it had to respect nature's wisdom. (Ms. Schulick)

Within the realm of innovation and sustainability, the company strives to develop products that will provide healing while protecting nature. The growth of the business was described in terms of providing healing products, but never at the expense of the Earth.

We have a healing mission because we are an herbal company. If you look at our guiding principles, protecting the Earth is in the top three and we are a Triple Bottom Line company (people, planet and profits). You have to make a profit in order to help people and the planet. It is part of our day-to-day decision-making. Number one, we do no harm and we are here to heal. The healing mission is first, but never at the expense of the environment. (Ms. Newmark)

B. Eco-Culture

Several key statements emerged from the analysis of the interview data related to this thematic category, which included, (a) CEO/leadership commitment to sustainable practices (3 of 3 participants); (b) a corporate culture that comes from the top and moves down (2 of 3 participants); (c) that the company waits in order to develop a truly sustainable product (2 of 3 participants); (d) a sense of community/family with employees demonstrating a sense of ownership; (e) awareness of sustainability infused in the company culture; (f) innovation as part of the culture; and creation of the Sustainability Department. In addition to these commonly mentioned characteristics, interview participants offered insights into this thematic category, particularly those related to eco-expense reduction, recycling, and reusing energy sources and materials.

Table 5B (Appendix F) illustrates the variety of responses given by the New Chapter interview participants related to this thematic category.

Concerning the Eco-Culture, the interview participants commented on the leadership commitment to environmental sustainability and practices, along with a company focus on energy, and economics. Eco-expense reduction was a key factor, expressed in some way by all interview participants, yet in different ways.

Ms. Newmark described some of the company's efforts to reduce and reuse:

There are parts of what we do to take advantage of existing technology that is cost efficient like plastic caps, which are obviously are not sustainable. Our labels use soy-based inks and we use glass, which is completely recyclable. We are on a lot smaller spectrum than what can happen compared to British Petroleum, obviously. I think we probably operate in the top 10% of organizations in the industry from that perspective. Again, this is my opinion, but seeing the way we recycle cardboard, we have a huge recycling capability, and when we chose any raw material, even construction materials, we build and purchase eco-friendly materials like cork flooring and recycled furniture. Therefore, that is the intention going forward. When you look around you see printers, ink cartridges; so there is the mix, and part of it is keeping the business running and the other part is doing everything we can where we can to be sustainable. If we could get it completely eco-friendly, you know a printer made out of cardboard that was recyclable, we would do that, but the technology just is not available for some functions in how we need to do business. (Mr. Miodonski)

Another important aspect of the company that supported the notion of the company's Eco-Culture and commitment to sustainability was the concept of going to great lengths not to waste natural resources. According to Mr.

Miodonski:

We just got the results back on an initiative, which is wonderful. When we take a botanical like turmeric, there is oil and water-based compounds contained it. When we send it to a factory, they do an oil-based distraction to get the material we require out, and compost what remains. At another factory, they do a water-based extraction, and they compost what is left. We talked to each factory and learned the process, and found out that if we take the turmeric and send it to the oil-based factory first, and send the left over to the water-

based facility for extraction it would be more efficient. Now, instead of using 150,000 kilos of turmeric, we use 75,000 or 80,000 kilos.

Ms. Schulick also commented on this same concern for waste products at the company. She noted, "When it comes to our concern about waste and what we produce here, we put a tremendous amount of effort into that. Through the years we have gotten better and better."

The commitment applies to new processes as well, with New Chapter demonstrating patience in business practice by waiting to launch a product until they know that the product is truly sustainable. According to Ms. Schulick:

Our most recent launch of a fish oil product is a good example. Fish oil is an important category in our industry. We have always wanted to be a part of it and we have waited a very long time to do that because it took time to find a product that we felt was truly sustainable. We use a wild Alaskan salmon source for our fish oil. It is truly one of the only sustainable options on the planet.

As noted previously, Ms. Newmark described the support of the organization in terms of sustainable practices, making the job of eco-expense reduction and conservation an easy task. Ms. Newmark noted, "I have the support of the organization, so for me it is easy to follow through on the initiatives of recyclability and sustainability."

Interview participants expressed the strength of the commitment to sustainability as something that makes the company distinctive. According to Ms. Newmark, "I think New Chapter really takes it a step further, which I embrace and I think it is the right thing to do. The fact that New Chapter is willing to do that and make the effort is important, because there is a cost involved in being overly eco-friendly beyond what is easily available or cost efficient." Ms.

Schulick described a sense of unique commitment to the environment in terms of the company's place in nature and the resultant culture that understands the organizational commitment to this concept.

We are not just a single species operating independently; we are just one of millions of species who share this planet Earth. It is a reminder every day that we are working on behalf of all these species and [company leadership] make every decision based on the planet that we share with all creatures. We are connected to nature and in every decision we make are reminded of our impact on the Earth and whom we are representing and working for. Not just the healing of other humans, but also the healing of our planet, and all of the species that reside here. We all have equal value.

Ms. Newmark agreed that this type of ideology and culture stems from the company leadership at the top level. Ms. Newmark stated, "Yes, it's part of our culture. It is built in...I think culture, in my experience, always comes from the top down. As long as our CEO and Founders lead with those principles, then our senior management has to implement those beliefs and policies as part of their daily job."

In addition to this sense of global responsibility, the interview participants offered insight into the inner workings of the company, revealing a team-centered, family-type of atmosphere within the organization, with all employees taking ownership and responsibility for the company and its actions. According to Ms. Schulick, "There is a family feeling at New Chapter that we hold dear. The company has grown in a way that people feel like they are a part of a community. It is something we have worked hard to maintain and will continue to keep no matter how big we get." Ms. Newmark also provided an example of the sense of ownership and pride in New Chapter:

Yesterday, an employee who had an issue with our water purification systems stopped me in the hallway. Most of our purification systems are plastic free, but there is still one left with a plastic bottle. This employee wanted to let me know it was still there and that we should fix it. I think there is a sense of company ownership that people have here at New Chapter. Another example is that we have an office compost program where everything is composted or recycled. Our paper and our food scraps are all collected, and sent to a farm to be composted. Some of our employees made the signs themselves they got so excited over the program. It shows our employees are moving initiatives forward. We do not have an official 'Green Team' but there is a lot of excitement about sustainability and in the building, people will talk when they feel we are not making the right choice.

C. Eco-Redesign

A few common themes emerged from the data within this category, which included (a) the recycling efforts of the company, (b) retrofitting their building for LEED, and (c) finding sources of raw materials that ensure pure organics. The variety of invariant constituents provided by the interview participant data is provided in Table 5C (Appendix F).

The category of Eco-Redesign included specifics in terms of the recycling efforts, retrofitting the building to meet LEED standards, and the commitment to the true organic nature of the resources used to develop New Chapter products. Ms. Newmark and Mr. Miodonski specifically noted the recycling efforts. "We just completed a first audit for 2009 of our carbon footprint, which includes quarterly waste audits that we do and 87% of all materials get composted, or recycled" (Ms. Newmark).

We bring in many raw materials to manufacture our products that come packed in boxes, so we recycle many boxes. Last month, recyclability of materials coming into the building was 93%. As a new employee, I got a lesson on how to use my trashcan. The larger part is for recyclable material and the other smaller receptacle is for non-recyclable material. (Mr. Miodonski)

In terms of LEED, interview participants described the retrofitting of the current building. “We just retrofitted another building two doors down using environmentally friendly materials. We are trying to use recycled furniture, we have used cork flooring that is eco-friendly, ceiling tiles that are eco-friendly and only use VOC-free paint. Across the board, we take an eco-friendly approach” (Ms. Newmark). “We are putting up new lights, we use the nontoxic paints, [and] we use the good flooring when we do make improvements” (Mr. Miodonski).

Interview participants mentioned the sourcing of raw materials, several times. Ensuring the quality and sustainability of these resources is important to New Chapter.

Our trip to India helped to find out where our plant materials come from. How they are grown and treated. How the farmers are treated; including other aspects that affect the raw materials. Our goal is to have a pure organic, using organic fertilizers rather than man made. We will have to return to India, and plan a trip to China. There are many different efforts to get this figured out (Ms. Newmark)

D. Eco-Tracking

A single common theme emerged from the data related to Life Cycle Assessments, supply sources and waste generated in the New Chapter manufacturing process. The variety of invariant constituents is provided in Table 5D (Appendix F). Because the variety of responses to Eco-Tracking was diverse, the only common statement with regard to this category is that of the use of Life Cycle Assessments. “We do life cycle analysis on our products from extraction to store. We also did life cycle analysis of our glass manufacturer, which is part of our reporting systems” (Mr. Miodonski).

I try to keep it simple. So sometimes, these big statements do not ring so much with me, but the intent of what I'm trying to accomplish is not only supplied raw materials with brokers. Our goal is to figure out where the raw materials are coming from and how they are grown to ensure controls are in place. The things having lifecycles are glass and cardboard, which we have discussed already. To talk to that particular issue is to say what we are assessing is the eco-friendliness and the ability of our supply chain to supply us with materials that meet all the criteria that you would expect from a company that espouse our values...The inputs that we require we want recycled. We want recyclable materials when possible. That is why we did not move to plastic. Glass is expensive and heavy, but is recyclable. (Ms. Newmark) Other areas I focus on include how we package and what we package in, and how that affects our carbon footprint. For example, I work with a company that has done a baseline of our carbon impacts according to the Global Reporting Initiative (GRI) standards, we have decided to focus on Scope 1 and Scope 2 and there is a whole method to how you track and value your footprint in terms of carbon. We do not have much air pollution based on our manufacturing processes. Our waste generation is low and we do not use much water in our process so those are not issues. Energy use we know specifically and we try to limit it. (Ms. Newmark)

E. Eco-Advantage Mindset

Common statements among the interviews participants; included similar perceptions of the CEO commitment, the continuous and consistent commitment to eco-sustainability, which runs throughout the company, from the top down. The variety of invariant constituents related to this thematic category is provided in Table 5E (Appendix F). The leadership commitment is critical to the company culture and attitude. In this case, the leadership seems to demonstrate a strong and consistent commitment to sustainability. This was exemplified by the words of the interview participants. "I would say the commitment level of senior management is very high" (Ms. Schulick). "Our leadership is the reason that we have a culture of sustainability. It is directed from the top down. I do not think you can effectively do my job without buy-in from leadership, but in our case it is

more than buy in. They are the heart and soul of our environmental and healing missions on both the people and the planet side” (Mr. Miodonski).

I think culture in my experience always comes from the top down. As long as our CEO and our founders lead with those principles, then our senior management has to implement those beliefs and policies as part of their daily job...It is much easier for me to say we cannot do that when I have the support of the organization. Therefore, for me it is easy to follow through on the initiatives of recyclability and sustainability. (Ms. Newmark)

Although mentioned by only one interview participant, the notion of foregoing profit in order to ensure sustainable practice truly highlights the New Chapter commitment, which centered on the commitment of the leadership.

There are times when you forego profit in order to do the right thing. Many products are very lucrative opportunities that we just say no we are not going there. If they are not sustainable, we just say no. To have that kind of commitment is a real thing and it is important to put it out there and let people know. That is why our aspiration and ideals are so important. (Ms. Schulick)

F. Triple Bottom Line

The thematic category revealed common responses among the interview participants, but highlighted many different ways in which the company addresses and acts according to the Triple Bottom Line. Table 5F (Appendix F) provides the variety of participant responses within this thematic category and the associated frequencies.

Interview participants also provided insight into the company vision in terms of social responsibility and the Triple Bottom Line. According to Ms. Schulick, “We do not make any decision without considering the people, planet and profit aspects. I guess what I want to put out there is what any company knows: it is not easy.” Mr. Miodonski concurred, “It is just kind of a basic understanding of how we do business, but I would say our innovation is based on

health first. We will not make any decisions on products or movement without deeply factoring in its environmental impact. We will do no harm. It is encumbered upon us to come up with the matrix of what that means.” Mr.

Miodonski noted:

We recognized our supply chain was not working right and we fixed it. This is a step in the right direction to work directly with the farmers in India while using our relationships to build schools and hospitals to help the local communities. That is something we did not do in the pharmaceutical business. We have a different culture here at New Chapter with sustainability expectations built into it. We assimilate it into our thinking. At times, economically it may not be such a good idea, but we talk about the pros and cons. New Chapter is trying to do the right thing and sometimes that means we incur higher costs as a result. We have 200 people working at New Chapter that we have to take care of as well... we are plugged into it (sustainability) very closely. (Mr. Miodonski)

With particular interest in corporate social responsibility, the interview participants shed light on several aspects of the company that ensure corporate social responsibility. Ms. Schulick stated, “We take responsibility for our impact on society and the environment. One area where I place a focus is on our community culture, as well as the contributions we make to the Brattleboro, Vermont area and other communities. I’d say that for intent, we are a 100%, because we are focusing so intently in this area.” The company was described as doing as well as possible to improve the circumstances of everyone. For example, Ms. Newmark stated, “We are trying to do as much as we can and improve wherever possible.” This notion includes environmental protection:

That is more our commitment to sustainable agriculture and the protection of endangered plant species and has a lot to do with our work at our farm in Costa Rica and in the neighboring rain forest. We have a mission for producing additional seed sanctuaries throughout the world. We have a seed sanctuary at our farm, where we protect endangered species of the rainforest. (Ms. Newmark)

Summary of Findings

Through the analysis of the interview data, providing invariant constituents related to each thematic category, several overarching themes were revealed, which represent the overall commonalities of the perceptions and experiences of the senior management specific to the categories of the Eco-Sustainability Conceptual Framework. The following themes represent the common responses of the interview participants from New Chapter:

Theme 1: Recycling efforts and building retrofitting are responses to the care and commitment of the organization to sustainability and their respect for Mother Nature.

Theme 2: Life Cycle Assessments enable the identification from source to product of any weak links

Theme 3: CEO and leadership provide positive contribution to the overall organizational culture and ownership over the commitment to sustainability

Theme 4: A focus is on doing as much as possible to improve wherever possible, in addition to improving the lives of farmers who serve as global suppliers for the company.

Theme 5: The Company does not make decisions without first considering and striving to improve people, planet, and profit. Corporate Social Responsibility is strong.

Interviews with New Chapter senior management provided insight into the vision and commitments of the company. The analysis of three interviews with

senior management professionals at the company revealed a leadership and company culture centered on the importance and value of nature. The analysis of each of the three interviews revealed five themes that served to provide an understanding of a company focused on sustainable practice and the positive attitude of the interview participants, and ownership of any problem stemming from a trickle down from the company leadership.

The themes provide insight into the essence of the mentality and activities of the company that serve to support eco-sustainability. Recycling and reuse efforts were felt to stem from a respect for Mother Nature and her resources. Thus, the use of Life Cycle Assessments enabled this, providing information on their supply chain and any areas in need of improvement. The company leadership supports the culture and commitment to sustainability, with a company focus on the positive effect of the company across many dynamics, down to the quality of life of the farmers, who are supplying the company and serving this global market. The mindset and culture of the company support contemplative action in which decisions are made with consideration of the effects on and improvements for people, planet, as well as profits.

CHAPTER 6

HITCHINER MANUFACTURING

RESEARCH CASE STUDY

As a multinational corporation, Hitchiner Manufacturing Company is the premier supplier of metal castings in hundreds of different alloys for a broad spectrum of global markets and customers that include leaders in the automotive and aerospace industries. Hitchiner Manufacturing Company's North American Operations include four manufacturing facilities: the Ferrous-USA Division and the Gas Turbine Division, located in New Hampshire, USA; the Ferrous-Mexico Division, located in Santiago Tianguistenco, Mexico, and Hitchiner Manufacturing Company de Mexico, located in San Luis Potosi, Mexico. Metal Casting Technology, Inc. (MCT) is a Hitchiner Manufacturing-General Motors Corporation joint venture, research and development center located in Milford, NH that supports all of their divisions. Hitchiner Manufacturing Company's exclusive countergravity casting technique, pioneered in the 1970s, is one of the most significant process advancements in casting technology. At 66 years old, Hitchiner Manufacturing is the second oldest case study company to offer insight into the use of the Eco-Sustainability Conceptual Framework and Eco-Scorecard. Upon arrival at Hitchiner Manufacturing, the first interview meeting took place with Mr Morison, who had expressed an interest in being part of this research study, which lead to their involvement as a case study. Each of the interview participants was extremely generous with their time. In total, we spent a full day on site getting to know the Hitchiner Manufacturing Company.

Company Overview

Hitchiner Manufacturing, founded in 1946, is a privately held company with its headquarters located in Milford, New Hampshire. The company produces castings in more than 160 different alloys for a broad spectrum of domestic and offshore markets that include a significant portion of the automotive, golf, military, and aerospace industries. The company is a supplier of complete-to-print, high-volume, full-service commercial investment castings. It leads the industry for highest unit-volume production, shortest lead times, and reduced inventories. The company designed and built the first mechanized investment casting plant using automated shell-building equipment and conveyor systems. Hitchiner Manufacturing introduced mechanized melting and pouring of metal and is the first investment casting firm to use large-size, induction melting furnaces and automated aluminum dies for wax patterns.

Ferrous Operations consists of two manufacturing plants located in Milford and Littleton, New Hampshire. At the centre of Ferrous Operations are the Automated Casting Facility, a 90,000 plus square-foot plant that employs some of the most advanced automation known to the industry. Combined with new manufacturing methods and the power of a distinguished team focused on customer needs makes Hitchiner Manufacturing's complete-to-print countergravity casting more competitive than the alternative, lower cost, but less advantageous processes, such as sand casting, forging, stamping, and fabricating.

The Milford, New Hampshire location is the main production facility for the primary products involving wax injection, pattern assembly, incorporating shell building, casting, and heat-treat operations. Hitchiner Manufacturing workers in Littleton, New

Hampshire provide medium-to-high volume machining and finishing. State-of-the-art high volume machining equipment enables Hitchiner Manufacturing to supply castings machined to print and sub-assembled, when specified.

The Ferrous Division produces parts in a wide array of sizes and configurations with primary sales in the automotive, diesel, and military markets. Leading programs are the automotive rocker arm, rocker arm shaft assembly, and intermediate lever programs in high-volume production for General Motors, Daimler-Chrysler, Volkswagen, and BMW. Additional products include commercial diesel engine turbocharger wheels for industry leaders BorgWarner and Honeywell Garrett.

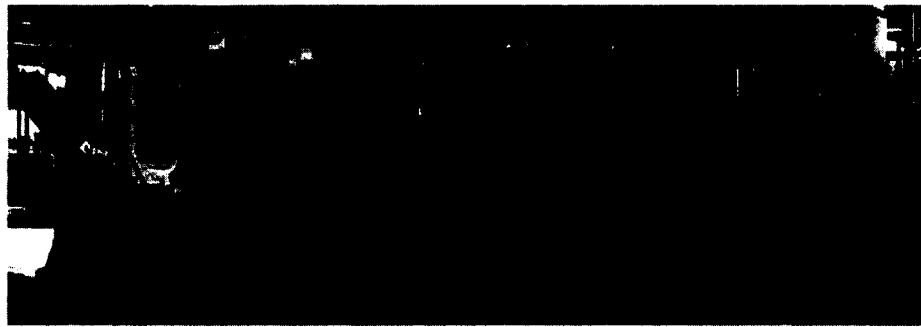


Figure 12. Countergravity Casting at Ferrous Operations in Milford, New Hampshire (Photo Courtesy of Hitchiner Manufacturing Company)

Company History

When A. Fred Hitchiner Manufacturing worked for the War Production Board during World War II, he saw the successful application of a technology rooted in a 5,000-year-old process known as investment casting, commonly referred to as the *cire perdue* or *lost-wax* method of casting. During World War II, investment casting provided a shortcut for producing near-net-shape precision parts and allowed for the use of specialized alloys that could not be shaped by alternative methods. This investment casting process was applied to production of the first blades for jet engines.

After the war, Mr. Hitchiner was among those who wanted to capitalize on the precision, design freedom, and near-net-shape results of investment casting technology. In 1946, he bought a small brass foundry in Long Island, New York and then relocated it to a less expensive site at the Amoskeag Millyards in Manchester, New Hampshire. Unfortunately, for Mr. Hitchiner, the state was no longer a highly industrialized area and suffered from a faltering economy and low employment. By 1948, unable to cope with these unstable conditions, Mr. Hitchiner had to sell his business or recruit a strong investor.

Meanwhile, in 1947 George Abbot Morison had retired to the family farm in Peterborough, New Hampshire. Concerned about the dismal condition of New Hampshire's manufacturing economy, he resolved to revitalize the dying industrial base and create jobs. After hearing about Fred Hitchiner's company, Mr. Morison was intrigued by the potential of investment casting for commercial use and in 1949, he put up 50% of the purchase price for the foundry and his son, John H. Morison, paid the other half and became president of the company, which continues to operate under its original name. According to the company's history published in the *Casting Granite into Gold (Casting Granite)*, Morison asked Hitchiner to stay on with the company based on his extensive knowledge and experience with investment casting technology.

Once Fred Hitchiner was able to focus on sales and marketing, development of the solid-mold investment casting process quickly began to contribute to the growth of New Hampshire's economy and to creating jobs. By April 1950, sales reached an annual rate of \$250,000 and Hitchiner Manufacturing broke even. The large number of orders brought on by the Korean War pushed the company's facilities to capacity and in 1951,

the company, along with its 50 employees moved to a newly constructed plant in Milford, New Hampshire.

As the leader of a highly educated and trained workforce, Mr. Morison emphasized the need for expertise in many disciplines, from basic literacy and mathematics to statistical process control, and offered apprenticeships in specialized technical fields and business management seminars. In 1953, Hitchiner Manufacturing was one of the first companies to implement the Scanlon Plan, which gave employees a stake in the company. During the 1950s, Hitchiner Manufacturing products included castings for sporting firearms, electric motors, electrical connectors, and aircraft components.

In 1994, Nicholas Babich, President & CEO retired from Hitchiner Manufacturing. His long-range strategy and organizational development initiatives had established the company's evolving strengths on growth paths for the 1990s and beyond. His successor, John H. Morison III reaffirmed the company's long held tradition of integrity-based leadership by launching a continuing ethics-training program for all employees, agents, and suppliers. According to Morison III, quoted in *Casting Granite*, "The foundation for [Hitchiner Manufacturing's] success has been the creation of innovative technology, superior quality and service, and, perhaps most of all, the integrity with which this company conducts its affairs." Currently, John Morison III serves as the Chairman of the company.

More than a decade into the twenty-first century, Hitchiner Manufacturing has established its leadership in foundry technology and positioned itself as the foremost global supplier of commercial investment castings. The company is ready to maintain

its premier rank by continuing to realize the promise implied in its motto, “Imagination in Metallurgy,” and an industry leader in environmental sustainability.

The Hitchiner Manufacturing website (<http://www.hitchiner.com/>) describes the company as a lean, nimble organization united to live the values of their principles and deliver the highest service and product value. The depth of knowledge, experience, and perspective of their corporate, sales and marketing, research and development, engineering, and operations personnel is an exceptional match to their customers’ objectives. Their “Living Values” demonstrate a culture that embraces a commitment to sustainability. Interview participants discussed these living values as part of our interview, which include the following:

We respect the Earth. We spur sustainability. Responding to tomorrow’s urgency today, we enhance our policies and practices continuously to ensure the good health and safety of all persons, creatures, ecosystems, and communities we touch. We fulfil the environmental requirements of local, state, national, and international authorities. We are coloring casting green.

We embrace responsibility. We take responsibility. We recognize our actions have an effect upon ourselves, and all others with whom we come into contact. We are stepping up.

We act in good faith. We deal in truth. We conduct our relationships with an open mind. We base our decisions and actions on the best and most complete information and analysis available. All of our transactions strike a just balance between what is offered and what is received. We are building trust.

We nurture achievement. We seek the most diligent talent. For every job, we provide the freedom, education, and training needed to implement new ideas, apply knowledge, and practice skills. In an environment that encourages initiative, fosters teamwork, recognizes effort, and rewards success, we offer equal opportunity and fair compensation for all. We are making leaders.

We deliver quality and value. We exceed expectations. Our market depth, rapid-response capability, competitive pricing, and high-quality products and services set ever-rising standards of value. We are striving for excellence.

We advance the art. We challenge the status quo for every goal, objective, and task we set for ourselves. The aggressive development of better processes, systems, equipment, and ways of working is an essential and constant element of all our endeavours. We are pushing the limits.

We are good citizens. We contribute. Through robust personal engagement and financial support of government, civic, and charitable organizations, we promote the welfare of a global society and the communities in which we live and work. We are making a difference.

We honor the law. We do not compromise. We follow the laws and regulations of the countries, states, or provinces, and localities in which Hitchiner Manufacturing operates. This commitment is absolute. We are working right.

We guard our integrity. We make good on our word. We affirm our leadership through vigilant adherence to the principles, ever mindful that they are the basic elements of personal, professional, and commercial growth and achievement. We are leading by example. (<http://www.hitchiner.com/>)



Figure 13. Finishing Department at Mexico Operations
(Photo Courtesy of Hitchiner Manufacturing)

Individual Interview Narratives

The following selected responses from the interview data collected provide an in-depth look at the interviews with each individual participant. The data provide examples in support of the themes identified during the analysis. As noted, interview data were collected from three senior representatives from Hitchiner Manufacturing.

Interview with Mr. John H. Morison III, Chairman

Mr. John H. Morison III, Chairman holds a senior leadership position having worked in various departments as a manager since 1983. He confirmed that “a goal of Hitchiner Manufacturing is to produce profits, protect the environment and improve the lives of its stakeholders, and we do that through various ways,” which is consistent with the research definition of a sustainable enterprise (A-1). He stated:

We are different from most companies in that we do not have a product that we produce, we have a process that is what we offer to our customers. The process fortunately is one that in and of itself is capable of reclaiming the products of other people, particularly in terms of the metals we reprocess and reuse for most products. The exception is with the aerospace specifications that do not allow for that in many cases. With that exception, everything else is recyclable from the alloy perspective. In addition, certain parts of the process that we use to get to the finished product before melting the metal can be recycled. Therefore, the greater the amounts of recycling we do help protect the environment since we do not have to go back and get raw materials at the source.

Hitchiner Manufacturing is committed to ever-higher environmental standards in its own operations and supply chain and recently introduced a new exclusive innovative process into production for the first time (in 2010), called the several layer investment casting (SLIC) process. The SLIC has the potential to slash mold-heating energy use over 87% and cut shell material use by 70%. It took about eight years, according to Mr Morison, to develop SLIC, which is a hybrid process that originated from their Research & Development in combination with collaborative work with General Motors (B-4).

When rating Hitchiner Manufacturing as operating within the carrying capacity of the Earth (A-2), Mr. Morison felt any manufacturing company would have trouble answering this question in a positive way, due to the type of materials used in their process that are extracted from the Earth and energy (fossil fuel) they consume. He explained:

In pure terms, if we were to interpret ideal vs. actual we are not doing well at all because we do take more out than we put back. I suppose it is like the idea of the true cost of any product. We probably do not give ourselves credit enough for the savings that we afford other people by incorporating our products into their products. I think a lot about the advantages that we have and summarize it in that we do not make cars, but we make cars more efficient. We do not make gas turbine engines, but our parts make gas turbine engines more efficient. If we give ourselves credit for that, then maybe we are ok in terms of the carrying capacity. If you look at this literally, unless you are really giving back and creating environmental advantages that offset what you take out, you are not operating within the carrying capacity. That is why I say very few manufacturing companies are.

The discussion around how very few companies operate within the carrying capacity of the Earth addressed several aspects of business impacts on the environment and why reducing their ecological footprint including their supply chain is important. This affects companies whether they manufacture a product or process such as Hitchiner

Manufacturing. According to Mr. Morison:

Energy studies conducted in 2009 are benefitting the company with a reduced carbon footprint and cost-savings. Management realizes there is a lot we can do and are moving forward in making further energy improvements. After operating using manufacturing techniques for over 50 years, it took a combination of courage and innovation to make changes, which started as 'low hanging fruit' and are resulting in significant cost savings. If you can get them [employees] to understand the true costs they are saving over the long run, [and that it] is going to improve their bonuses in the future, then they might be willing to go along with it. In some cases, they may not have any choice, but there is a certain amount of passive resistance unless you can make it clear this is something that is going to set us up to be more competitive in the future.

Cost savings on raw materials turns out to be a primary innovation driver that carries secondary ecological benefits (B-4). Mr. Morison explained:

It was how can we come up with a process that uses less metal, less shell material, less wax, and costs us less so that we can be more competitive. There was nothing altruistic or environmental about it at the time. As we drove toward the process that allows us to do that, we started to see advantages, way beyond the material savings that drove the initial investigations that resulted in the process. In the case of ore process and metals, if you can use scrap, you can use it forever; you do not need to go back to the environment. I think there is going to be some shifts in the way raw materials are looked at and for ways to take advantage of that in the future.

The company website page, titled “Green Design Matters,” states how fuel-efficient, low-emissions technologies provide a green path into the future for aerospace, defense, automotive, and industrial gas turbine design. Global pressure for these technologies means providing high-performance lightweight components made quickly, cost-effectively, and in the right volume to keep products in customers’ supply chains. According to Mr Morison, from design to application, Hitchiner Manufacturing-made parts meet the green challenge better, faster, and in the most optimal volumes than any other manufacturing method on the planet.

In the air and on the ground, Hitchiner Manufacturing's exclusive countergravity investment casting process is uniquely qualified to take you farther and faster using less. Unlike sheet metal fabrication and other methods, Hitchiner Manufacturing’s processes produce high-performance, lightweight, thin-wall parts with no design compromises. With walls as thin as 0.38 mm (0.015 inch), or as thick as 15.24 mm (6 inch), components can be cast to almost any shape and complexity of design in a wide range of stainless steel and reactive metal alloys, including titanium. The result is light-weight, strong components that function reliably and cleanly in the tortuous high-temperature environments of increasingly fuel-efficient aerospace, defense, automotive, and industrial gas turbine applications.

In providing the Hitchiner Manufacturing processes, Mr. Morison acknowledged concerns over resource scarcity issues related to iron ore and petroleum reserves. Interestingly, these issues are addressed in a family-run business by each generation due to changes in the way raw materials are secured and effectively used. He said; “You can argue [that] what is really driving this [innovation] is that we are looking for a future

competitive advantage today, in order to be in a much better position when energy costs increase; then we will have a real competitive advantage.”

When asked if making decisions for the long-term is part of their culture (E-18), Mr. Morison confirmed there is an advantage if you are a privately owned company where you can look at the long-term, along with having the right managers in place that can implement the decisions made. “We are really fortunate now because we have people who understand the manufacturing process and the technical advantages that we have and are willing to make the investments required.” For example:

One of the goals I gave myself for the company was to become a zero discharge company (stretch goal). Getting anyone to think that was a good idea in 1998, was almost impossible because it cost money and even though it was a profitable year, nobody was willing to look at the need to reinvest. We did not have the right managers at all levels of the business to get it to work. Maintenance and Facilities were the areas that took us the longest to switch. It was not until three years ago when a new Facilities Manager (Keith Tuthill) took over was it possible. He was very methodical about conducting a skills-analysis of the maintenance staff. Through that process, he was able to reduce the total number of staff from 62 to less than 20. Now, we probably have the cleanest, best running plant we have ever had. That gives you an idea of the sort of scale of what is doable, but it is all management practice within the company itself. You almost have to go through each department such as sales, engineering, and manufacturing until you get that on all levels. This company is not going to move forward if one department holds us back. We have been fortunate because we have been able to move this [process] forward since 2005.

Another innovation focus discussed by Mr. Morison was on future market needs, such as solar collectors and turbo chargers. He noted:

For the next 20 to 30 years, we will still have internal combustion engines to give us opportunities. The ability and the success in driving innovation lies solely in the people you have and how you organize and manage them. If you have the mindset and everybody is operating as active participants in the culture, then it will work. Getting everybody to have the mindset whether it is innovation for the environment or innovation for the process is the challenge. For example, we have a R&D facility, which is where one might think your innovation comes from. For years, even before 1986, which is when we formally entered into the arrangement with General Motors it operated as a separate entity. The perception was stereotypical of the Research & Development geeks who are over there doing their thing and they never made anything

that worked and we've got monuments to all of these things they did that didn't work and yet they still get all of the money.

Here is an interesting dynamic of culture, mindset, and leadership related to innovation. According to Schein (2010), a company's sub-culture is where problems in teamwork can occur due to having people from different occupations, with different objectives and cultures, all interacting. Views tend to be quite strong and can influence a company's macro-culture. Because culture is the product of learning, and like the personality of the company, changing culture is possible, but must usually do with thoughtful persistence (Schein, 2010). Perhaps it took a strong leader, a boundary spanner that created a cultural island as Schein referred to in addressing the different occupational sub-cultures of R&D and Production. Perhaps this applies to the different departments at Hitchiner Manufacturing about their views toward innovation and sustainability, which contribute to the company culture. On the Hitchiner Manufacturing Eco-Scorecard, the element of Eco-Advantage Mindset had the highest percentage score of 13.33 (83%), followed by Eco-Redesign with 12.17 (76%).

Interview with Mr. Keith Tuthill, Facilities Manager, USA

Mr. Keith Tuthill, Facilities Manager, USA, started working at Hitchiner Manufacturing straight out of technical school, working his way through the company for 15 years until he went to work for a competitor. Eventually he went on to work for a second foundry manufacturer, and when Hitchiner Manufacturing learned of his move, the company reached out to recruit him back. Now in his third year back at Hitchiner Manufacturing, he is held in high esteem for his management skills and proven abilities at energy reduction and cost savings, according to the other interviewees. Originally, from Milford, New Hampshire, he decided to return, noting:

I think Hitchiner Manufacturing is going through a cultural change. One of the changes is a higher value placed on the employees (E-18), coupled with a management commitment, which is one of the reasons why I came back to Hitchiner. I could see the difference in the culture and the effort put forth, where they care about the employees, by putting more effort into their training and awareness. For example, all of my staff is going through training to improve fundamental skills to aggregate promotions within their labor grades. As their skill levels improve, they are making a positive impact, whether it is for the environment or the operation of the business, since they are more knowledgeable. They know that if they do not fix these air leaks, it is going to cost us money. By educating the workforce, our skill levels are improved.”

When meeting with Mr. Tuthill, he shared a PowerPoint presentation showing how Hitchiner Manufacturing tracks all of their energy use, measured against every 100 molds (castings) produced, compared to energy costs (D-11-14). He stated, “The reason why we chose cost per 100 molds is that it is a constant. Whether our demand is 3,000 or 5,000 our measurement is per 100 molds; that’s our standard.”

Tracking these results began in 2009 using several metrics. The Eco-Tracking extended to waste streams, energy use, and energy reduction projects as a priority initiated by senior leadership (D-12). According to Mr. Tuthill,

A lot of it has to do with economic reasons, for cost savings and then of course the environmental issues. We use an ethyl silicone based slurry material which is oil based. One of the big discussions in 2009 and moving forward is how to change our process over to water based slurry. This will economically reduce our waste stream costs and environmentally, it is what we call *going green* due to eliminating the volatile chemicals used in the process. We went after many of the “low hanging fruit” the obvious issues that were easiest to deal with in the short term. We have replaced the old style, big baluster style bulbs with more energy efficient bulbs. Since Hitchiner Manufacturing runs 24 hours a day almost 7 days, a week the need for lights is almost constant. We had two major projects where we replaced all the old lighting with more efficient lighting, and we received rebates from Public Service of New Hampshire for our energy conservation projects.

The Eco-Tracking (E) percentage scores were the third highest in Year 2 (2010).

In the Mexico facility, we have installed skylights everywhere to make use of the natural light during the day. They do not even turn on their lights and it is very effective. We do many different projects for cost savings focused on energy reduction,

which reduces our carbon footprint and increases the profit margin within our organization. In addition, we are looking at different ways to utilize the water pumped throughout the facility as a heat source. This year we are driving hard to recover waste energy, waste heat and waste material. What impresses me the most is the commitment from senior management to go after these energy reduction initiatives, the management team is committed to creating a better work environment as well.”

When asked about the use of stretch goals (B-4), Mr. Tuthill confirmed their use for profitability, in addition to other metrics measuring safety, quality, productivity, and utilization. Utilization is the efficient use of resources whether they are energy, equipment, raw materials or labor. It turns out labor and energy (natural gas) has the highest costs. Hitchiner Manufacturing achieves its green goals with a continuous improvement strategy, continuous energy conservation, operations efficiencies, and process improvements. All operation sites have dramatically reduced pollutant emissions, energy and material usage. Hitchiner Manufacturing implements this strategy using 5S to manage Kaizen, lean manufacturing and other management techniques.

The objective of Kaizen include eliminating waste or activities that add cost but not value, and providing just-in-time delivery, production load leveling of amount and types, standardized work, paced moving lines and right-sized equipment. Kaizen takes processes, systems, products, and services apart then rebuilds them. The 5S Principles in Manufacturing Management (Sort, Set Order, Sanitize, Standardization and Sustain), is based on five Japanese expressions of these principles for maintaining an effective and efficient workplace in the manufacturing and production. The 5S also refers to a structured methodology of using these principles as the basis for continuous improvement in the workplace. The terms are:

1. Seiri (Sort) aims at eliminating everything that makes the workplace cluttered, and is not required for the job being performed.

2. Seiton (Set Order or Organize) refers to the efficient placement, arrangement, organization and scheduling of the equipment and material.
3. Seison (Sanitize or Sweep & Shine) refers to maintenance of tidiness and cleanliness in the workplace.
4. Seiketsu (Standardization) refers to an ongoing, standardized and continually improving Seiri, Seiton and Seison.
5. Shitsuke (Sustain) accounts for the discipline with leadership, involvement of people, and integration into the performance measurement system.

In discussing the role of innovation (B-4) at Hitchiner Manufacturing, Mr. Tuthill was most proud of their countergravity investment casting process saying, "I have had exposure on both sides of countergravity vs. conventional pouring. The major difference is the material use and the amount of extra effort it takes to process the parts. The countergravity pouring draws the metal up into the mold and a vacuum holds the metal long enough for it to solidify, when the mold is released the whole center sticks." Next, the material drawn up into the mold will drop back into the furnace for melting. Mr. Tuthill has contributed to this process with more recycling efforts (B-3) and the use of closed looped systems (C-8). He explained, "We are always looking at ways to reduce the amount of material put in, whether we use less metal, less shell material, or less wax to create the best yield possible."

We discussed how Hitchiner Manufacturing is helping customers reduce their ecological footprint by using less resource materials in the process by recycling and using closed loop systems (C-7-8). Mr. Tuthill also talked about reclaiming sand and wax:

We send used wax back to the manufacturer for cleaning and have it returned to the Mexico facility for reuse. New projects for 2010 will add more closed loop systems, including heat recovery. In Mexico, we installed a heat exchanger onto the oven exhaust to pre-heat water for the steam generator, thus consuming less natural gas. In New Hampshire, we are looking at different ways to pump the excess hot water all the way around the facility for heat.

Due to all of the closed looped systems, recycling and other conservation efforts, Hitchiner Manufacturing had a cost-savings of \$374,816 in 2009. Many of these efforts included behavioral changes by employees to using an ultra-sonic sensor to detect air leaks from equipment. According to Mr. Tuthill:

What impressed me the most is the commitment from senior management to go after these energy reduction initiatives. They mean to do what is right for the business and what is right for the environment. The management team is committed to going after these things to create a better work environment.

Finally, the last topics discussed dealt with the Triple Bottom Line, interacting with stakeholders (F-19) and Corporate Social Responsibility (F-20). Mr. Tuthill commented, "I think Hitchiner Manufacturing is very responsible and very in tune with our social responsibility. Years ago, we had a company across the street called 'OK Tool' that went out of business and became a superfund site. Hitchiner Manufacturing along with other local companies was instrumental in cleaning the site up." When asked if the company engaged in local community building, Mr. Tuthill replied, "I know Hitchiner Manufacturing does get involved with the local community. In my role, I get involved with the local fire department. We invite them in, give them a plant tour and let them use our facility for training purposes."

Hitchiner Manufacturing's commitment to its local community can be viewed on their website, which describes supporting a wide range of community-based organizations, including the Souhegan Valley Boys and Girls Club, Child and Family Services of New Hampshire, and Rotary Clubs. Contributions to the arts include the Currier Museum of Art (Manchester, NH), Monadnock Music Festival, and opera programs. Hitchiner Manufacturing has also provided over 20 college scholarships.

In addition, conservation and preservation efforts exemplify the Company's community commitment. The 194-acre Hitchiner Town Forest was donated by the company to the Town of Milford, NH, is a highly valued northern New England wild space. In addition to trails for hiking, mountain biking, cross-country skiing, and snowshoeing, the forest provides prime habitat for white-tailed deer, wild turkey, red and grey squirrels, ruffed grouse, weasels, mink, fisher cats, snowshoe rabbit, red fox and porcupine. The variety of forest types and age classes provides a multitude of habitat and edge between two types of ecosystems according to the Town of Milford, NH Conservation Plan. In addition, Hitchiner Manufacturing's 100+ year-old, 70-acre Savage Farm, preserved by an easement for agricultural purposes, is a key resource within the active agriculture component of Milford, New Hampshire.

Interview with Mr Marc Riquelme, Vice President of Sales & Marketing

Mr. Marc Riquelme, Vice President of Sales & Marketing has worked in the industry for over 20 years in Europe and China, which included supervising the development of a new investment- casting foundry in Asia. He has extensive experience in operations, engineering, quality control, sales and marketing. He is also fluent in English, French, and Spanish. Based on his work experience, he brings a multinational perspective to the company that is valued by his co-workers. We began by discussing the company's relationship with its stakeholders in the context of a sustainable enterprise (A-1). Mr. Riquelme shared:

We have put our core values on the Hitchiner Manufacturing website. I think we are working to achieve our goals and we do a lot as a company. Any company needs to make a profit but in the meantime, we look after our employees and we look after our customers. This company was located in Milford, New Hampshire to generate employment because Mr. Morison realized there were not enough job opportunities in the area. This was part of the company's beginning in 1946 and the wisdom.

Perhaps this wisdom was part of creating a sustainable community by providing a source of local employment, which still continues and is a strong attribute of the company.

According to Mr. Riquelme, those values are key and just as important as the community perception of the work performed at Hitchiner Manufacturing.

For this reason, he has been promoting and encouraging people to visit the plant to see what they are doing and how they protect both employees and the environment. Providing tours to people makes Hitchiner Manufacturing's work transparent and communicates their environment, health, and safety priorities (B-6). These company values are in alignment with Mr. Riquelme's professional and personal values, which is why he came to work for Hitchiner Manufacturing, confirming that sustainability does contribute to a company's ability to recruit and retain talent.

Another quality that brought Mr. Riquelme to Hitchiner Manufacturing was their proven record as innovators. According to his assessment, a hallmark innovation of Hitchiner Manufacturing was the countergravity process, which created a far advanced, more efficient process that uses less energy and material (B-3). Other companies use this process under their license in Japan and Canada. In his opinion, "Many companies are stop and go. They do not want to take any risk and they do not want to invest to try something different. Because when you take on new technology that can be good, but sometimes you can fail, innovations are not always guaranteed. That good idea may not generate a financial return."

Another risk addressed by Mr. Riquelme related to the cost of currency. He explained:

In the global market, more and more people see the risk in terms of currency. We seem to swing between the euro and the dollar. When you see market currencies change, there is a production risk with the variation. Local production in the same currency is better. It is not only the cost of transportation; it is the cost of the

currency. The variability due to the currency favors local markets vs. global market since a currency can vary by 20-30%.

Mr. Riquelme spoke of innovation as an investment in the future, and as a way Hitchiner Manufacturing has differentiated itself, giving the company a competitive advantage (B-4). He discussed another innovation recently launched with the SLIC process discussed earlier. The SLIC process is even more efficient in terms of the cost drivers of energy usage and materials that reduces material usage and our carbon footprint (A-2). Hitchiner Manufacturing's ability to produce difficult designs with waste reductions of 30% to 40% differentiates them in the marketplace. When clients in the aerospace, defense, and automobile industries seek higher fuel efficiency, Hitchiner Manufacturing's process can achieve this goal. These reductions are achieved through recycling materials (B-4), closed-loop systems (C-8), and innovative technology (B-4), thus giving Hitchiner Manufacturing a competitive advantage.

When asked if Hitchiner Manufacturing uses stretch goals for innovation and ecological sustainability (B-4), Mr. Riquelme replied:

In terms of innovation, the answer is yes. In terms of ecological sustainability, we do not have a single goal, except for energy conservation. As a member of the senior leadership team, we discuss progress in these areas at our monthly meetings. We have some action plans and targets for pollution prevention and energy conservation. We call it energy conservation instead of ecological sustainability. In addition, cost reduction means recycling and finding energy solutions. For instance, we are recycling materials taken back from the customer.

Next, we discussed Eco-Tracking activities such as Life Cycle Assessments (D-11), supply chain audits (D-11), tracking inputs and outputs, materials database (D-13), and environmental management systems (D-14). Hitchiner Manufacturing is not conducting Life Cycle Assessments, which makes sense, since they are different from most companies in that they do not produce a product, instead they provide a process to

customers. When it comes to supply chain audits, Mr. Riquelme noted, "Doing an audit is something we need to do for improvement on conservation with our own packaging and to reduce the packaging from suppliers. Right now the packaging is either used or disposed of, so I would rate us at 2 to 2.5 (50% to 62%) on supply chain audits."

In terms of tracking a core set of environmental indicators, and inputs/outputs, Hitchiner Manufacturing utilizes an extensive materials database since they work in a highly controlled environment in order to meet element specifications for clients. They use a spectrometer for quality control and only elements with a certificate from their surveyor. In addition, they have strict rules and regulations to follow with respect to the use of elements such as nickel, chromium, aluminum, cobalt, and iron.

When asked about environmental health and safety practices (D-14), Mr. Riquelme shared, "Actually, we are doing more than what Occupational Safety and Health Administration (OSHA) requests of us. We value our employees and do not want to put them at risk. Our target is zero. We do not want an accident or our people injured, so we are making sure employees get the right training and equipment to ensure their safety." An advantage Hitchiner Manufacturing has over competitors is their International Organization for Standardization (ISO) 14001:2004 certification at their Mexico facility, and management is considering it for their New Hampshire sites. Mr. Riquelme does not foresee needing any additional work done in the plants; it is just a matter of paperwork. This certification is especially important to clients in Europe and others requiring suppliers to be environmentally sustainable (low carbon footprint). Mr. Riquelme commented, "ISO 14001 is common in Europe. More and more customers in Europe ask you about it. I have never had a question from any of our U.S. customers. In

Europe, some people decide whether to work for a particular company based on ISO 14001 and if a company does not have ISO 14001, people will simply not do business with you.”

We concluded the interview with Mr. Riquelme giving Hitchiner Manufacturing a rating of 3 to 3.5 (75% to 88%) on Triple Bottom Line (F-19) and Corporate Social Responsibility activities (F-20). In closing, he stated:

We are not using the term Triple Bottom Line, but I think our approach is probably quite close to its concept in applying a sustainability lens to our company. It is a balancing activity and we have a long-term view not just for the short term. We need to achieve long-term targets not just month to month. I used to work for a company whose only interest was on how much money we made. Hitchiner Manufacturing has a different approach, a long-term focus and to be part of this community.

Eco-Scorecard Results

The results of the participant evaluations on the Eco-Scorecard were compiled and presented on the following Eco-Scorecard. The ratings offered by participants were converted to percentages, as noted in the methodology.

Hitchiner Manufacturing Eco-Scorecard Results

A.	Key Performance Indicators for Sustainable Enterprise	Baseline 2008	Year 1 2009	Year 2 2010
1.	A sustainable enterprise is one that produces profits, while protecting and restoring the environment, and improving the lives of the stakeholders with whom it interacts.	56%	66%	75%
2.	Company operates within the carrying capacity of the Earth.	69%	71%	79%
	SUB-TOTAL	63%	69%	77%
B.	Key Performance Indicators for an Eco-Culture			
3.	Eco-expense reduction to cut environmental costs by not wasting natural resources and by avoiding regulatory burdens due to pollution or waste disposal.	62%	71%	79%
4.	Company uses Stretch Goals as a driver for innovation and eco-sustainability. *Company applies a sustainability lens to getting things done.	50%	63%	66%
5.	CEO and Senior Management have a commitment for sustainable practices and environmental stewardship. *Money and incentives tied to eco-accomplishments. *An environmental ethos reflected in the mission/vision/values.	50%	58%	75%
6.	Storytelling of the eco-successes and lessons learned in CSR/Sustainability/EHS Reports. *Eco-training, a form of knowledge sharing which contributes to innovation is available. *Jobs titles reflect responsibility for sustainability.	50%	50%	50%
	SUB-TOTAL	53%	60%	68%
C.	Key Performance Indicators for Eco-Redesign			
7.	Utilizes Design for the Environment (DfE) to help customers reduce their ecological footprints and designs out environmental problems. *Company understands the environmental market drivers.	69%	71%	79%
8.	Use of Closed-loop Systems	69%	75%	83%
9.	Green Building and LEED Certification, *Retrofitting existing buildings for energy efficiency.	56%	66%	75%
10.	Supply Chain Audits	50%	58%	66%
	SUB-TOTAL	61%	68%	76%
D.	Key Performance Indicators for Eco-Tracking			
11.	Company uses Life Cycle Assessments to measure ecological footprints and understand environmental impacts and ecological consequences of the products/processes along the value chain. *Supply chain adjustments.	56%	54%	58%
12.	Develop a Core Set of Environmental Indicators that track energy use, water and air pollution, waste generation and compliance. *Data/Metrics of Inputs and Outputs are used.	63%	83%	83%
13.	Establish a Materials Database to determine what is in your products or connected to your processes.	63%	75%	75%
14.	Environmental Management Systems (EMS) for environmental and risk assessment or *Environment, Health & Safety practices.	69%	83%	75%
	SUB-TOTAL	63%	74%	73%
E.	Key Performance Indicators for Eco-Advantage Mindset (Genesis/Organic Process)			
15.	CEO's Commitment to Sustainability and Environmental Strategy – top down support. *Doing the right thing that reflects values do matter within the organization.	56%	71%	83%
16.	Company is using a sustainability lens to ID new opportunities. *Company is placing a focus on Innovation.	69%	79%	88%
17.	Company establishes dialogue with both friends and foes. *SME engages in local community building. *SME is involved with Stakeholder engagement and eco-activities.	75%	83%	83%
18.	Leadership makes decisions with the long-term in mind for a tighter regulatory framework, rising customer expectations and market realignment driven by natural constraints. *SME places a value on higher employee retention, stronger customer loyalty and higher brand value. *Leadership looks at the whole value chain from raw materials to suppliers who meet customers' environmental needs, to product end of life.	62%	71%	79%
	SUB-TOTAL	66%	76%	83%
F.	Key Performance Indicators for the Triple Bottom Line (TBL)			
19.	The Triple Bottom Line Approach, which encompasses sustainability as the intersection of economic, social and environmental performance is used.	62%	66%	75%
20.	Corporate Social Responsibility (CSR) is a concept whereby organizations take responsibility for their impact on society and the environment.	80%	79%	83%
	SUB-TOTAL	72%	73%	79%
TOTAL SCORE		62%	70%	76%

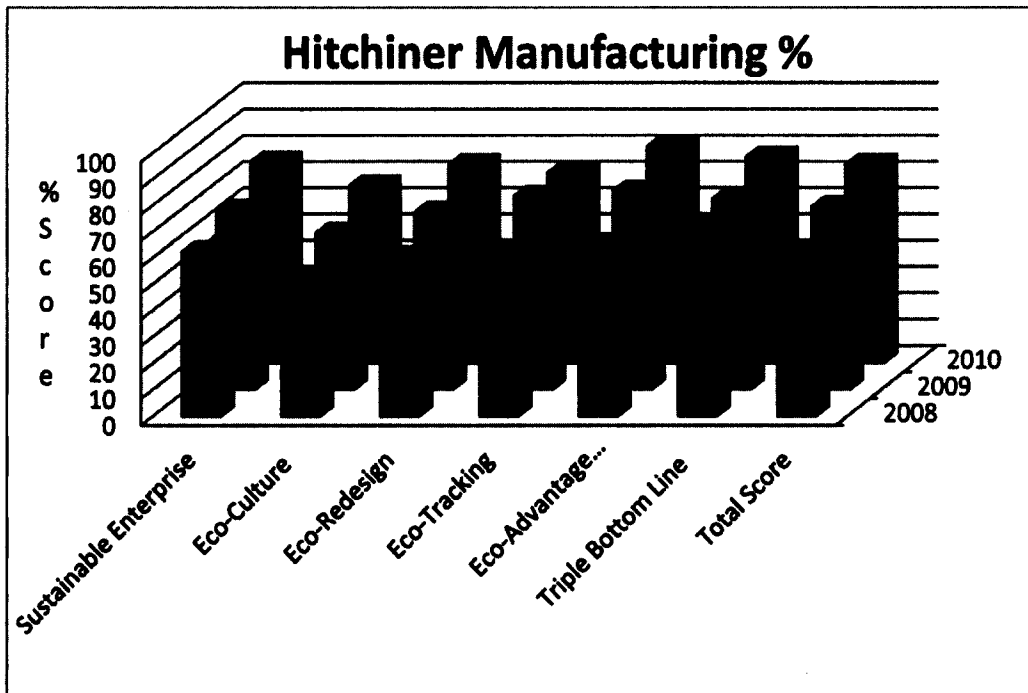


Figure 14. Hitchiner Manufacturing Scorecard Percentage Scores

Analysis of Interview Data

Qualitative analysis of the three Hitchiner Manufacturing transcribed interviews was used to identify themes as they relate to the Eco-Sustainability Conceptual Framework and Eco-Scorecard. The key invariant constituents are provided in Table 6-1 as they relate to the Eco-Sustainability Conceptual Framework. Tables' 6A-6F in the Appendix G represents the full variety of interview participant responses, inclusive of the single responses, used in the cross-case analysis in Chapter 9.

Table 6-1

Key Invariant Constituents of the Eco-Sustainability Conceptual Framework by Category: Hitchiner Manufacturing

Invariant Constituent	# participants to offer this experience (n=3)
<i>A. Key Performance Indicators for Sustainable Enterprise</i>	
Recycling and reuse of raw materials/ shift focus on reuse	3
Company striving to reduce carbon footprint	2
Growth and development along with innovation and improvement	2
<i>B. Key Performance Indicators for an Eco-Culture</i>	
Recycling rather than use of raw materials	2
Leadership commitment to sustainable practices of recycling materials/ production waste & environmental and energy use reduction	2
Cost reduction by innovative energy use, tracking, & recycling/ Targets for pollution and energy conservation/ focus on and innovation in energy reduction processes	2
Stretch goals for innovation in sustainability and profitability	2
<i>C. Key Performance Indicators for Eco-Redesign</i>	
Fuel transfer for more economical vehicles and less fuel use	2
Closed loop system reclaiming wax	2
Closed loop system for air emissions/ air meds	2
Replaced old lighting with more efficient	2
Water cooling and heating for reuse elsewhere and plans for more heat recovery	2
<i>D. Key Performance Indicators for Eco-Tracking</i>	
Track materials use, costs, and wastes, including energy use, water, air pollution, waste generation, and compliance	2
Materials database	2
Castings can be melted down and reverted to virgin material/ get rebirth, recycled material every time it is melted down	2
Health, environmental and safety practices/ Environmental and risk management: Going beyond OSHA requirements; value employees and	2

Invariant Constituent	# participants to offer this experience (n=3)
do not want to put them at risk	
<i>E. Key Performance Indicators for Eco-Advantage Mindset</i>	
Management team very committed to sustainability, which is a big part of the company	2
Company values employee retention and customer loyalty	2
<i>F. Key Performance Indicators for the Triple Bottom Line (TBL)</i>	
Involvement with local community	2

A. Sustainable Enterprise

Within this theme, interview participants offered several different elements, representing the company's performance indicators for sustainable enterprise. Common elements among interview participant perceptions included (a) the company is striving to reduce the carbon footprint (2 of 3 participants), (b) growth and development linked to innovation for improvement (2 of 3 participants), and (c) recycling rather than use of raw materials (2 of 3 participants). In addition to these commonly mentioned characteristics among the interview participants, they offered insights into this thematic category, which included shared personal and company values, a balance between caring for employees and customers, a competitive advantage in sustainable practices, mission, company goal of producing profits and protecting environment, creating sustainability in the local environment, cost saving and energy reduction working together. Table 6A (Appendix G) provides the variety of invariant constituents mentioned by interview participants within this theme and the associated frequency of occurrence among the three participants.

Interview participants commonly noted the eco-sustainability indicators of recycling and reuse of raw materials, the company is striving to reduce its carbon footprint, with growth and development stemming from innovation and improvement. All three of the interview participants noted the importance of recycling and reuse for the company in terms of both cost savings and less impact on the environment in the form of raw materials. For example:

The greater amount of recycling that we do helps us protect the environment because we do not actually have to go back and get raw materials at the source, which for the alloys would be going to do binning which by nature, is somewhat disruptive. That part of the process helps allow for minimal damage to the environment. We are always looking for ways to improve the process, by which we mean improve the material use efficiency. We have been quite successful in doing that. This gives us a competitive advantage with our competitors. Because of that competitive advantage, we find that we can go in at market prices that are higher and generate a profit level that is at least compatible with the industry norm and in some cases higher. Therefore, sustainable practices help us with our profitability. People are beginning to say let us look at doing this a different way. If you can come up with an alternative as in the case of ore process and metals, if you can use scrap, you can use it forever; you do not need to go back to the environment. I think there is going to be some shifts in the way raw materials are viewed and how we find ways to take advantage of that. (Mr. Morison)

We use three materials to make our product: wax, shell material, silicone, and alloy. In other companies, the sand used for making the models is traditionally only used once. In Mexico, we recycle all the sand and have specific agreements to do it that way. (Mr. Riquelme)

Through this commitment to recycling and reuse, interview participants specifically addressed how the company is striving to reduce its carbon footprint.

We monitor air emissions since Hitchiner Manufacturing is audited to make sure we are not discharging any bad air. We do return air, so any air that is let out can be return back to the facility. We pilot different projects at our Mexico plant, for example, we put together a heat exchanger and burn out a stack so the exhaust that emits from the oven is very hot, well over 600 degrees. We take that heat, and recover the heat back into the facility for pre-heating water for a machine that would ultimately use more natural gas to heat the water. We actually use this waste heat to reheat. (Mr. Tuthill)

Mr. Morison noted, “The more expensive or more precious resources become, the more it becomes a driver for innovation for us (effective use/reuse of resources). We grew up in a resource rich environment where there was no incentive to do anything else because the resources would always be there. That is no longer the case due to declining resources.”

According to interview participants, growth and development of the company has been fueled by their strong innovation. From the very beginning of the company to their counter gravity process; “One of the main processes is called counter gravity... a far advanced more efficient process. This process uses less energy and material” (Mr. Riquelme). This growth is attributed to sustainable practices with regard to material use and associated cost reductions that allowed for greater profitability. According to Mr. Tuthill, “We review the cost of doing business with how much material we use. How can we reduce the amount of material that we use in our process? The other one is how much is natural gas costing us. How much is electricity costing the company? What are the ways that we can go after those energy cost reductions?”

B. Eco-Culture

Several key elements emerged from the analysis of the interview data related to this thematic category. Table 6B (Appendix G) illustrates the variety of responses given by the Hitchiner Manufacturing interview participants related to this thematic category, and demonstrates the common invariant constituents of (a) recycling rather than use of raw materials (2 of 3 participants), (b) leadership commitment to sustainable practices (2 of 3 participants), (c) cost reductions through innovation in energy reductions (2 of 3 participants), and (d) stretch goals for innovation and profitability (2 of 3 participants).

In regard, to the Eco-Culture, the interview participants reiterated and maintained a focus on reuse and recycling, as was mentioned in the eco-sustainability section. This company-wide commitment to eco-sustainability stems from the leadership's commitment to sustainability. Mr. Tuthill and Mr. Riquelme described the culture stressing the importance of reuse/recycling and the link to innovation:

We have found alternative uses for our sand waste. We will use what we call backing up our mulch, so we do not have to put so many layers of slurry and sand on it. We have been able to reduce the amount of layers of material that we put on the product, backing them up with this reused sand. We have developed many different innovations. Now we are to the point where how do we drive that to the next level. We are doing those things now so how do we get better at what we do in the future. How do we make our quality better? How do we get rid of or reduce the amount of waste that we have? This year is the year that we are concentrating on those types of things to bring it to the next level. (Mr. Tuthill)

We have some action plans and we have targets for pollution prevention and energy conservation. We do not call it eco-sustainability; we call it energy conservation. In addition, cost reduction means recycling or finding alternative solutions. For instance, we are recycling materials back from the customers. (Mr. Riquelme)

Interview participants also described the tracking of energy and materials use:

We are continuously tracking our efforts. We track total energy, which is all of the facilities combined; we also break it down to each facility to ACF, gas turbine and our Littleton facility. We track our energy costs... This year we are working on all of our projects to create more energy savings. So we had compressed air, we had dust collectors, the air mixers were changed to electric mixers, we shut down rooftop exhaust blowers, re-wired some of our compressors and air dryers, repaired compressed air leaks, heat recovery, and recycling the dryers. Therefore, we have quite a list to go after and we continually add this list. (Mr. Tuthill)

This type of commitment to reducing energy, material use and waste reduction is developed through a company mindset and culture of environmental sustainability that stems from leadership. According to Mr. Riquelme, "First, innovation has been part of this company for a long time and that is a key differentiation compared to some of our competitors." Mr. Tuthill noted the commitment of the management team, "I would say

our management team is very committed.” Finally, Mr. Morison tied these thoughts together by saying:

They work hand in hand. If you have the mindset and everybody is operating as active participants in the culture, then it will work. Getting everybody to have the mindset whether it is innovation for the environment or innovation for the process is the challenge.

C. Eco-Redesign

A few common themes emerged from the data within this category, which included fuel transfer for more economical vehicles as well as closed loop systems for the reclaiming of wax and for air emissions, replacing old lighting with efficient lighting, and water heating and cooling for reuse elsewhere. The variety of invariant constituents provided by the interview participant data is provided in Table 6C (Appendix G), with key constituents listed in Table 6-1. The concepts of Eco-Redesign commonly shared by interview participants primarily include specifics in terms of the redesigns used to support eco-sustainability practices, such as closed loop systems, for greater efficiency.

For example, on fuel transfer Mr. Tuthill explained:

We do a lot of work between automotive and aerospace. For the automotive side, we do fuel transfer, more economical vehicle, less fuel usage, different rocker arm designs for smoother operating engines. Same thing in aerospace for different types of fuel trains delivering fuel to engines. Hitchiner Manufacturing is involved in many of those different designs. (Mr. Tuthill)

As Hitchiner Manufacturing has been able to increase energy and resource efficiency, the company has been able to pass these efficiencies on to their customers in reducing their carbon footprints as well.

Actually, we are processing to be more efficient in terms of material and energy usage and we are designing the product with customers to reduce the material usage for their own product. We can offer something different to our customer because we can offer very difficult designs with a more efficient manufacturing process as compared to an older, less efficient process. (Mr. Riquelme)

Mr. Tuthill described some of the energy saving, closed loop processes:

We have identified several projects [in the U.S.]. The first one is to duplicate what Mexico did only we have a steam generator that can take exhaust heat and use it to reheat its own water. We are going to install heat-exchanging equipment to pre-heat that water using its own exhaust. That is a good source of heat recovery. The other projects we have, is with ovens that we use fresh combustion air. It takes outside air and it mixes it through a nozzle for creating a good combustion with natural gas. The problem with that is the outside air is cooler air so we're going to take and recirculate it through our combustion air, pre-heat it so when it goes through the burner nozzle it'll already be pre-heated and it won't take as much effort to get the BTUs out of that unit that we need... We take our spent wax, we send it back to the manufacturer, and what they will do is clean it and then send it to our Mexico facility for reuse. Years ago, we used to use water to cool our equipment, any machines that needed cooling. Now we use closed loop systems for cooling that equipment. Another closed loop system, is when we use water savers, where we recycle the water we need instead of running fresh water through the equipment and down the drain.

In addition, two interview participants noted the project involving the replacement of old lighting. "Yes, we have been doing a lot of work especially in lighting. At our plants in the U.S. and Mexico, we have been replacing the old lights with more efficient lighting. There has been some motion sensors installed as well" (Mr. Riquelme). Mr. Tuthill stated, "We have had two major projects where we have replaced all the old lighting to a more efficient lighting. We have actually gotten rebates from Public Service of New Hampshire for energy conservation"

D. Eco-Tracking

Themes emerged from the data related to tracking materials use, costs, and wastes; use of a materials database; strong environmental and risk management practices; and recycling material for reuse. The variety of invariant constituents is provided in Table 6D (Appendix G) with key invariant constituents noted in Table 6-1. The company conducts Life Cycle Assessment of sorts with the castings. According to Mr. Tuthill, "Any of our castings, when they become unusable, they can be recycled into metal

castings. It can be melted down and reverted into virgin material. We do not have any castings going into landfills.” However, Mr. Tuthill could not say if the tracking of materials, costs, and wastes was actually assessed or not. He stated, “I know from a business point of view we track our material use, material costs, and our material waste. Therefore, we track that, but as it relates to the life cycle analysis, maybe not?”

When asked about Hitchiner Manufacturing’s materials database, Mr. Riquelme noted the use of such a database, “We have all the details about any materials. We are working in a very controlled environment. We test all of material... In addition, we are checking our material for trace elements when we have a very strict specification from a customer. There is a lot of control of the material coming in.” Finally, in terms of health, environment, and safety concerns, Mr. Riquelme noted that the company truly goes beyond what is required. He stated, “Actually, we are doing more than what Occupational Safety and Health Administration (OSHA) requests of us. We value our employees and we do not want to put our employees at risk.”

E. Eco-Advantage Mindset

A single common invariant constituent was noted among the Hitchiner Manufacturing interview participants, with two participants describing the commitment of the senior management team, in contributing to the company mindset. The variety of invariant constituents related to this thematic category is provided in Table 6E (Appendix G) with key common invariant constituents given in Table 6-1. In terms of the Eco-Advantage Mindset, the company leadership at Hitchiner Manufacturing is dedicated to environmental sustainability. According to Mr. Tuthill:

What impresses me the most is the commitment from the senior management to go after these energy reduction initiatives. In addition, to going after what they mean to;

it is the right thing to do. What is right for the business and what is right for the environment. The management team is committed to going after those things to create a better work environment as well.

When asked if he thought that the leadership looks at the whole value chain from raw materials to suppliers to meet customer's environmental needs, Mr. Tuthill answered, "Definitely yes, especially at the different levels of the organization." The company leadership and its commitment to energy reduction and environmental sustainability practices come from a long history and tradition of innovation. According to Mr. Riquelme, "Some of the old slogans were *imagination technology*, meaning trying not to take everything for granted and trying to do it better. That has been part of this company." Two participants also shared opinions of the value placed on employee retention and customer loyalty. Mr. Riquelme expounded on the reason for this commitment to customers by stating; "We have to plan the work with the customer, we are more and more working with the customer to get more material coming back to us, and if we are scraping the material, we can give them a better price."

Mr. Riquelme also noted the importance of these reductions and recycling of materials to their competitiveness in the market. He stated:

In the past, the competition came from U.S. and European companies. Now we are more and more in competition with China and India. It has been enough for us but in another 10 to 15 years, we need to use a different technique for our processes to make a differentiation. We are competing with Chinese labor and in our industry; labor is a huge cost driver. This means we need to offset the costs while finding innovative ways to reduce the cost of energy and the materials we use. That is the only way for us to stay in the market.

F. Triple Bottom Line

The thematic category revealed a single invariant constituent common among two of the interview participants, which highlighted the involvement with the local

community. Table 6F (Appendix G) provides the variety of participant responses within this thematic category and the associated frequencies. “Although the terminology may be different, this describes the approach to our business,” Mr. Riquelme stated, “We are not using the term Triple Bottom Line but I think our approach is probably quite close to its concept and that is probably something we can use to put some sort of measurement in place to be sure we are.”

The interview participants confirmed that Hitchiner Manufacturing is involved in the local community and concerned about the image they are presenting. According to Mr. Tuthill and Mr. Riquelme:

I know Hitchiner Manufacturing does get involved in the local community. In my role, I get involved with the local fire department. We invite them in, give them a tour, and let them use our facility for training purposes. At our training center, we invite the local community to different events. I know that our Director of Procurement is in the Chamber of Commerce and participates in many Chamber activities that go on. Our Human Resources group is involved in some community partnerships as well. (Mr. Tuthill)

This Company is involved with other local organizations. Being involved in Girl Scouts and doing a lot of things for helping the local communities such as building up the Arts in Manchester through contributions our company is giving back a lot of money to its communities. (Mr. Riquelme)

In terms of the company’s own environmental impact on the local community, Hitchiner Manufacturing seems to be sensitive to that impact. Mr. Tuthill stated:

I know we always try to make sure our grounds are clean to represent our company. That any of our storm water runoff meets with the regulations. We test it, sample it and inspect it. Anything that can come off the property, we want to know what the impact would be so we make sure we monitor all of these different areas.

Finally, Mr. Riquelme provided insight into the culture at Hitchiner Manufacturing that promotes forward thinking and investing in the future, not solely profit for today.

As employees, we work responsibly. It is not just making profit for profit sake. It is about innovation and investing in our future. It is a balancing activity and we have a

long-term view not just short term. We need to achieve long-range targets, not just month to month. I used to work for a company whose only interest was how much money they made. Hitchiner Manufacturing has a different approach and that is something to work with and to be part of this community.

Summary of Findings and Conclusions

Through the analysis of the interview data providing invariant constituents related to each thematic category, several overarching themes were revealed, which represent overall commonalities of the perceptions and experiences of the Senior Management participants specific to the elements of the Eco-Sustainability Conceptual Framework. The following themes represent a summary of the common responses of interview participants from Hitchiner Manufacturing:

Theme 1: A company-wide commitment to sustainable practices of recycling, reuse, and reduction in waste, energy, and environmental impact to reduce their carbon footprint and reduce energy and materials costs.

Theme 2: Focus on innovation and improvement, closed loop systems, tracking, and environmental and safety risk management to promote further growth and development and a better work environment with the use of stretch goals for innovation in sustainability and profitability.

For Hitchiner Manufacturing to remain a global competitor, it must reduce costs to compete with countries like China. The company's commitment to sustainable practices is not only commendable; it is advantageous in the global market. Innovation in recycling and reuse of materials, closed loop systems, and energy reduction, have enabled Hitchiner Manufacturing to reduce costs while preserving natural resources, becoming a leader in sustainable practices as well as given the company a competitive advantage.

Analysis of the three interviews revealed a company and culture concerned with eco-sustainability practices that reduce, reuse, and recycle material, using innovation to improve cost savings and reduce the company's carbon footprint. The three interviews provide insight into a company less focused on immediate profits and more focused on the long-term health of the company as well as the environment. Community involvement and eco-sustainability and innovation, particularly within the energy reduction sector, have provided a market for Hitchiner Manufacturing as a sustainable enterprise leader, and global competitor.

CHAPTER 7

MONADNOCK PAPER MILLS

RESEARCH CASE STUDY

Monadnock Paper Mills manufactures premium, high performance papers with headquarters in Bennington, New Hampshire. The company is located on the banks of the Contoocook River, which provides hydro-energy to the company. Monadnock Paper Mills' niche market focus is on sustainable product design and manufacturing, value-added product performance, and customer satisfaction for a broad base of global clients. Unlike other large land-holding paper mills, Monadnock Paper Mills does not own forestland used in the production of pulp. They only utilize pulp from third party-certified suppliers. Monadnock Paper Mills is the oldest of the case study companies in this study; at 193 years-old, the company offers unique insight into the compatibility of the Eco-Sustainability Conceptual Framework and Eco-Scorecard for reaching conclusions in Chapter 10.

Company Overview

The mission statement of Monadnock Paper Mills states:

To meet the needs of our global customers with high performance papers for the printing, packaging, and technical specialty markets. We support our mission with the continuous rapid development of new value-added products, high levels of customer service and continuous operational improvement. We accomplish our mission with an uncompromising commitment to the health of our employees, the environment and the communities in which we operate.

Throughout its history, Monadnock Paper Mills has upheld environmental stewardship as a core belief, demonstrated by their numerous achievements, awards, and

acknowledgement as an industry leader. However, as principle and as stated on their website, “We just don’t do it for awards and recognition. We do it because we live here. We do it because we raise our families here. And, we do it because we would like to leave our beautiful area of New Hampshire as pristine as we found it nearly two centuries ago” (www.mpm.com).

This company, recognized by the State of New Hampshire, the New Hampshire Businesses for Social Responsibility, and the Sierra Club, among others for their sustainable practices, is also involved in supporting local community arts and culture. Monadnock Paper Mills has certification in the International Organization for Standardization (ISO), ISO 14001:2004 for Environmental Management Systems and ISO 9001:2001 Quality Management Systems and is looking into using the ISO 26000: for Guidance on Social Responsibility. The company is an Environmental Protection Agency (EPA) Climate Leader (Monadnock Paper Mills was one of the first New Hampshire company taking part in this program), which has helped organizations nationwide reduce their greenhouse gas emissions since 2002-2010, EPA Performance Track Company, SmartWay Transport Partner, EPA Green Power Partner, and EPA Environmental Merit Award winner. Monadnock Paper Mills’ other awards include:

- Forest Stewardship Council Certified (SW-COC-001160)
- WasteWise Partner
- New Hampshire Governor's Award for Pollution Prevention
- New Hampshire Businesses for Social Responsibility Cornerstone Award
- Greenerpalooza Award 2010
- Business New Hampshire Magazine Lean and Green Award

The Corporate Environmental Policy of the company, found on their website, states that Monadnock Paper Mills is committed to responsible stewardship of the environment by;

- Promoting environmental awareness among employees and local residents
- Maintaining our record of compliance with environmental regulations and standards
- Continuing to invest in research to determine innovative ways to reduce waste and efficiently use natural resources
- Using environmentally friendly materials during the design and development of new products
- Encouraging legislators and state officials to develop sound environmental policies and regulations
- Continual improvements geared at reducing environmental impacts and pollution prevention identified in our Environmental Management System.

In the brochure, titled *The Monadnock Paper Mills Environmental Commitment*, and on their website (www.mpm.com) the following eight standards serve as explanations of how the company delivers on each:

1. All Monadnock's graphic arts printing and packaging papers are made with 100% renewable electric energy.
2. All Monadnock graphic arts printing and packaging papers are manufactured carbon neutral.
3. Monadnock is the only premium uncoated text and cover paper mill in the United States with a certified ISO 14001:2004 Environmental Management System.
4. All Monadnock recycled papers are Forest Stewardship Council certified.
5. Monadnock only buys pulp from suppliers who prove the pulp was sourced responsibly.
6. Monadnock continuously reduces the amount of resources it consumes in manufacturing even as its production increases.
7. Monadnock's solid waste is recycled and reclaimed for uses that "green" the environment.
8. All Monadnock's papers are process chlorine free.

On the back of this six-panel brochure and on the company website is a timeline of significant Monadnock Paper Mills environmental achievements along with national environmental milestones. It is a testament to the leadership and commitment shown by the company.

Company History

The year was 1819, when a small paper mill began on the banks of the Contoocook River in New Hampshire. Nationally, the 'Panic of 1819,' the first major currency financial crisis in the United States had occurred. The causes of the 'Panic of 1819' largely originated within the U.S. economy unlike earlier financial crises. This event marked the end of the U.S. economic expansion following the War of 1812 and ushered in new financial policies that would shape future economic development. Having experienced the 2008-2009 Great Recession, one can appreciate surviving such turbulent times in starting a new business venture in 1819.

According to the company's history recorded in The Newcomer Society's *Over the Years with Monadnock*, in 1782 Joseph Putnam was the first of several New Englanders who established businesses near the Great Falls of the Contoocook River. Putnam bought 100 acres of land for £85, and built a grist and sawmill at the falls. As new settlers arrived and set up small industries, the mill became the center of a thriving village, known as Putnam's Mills. Putnam and family members operated the mill until 1819, when Moody Butler acquired it. Although the main business of the mill had been to grind corn and saw logs, Butler saw the possibility for another use, the making of paper. The main ingredients for this venture were readily available: an abundant supply of flax from the neighboring farms; a plentiful amount of pure, clear mountain water from the Great Falls of the Contoocook River, and an available workforce made up of a majority of women to work in the mill.

After the Revolution (1775–1783), King George had cut off the supply of British-made paper, making American-made paper in great demand in the United States. In

addition, during the War of 1812, Great Britain's embargo on British goods made paper an even scarcer commodity. Taking advantage of a ready supply of flax and abundant water from the Great Falls, Butler began to make paper by hand. The papermaking process was a simple one, the pulp was prepared by beating and boiling the fibers of the flax in vats. Then a thin deposit of the wet pulp was poured into a screen-bottomed tray and shaken until an even sheet of drained pulp formed. Next, the sheet was placed between layers of felt, pressed to exclude the surplus water, then hung and sized.

By 1828, handmade paper was a thriving industry at Putnam's Mills; gradually, flax was replaced by linen rags and eventually by wood pulp. In 1832, the mill buildings were sold to Butler's descendant, John W. Flagg. Flagg erected new mill buildings and installed the latest papermaking machinery, including fourdrinier papermaking machines. These machines (named after their British developers, Sealy and Henry Fourdrinier) produced paper in a continuous strip or roll. It was to Flagg's credit that his mill was probably the first of the paper mills to use machines to make paper. Flagg ran a growing business for the manufacture of writing and blank-book papers. In 1872, the area known as Putnam's Mills became the town of Bennington, and the name of the paper-manufacturing company became Bennington Paper Mills.

During the Civil War, the paper business was slow and uncertain. After going through the hands of several short-term owners, in 1870 the Bennington Paper Mills became the property of William T. Barker. Barker bought new machinery, completely rebuilt and enlarged the mill, and hired additional employees. It was also during this time that railroad routes extended into Bennington and pioneers were streaming into the area.

The market for paper had greatly expanded and the Bennington Paper Mills, pioneers of the paper industry, shared in the prosperity.

In 1880, the Bennington Paper Mills became the Monadnock Paper Mills and continued to use wood pulp to make bond, ledger, and book papers. In 1900, a young Arthur J. Pierce came to Bennington to work at the mill and learn the paper business. After Barker's sudden death in 1903, Colonel Pierce (as he was known) bought the mill and became the sole owner. Pierce constructed a new brick building, which still houses the systems for stock preparations, and two fourdrinier machines. He installed every available new improvement for manufacturing paper, continued the production of writing and book papers, and expanded the range of bond and ledger papers. Colonel Pierce bought the balance of the dams and water rights along the Contoocook River and operated the paper mill efficiently until the late 1920s.

The Great Depression of the 1930s, the devastating 1938 flood, the near impossibility of obtaining equipment and replacement parts during World War II and, especially the Colonel's declining health in his last years, all combined to reduce Monadnock Paper Mills' operating efficiency and profitability from 1933 to the time of Colonel Pierce's death in 1948. In the absence of heirs, Gilbert Verney bought the Monadnock Paper Mills and immediately assessed the situation. The plant, like many other small paper mills in northern New England, had not continually modernized their equipment or operating strategy, thus making the mill no longer competitive with larger mills operating larger and faster paper machines. The mill itself was in extremely poor condition, staffing was at a minimum, little marketing existed and there were virtually no quality controls in place. Gilbert Verney realized that only a full-time operation could

justify the high fixed costs of the mill and assure its economic health. In early 1949, he put a No. 2 Machine in operation and ordered basic repairs made to the mill and converted the power plant from coal to oil. Revival of the company was obviously on the way when the Republic of China requested a large order for currency paper with regular shipments to China on a monthly basis.

Soon, however, the Korean War caused shortages and high prices for raw materials. To keep operating, the mill used kraft waste (wood pulp prepared with a sodium sulfate solution) to make kraft wrapping paper. After the Korean War, it became apparent that the market for bond paper was quickly declining. New papermaking skills had to be learnt to adapt to the change from letterpress to offset printing. Moreover, Verney remained keenly aware that the survival of the mill depended on further specialization and the development of greater technical expertise to serve special segments of the market. To this end, beginning in 1956 and for the next ten years, both paper machines were rebuilt and during each summer vacation shutdown of two weeks were scheduled and a major installation was accomplished.

First, the steam-turbine paper-machine drives were added, which increased speeds and gave better controls; then the company installed refining equipment, including new reels, winders, screens, and improved save-alls (devices that operated on the principle of sedimentation, flotation, and filtration to recover most of the fiber and filler). Another important installation was of Accuray equipment on each machine. In 1967, Monadnock was the first non-integrated mill (i.e., a mill that does not produce its own pulp) to install beta-scanning gauges. This equipment, later made even more efficient through microcomputer technology, allowed for close control of the basis weight, the moisture

level, and the sizing pickup on each paper machine and caliper. This gave the machine operator a basis for making more timely production changes. By the late 1960s, the majority of the paper machines and most of the stock-processing equipment had been replaced. Quality offset and opaque papers had been developed and refined. Furthermore, premium text papers and high strength book covers, top-of-the-line uncoated printing papers used for the finest printing projects such as annual reports, advertising brochures, had been added to the mill's product mix.

Gilbert Verney pursued his conviction that only continuous development of new products to serve special segments of the paper market could assure Monadnock's longevity. By the mid-1960s, the mill had gained a major market segment in the medical industry, supplying sterilized medical papers for packaging medical devices.

Monadnock's technicians also had been exploring the possibility of producing filter media for vacuum cleaners bags. Traditionally, vacuum filter paper had been made from rope fiber, but the mill's technologists believed that the paper also could be made from wood fiber. After two years of lab work and tests, representing the investment of thousands of dollars, an acceptable product was made for the Electrolux Company. In the following years, Monadnock also manufactured specialized filter paper for the Hoover Company and remained a major supplier of this product for a long time. In addition, the mill began producing strippable wallpaper, as well as tape and label papers.

During the 1970s, Gilbert Verney's sons, Richard and Geoffrey, joined the organization and that decade was one of continued progress and expansion. At that time, the main thrust of the mill's efforts was for ever-higher quality levels of paper for the graphic arts and the broadening of technical abilities in the specialty field. Monadnock

became particularly skilled in the area of special chemical additions and latex saturation. Embossed book covers and specially saturated wallpapers were developed. Monadnock was now a well-established company and recognized as having the highest reputation in its field.

As a tribute to his leadership, Gilbert Verney bought a rundown paper mill and, driven by a tedious pursuit of excellence, in 30 years transformed Monadnock Paper Mills into one of the finest small specialty/technical paper mills in the country. Sadly, when Gilbert Verney suddenly died in January 1978, Richard Verney, Gilbert's eldest son, succeeded him as chief executive officer and chairperson of the company. By cultivating new markets and customers, as well as investing in new facilities and equipment, Richard Verney kept Monadnock on its profitable quest for excellence. "We have always taken the position that we want to be in business for the long term," he told Jane Eklund of the *Monadnock Ledger* in 1994, the year of the mill's 175th Anniversary, "and therefore we continuously reinvest." The key to long-term success in such a cash-intensive business, he pointed out, was to put profits back into the business, stay current with technology, and produce a consistently high-quality product. This long-term perspective for investments assured both continued growth of the company and job security for its employees.

From its humble beginnings at the Great Falls of the Contoocook River and throughout its evolution, Monadnock relied on an adequate supply of water, and found ways to protect this natural resource. Process water for manufacturing originally was obtained from the Contoocook River, but by the early 1990s, process water came from wells of a local aquifer. Despite an increase in production tonnage of 40% over the course

of the 1980s, Monadnock reduced its water usage by more than 50%, going from 1,400,000 gallons per day to 650,000 gallons. The mill joined local communities and the New Hampshire Department of Environmental Services to designate the Contoocook River for protection and preservation.

Unlike the large paper corporations, Monadnock does not own vast forestland or process paper directly from wood instead; they purchase wood pulp from pulp mills across the United States and Canada. Thus, the plant does not generate the disagreeable odor produced by some other paper mills. Studies of methods to treat wastewater had begun as early as 1966. Then in 1973, prior to the Environmental Protection Agency's guidelines for effluent treatment, the mill financed the construction of a wastewater treatment facility. For this accomplishment, United Paperworkers International Union, Local #472, presented the ecology flag to Monadnock. The mill also found a way to recycle short paper fiber (a by-product of wastewater treatment) into compost, thus reducing the addition of solid waste to New England landfills and eliminating the transportation costs to take waste to a landfill. Now, the compost is given to local farmers to utilize.

Throughout the 1990s Monadnock continued to produce a portfolio of premium uncoated papers in both virgin fiber and post-consumer, waste-content recycled papers: Astrolite, Astrolite PC100, Dulcet, and Caress. Astrolite, with its high opacity and dimensional stability for maximum contrast and consistent printability, was among the brightest and whitest text and cover papers available. Astrolite PC100 is a 100% recycled paper, the ultimate in recycled paper. The use of post-consumer waste was a legitimate means of alleviating the stream of waste burdening America's landfills. Astrolite PC100

met nearly every specification of its sister-grade Astrolite. The production of Astrolite PC100 is a testament to Monadnock's belief in the value of recycling and to the company's dedication to stewardship of the environment. "For a long, long time, paper has been a medium for ideas. There are other media today, but I think many people feel there is certain permanence to paper. It gives you a feeling of security," Richard Verney said in a 1994 interview reported in the *Monadnock Ledger*. The enduring quality of paper and the sense of security became symbolic of Monadnock Paper Mills' robust endurance during the best and the worst of times and of the job security given employees.

In 1999, Monadnock Non-Wovens (MNW), a subsidiary of Monadnock Paper Mills, Inc. was established in Mount Pocono, PA to manufacture nonwoven material for the filtration, facemask, healthcare, and homeland security markets. With about 50 full time employees, Monadnock Non-Wovens's output capacity is 15 million pounds per year. Eighty-five percent of the company's business is the U.S. market and the remainder serves Europe and Asia.

In 2011, Monadnock Paper Mills continues to set industry standards for the designing of uncoated, natural paper surfaces. The company recognizes that its business success and its employees' security depend upon consistent and prompt delivery of high quality, innovative products and services. Everyone aims for the same goals to meet the needs, and even surpass the expectations, of both internal and external customers. Implementation of this philosophy on all levels has earned Monadnock Paper Mills the position of "one that stands alone," which is the English meaning of the Native American [Algonquin] word "*Monadnock*" that is symbolized by their logo and has put them at the forefront of specialty paper manufacturers. The Verney Family still proudly

owns and operates the Monadnock Paper Mills, which is the oldest continuously running paper mill in the United States, an accomplishment that is a tribute to their economic, social and environmental sustainability.

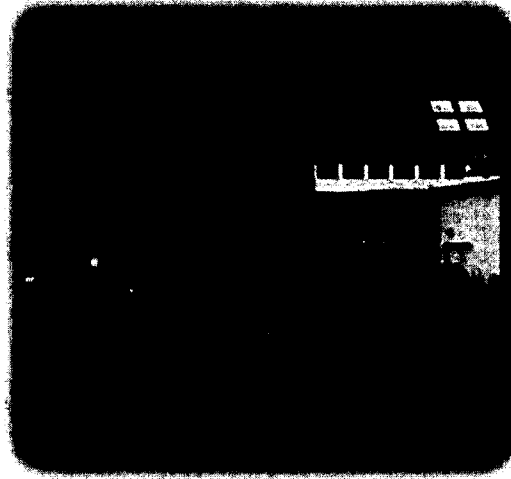


Figure 15. Monadnock Paper Mills, Inc. Headquarters in Bennington, NH
(Photo Courtesy of Monadnock Paper Mills)

Individual Interview Narratives

The following selected responses from the interview data collected provide an in-depth look at the interviews with each individual participant. The data provide examples in support of the themes identified during the analysis. As noted, interview data were collected from three senior representatives from Monadnock Paper Mills.

Interview with Richard G. Verney, Chairman & CEO

Mr. Verney, Chairman and CEO, defined Monadnock Paper Mills as a niche company seeking opportunities not served by larger companies. He stated, “We started an evolution up the ladder of quality within the printing paper industry; survival does a lot to motivate and stimulate innovation. We went from duplicator to offset, into pegs, to book publishing papers, to what we call text and cover papers. They are the highest

quality, uncoated printing papers made in the country.” These papers are used for advertising brochures, annual reports, and high-end publishing needs. One of the company’s early innovations came from choosing a new strategic business direction into specialty papers. This new direction represented a benefit in terms of a new market along with the risk that no one had ever done it before. That decision was the beginning of creating a niche market. They went about developing a technology process to make paper with the strength of hemp without having the string (undesirable part of the fiber) by adding chemical to cellulose fibers to make them stronger and breathable. After several years, a product that not only worked, but also met their standards, was successfully developed and Monadnock Paper Mills garnered a large share of the U.S. market for disposable vacuum cleaner bag paper, until it went offshore.

In discussing the role of innovation at Monadnock Paper Mills, Mr. Verney credited their ability to take risks when appropriate; “It comes from the confidence that we will make this work out, taking what we learn then applying that knowledge in the future. If you are doing something for the right reasons and for a better future, it provides a foundation for successful achievements.” Mr. Verney also addressed how products have cycles that reach a peak then decline or transform into another product. According to Mr. Verney, within these cycles, innovation can occur during phases consisting of start-up, trial and error, application, product, or process life followed by a downturn. Eventually another innovation process will take its place and the cycle repeats itself.

In applying the Eco-Sustainability Conceptual Framework, Mr. Verney focused on the Eco-Culture (B3-6) and Eco-Advantage Mindset (E15-18) categories as sources of innovation, discussing how his leadership role is a critical contributing influence (E15).

Through facilitation and mentoring, he has placed on emphasis on innovation at Monadnock Paper Mills. Mr. Verney has an intuitive ability to envision the future and determine the course the company needs to take in fulfilling their mission, vision and goals. He is willing to sacrifice some short-term gains for long-term security and profitability. When discussing Monadnock Paper Mills' history, Mr. Verney smiled and expressed a sense of pride attached to the legacy and recognition of the importance of giving back to the company's local community.

It is apparent, this quality has helped him, as a leader who anticipates how time brings about changes in which his company must adapt in order to provide sustained value (survive). Mr. Verney said, "I live less than a mile from this plant and I can hear the bell. This is my backyard and I want to take care of it." Longevity and service are important to Monadnock Paper Mills senior leaders as demonstrated by Mr. Verney. This was expressed when his tone warmed and another smile appeared as he shared a couple stories of staff members who had retired with 30 to over 50 years of service to the company, "They all are a part of the Monadnock Paper Mills legacy," Mr. Verney said.

Working within an industry that has historically not done a good job in terms of protecting the environment, Mr. Verney described seizing the opportunity to make a conscientious choice to create a competitive advantage by being an early adopter in complying with anticipated environmental laws and regulations (C-7-10). In early 1980, a compliance and outreach specialist was hired to "run with the program." This resulted in positioning Monadnock Paper Mills ahead of their competitors on the environmental front. Recruiting this person from the State of New Hampshire Department of Environmental Services (DES) aligned the company with DES and focused attention on

Monadnock Paper Mills business operations with a dedicated full-time person responsible for moving the company forward with this program. Mr. Verney has seen a renewed environmental movement today saying, "I think there is a whole new generation that wants everyone to do more (for the environment). Although, I wish they would credit how far we have come from the 1970s to where we are today."

Mr. Verney acknowledged Monadnock Paper Mills is uniquely located on the Contoocook River with forested lands on the outskirts of the mill. He discussed the current process they are going through with the 50-year relicensing of their four dams. They have a permit from the Federal Energy Regulatory Commission to operate their hydropower plant. In a good year, with the right amount of rain, Monadnock Paper Mills can generate 50% of their own electric needs.

One of the ways Monadnock Paper Mills positioned their specialty paper niche with European companies was to become International Organization for Standardization (ISO) 9001 certified. In achieving ISO 9001:2001 certification, they satisfied the vast majority of their customer needs by meeting 90% of the requirements of all the 15 other individual certification programs they were previously pursuing. They went on to attain ISO 14001:2004 as well. As a result, Monadnock Paper Mills has an environmental management system with specific goals and objectives that they measure themselves against on a continuous basis. To date, the company is the only paper mill making the types of products they manufacture in the United States that is ISO 14001:2004 certified, in addition to their paper being Forest Stewardship Council (FSC) certified. This is another example of how Monadnock Paper Mills has differentiated their manufacturing

process in became carbon neutral with their operations. However, Mr. Verney contended that being a good steward of the environment is no longer a differentiator; it is expected.

In reference to Monadnock Paper Mills' Eco-Tracking dimension (D11-D14) we see high scores in this category, which Mr. Verney credits as a source of innovation for ecological sustainability within the company. Implementing the ISO 14001 standards placed the company at an advantage in gaining traction with customers and in reducing Monadnock Paper Mills' carbon footprint along with strengthening their environmental commitment. Mr. Verney said, "As more companies become greener, our competitive advantage diminishes, that is why we have to focus (innovation) on the technical side of the business, which is in the new product development sector."

Toward the end of the interview, Mr. Verney reflected on lessons learned by saying, "If I have learned anything in my time here, it is that it always takes longer than we think to develop a new product. There lay the risks associated with innovation that need to be managed." Another insight dealt with long-term decisions, from his experience, being a private company gives them a time horizon that they would not have as a public company focused on quarterly earnings. Mr. Verney acknowledged the dedicated resources and priority placed on environmental accomplishments at Monadnock Paper Mills.

If leadership is one of the best predictors of innovation performance as confirmed by a McKinsey (2007) survey of 600 global business leaders, this was found to be the case at Monadnock Paper Mills. In Mr. Verney' s Eco-Scorecard, his highest scores were in the categories of Eco-Advantage Mindset (E), followed by Eco-Tracking (D), Eco-Culture (B), and Eco-Redesign (C). We see from the baseline years of 2008 to 2010 in

the Total Scores, an increase from 59% to 78%. The Eco-Sustainability Conceptual Framework was a good fit when applied to Monadnock Paper Mills. Mr. Verney addressed each section of the framework in describing how company activities within each category contributed to innovation for environmental sustainability. In addition, he identified specific natural forces such as climate change, energy, and water issues as challenges, along with identifying various internal and external stakeholders who influence their “cycles of innovation.”

At Monadnock Paper Mills, innovation has increased their ecological sustainability and their ability to pass sustainable products and practices along to their clients, serving as a competitive advantage as a seller and supplier to global companies like HP, Gap, Este Lauder and many others (B-6). Monadnock Paper Mills collaborates with clients in innovative problem solving on environmental issues faced in the marketplace, which in turn has created sustained value, increased their brand and generated revenue based on an environmental strategy (B-6).

Interview with David Lunati, Director of Marketing

The next interview took place with Mr. Lunati, Director of Marketing, a senior manager whose priority is on the Monadnock Paper Mills brand and marketing mix for invigorated sales. This process has been a source of great pride providing both growth and profitability, with Monadnock Paper Mills now working with global companies. Mr. Lunati has been actively engaged in a turn-around phase at the company, which he refers to as “cyclic change.” He has brought a new approach to the marketing mix, and he sees great potential and strong leadership at Monadnock Paper Mills.

Mr. Lunati believes achievement of the company goals, such as sustainability is a continuous process, and ingrained in all employees, not solely the leadership (B-5). He noted that Monadnock Paper Mills has gone through a transformation in recent years; through the difficult economic times, and believes the company is better for having adopted a Triple Bottom Line approach (F-19).

Similar to Mr. Verney, Mr. Lunati expressed the desire to keep their community in which they work beautiful (F-20):

There is a certain commitment to being a sustainable enterprise for the local community. We live in a beautiful part of NH and we want to keep it that way. The company carries the name of the Monadnock Mountain gracing the local landscape, which is a constant reminder of where you are and where you live.

Mr. Lunati commented on several generations of local families that had worked at the mill, and noted how Monadnock Paper Mills is committed to the local community and is a key employer in the region.

Mr. Lunati discussed the company's pride in their environmental accomplishments, and that promoting their innovative products and commitment to social and environmental sustainability supports a new marketing strategy (A-1). The marketplace was asking for this type of innovation, especially from large companies, who sought to learn from Monadnock Paper Mills. The company, therefore, found a niche in the marketplace in providing sustainable and environmentally preferable products, but they also serve an educational need for their clients in terms of implementing sustainability (B-6).

Mr. Lunati described Monadnock Paper Mills' need to accentuate their sustainability-marketing message, and how it has turned their business around (A-1). The company's start in packaging began with a line of packaging products with 80% post-

consumer waste, which had the highest amount of post-consumer waste in the industry. Monadnock Paper Mills used 100% green electrical energy in the form of low impact hydroelectric power, offset that with wind power credits, and manufactured carbon neutral through verifying mission and reduction credits under the ISO 14001's independently verified and audited environmental management system process. Thus, Mr. Lunati asserted, "Both product and process gained us entry into a new market we were never in before."

In a way, the market had to catch up to appreciate Monadnock Paper Mills' way of doing business, while the company needed to strengthen their marketing message to reach new clients. For Mr. Lunati, this has been an exciting part of his job, a return to profitability and growth while improving the Monadnock Paper Mills product offerings for their major clients. New markets now include NAPA wine labels, CD and DVD wrappings made with 100% post-consumer waste. Now, Monadnock Paper Mills wants to return to their mature markets to reinvigorate sales by improving not only the way they can make these products, but also leveraging their marketing message based on the good work of the Operations Team.

Monadnock Paper Mills employees have learned sustainable manufacturing provides value to their clients and individual consumers. In addition, it differentiates them in a highly competitive marketplace (A-1). When discussing sources of innovation within the company based on using the Eco-Sustainability Conceptual Framework, Mr. Lunati responded:

First, you have to have ownership; management and leadership at the top level buy into the Triple Bottom Line as we do at Monadnock Paper Mills. When you have it as a way of doing business (culture), it permeates the entire organization (mindset). Then

it continues on the Operational-side making sure we are good corporate citizens in our local community/state, and globally as it is transformed into the market.

From Mr. Lunati's perspective, it is easier selling to a larger company whose upper management and stakeholders have mandated sustainability in their supply chain. Monadnock Paper Mills has customers willing to pay a premium for the best environmental product to those wanting to go green, who do not want to pay a penny more for it. Mr. Lunati described working with the latter as the "Holy Grail" process. From my interview observations, Monadnock Paper Mills builds strong relationship through a creative problem-solving approach with their customers in providing sustainability solutions. As a result, they are part of several corporate supply chains of Fortune 500 companies, creating a competitive advantage on price, quality, and sustainable value. In Mr. Lunati's Eco-Scorecard, his highest scores were in the categories of Eco-Advantage Mindset (E), followed by Eco-Tracking (D), Eco-Culture (B), and Eco-Redesign (C). We see from the baseline year of 2008 to 2010 in the Total Scores an increase from 66% to 76% (see Eco-Scorecard in this chapter).

Interview with Michelle Hamm, Environmental Manager

The third interview conducted at Monadnock Paper Mills was with Michelle Hamm, Environmental Manager. During our plant tour and interview, her knowledge was insightful. Ms. Hamm is a third-generation paper mill employee, her family worked in the north-country paper mill of New Hampshire. Unfortunately, the tradition of paper millwork has diminished over the years with the closing of a majority of New Hampshire paper mills, which is a testament to the longevity of Monadnock Paper Mills.

Ms. Hamm's job responsibilities focus internally and externally in the area of environment management. In 2008, outreach and education activities included public

awareness fairs for employees and community members introducing topics from composting to solar-powered batteries (B-6, F-20). Event themes highlighted sustainability geared toward protecting and restoring the environment with sustainable everyday tips and practices. In 2009, the emphasis was on outreach and education to explain sustainable practices in manufacturing, such as their renewable energy production, on site wastewater treatment, beneficial uses of byproducts, what constitutes energy reductions, carbon neutrality, and greenhouse gases.

According to Ms. Hamm, Monadnock Paper Mills demonstrates a leadership role with their participation at the local, state, and national levels (B-6). From public speaking engagements to volunteer involvement in advocacy, education, policy, and legislation with organizations including,

- New Hampshire Businesses for Social Responsibility
- New Hampshire Business & Industry Association
- New Hampshire Department of Environmental Services
- New Hampshire Water Council
- New Hampshire Legislative Groundwater Commission
- U.S. Environmental Protection Agency and,
- American Forest and Paper Association (AF&PA is the national trade association of the forest, pulp, paper, paperboard, and wood products industry.)

Internally, Ms. Hamm coordinates the core set of environmental indicators to track energy use, water usage, waste generation, water permits, and compliance, which ties in with her work on ISO 14001 implementation and the Monadnock Paper Mills' 'Strive Process' (B3-6, C7-10). During out plant tour, Ms. Hamm pointed out printed signs throughout the plant that serve as reminders about what wastefulness accounts for in terms of either pounds or costs of raw materials. To help keep track of the data/metrics

of inputs and outputs needed to conduct Life Cycle Assessments (D-11), Monadnock Paper Mills maintains a significant materials database (D-13), which is part of their well operations. This is separate from ISO 14001:2004, in tracking, all materials coming in and out of the facility with a resource number for inventory levels, consumption rates, supply levels, and sales. This correlated with Ms. Hamm's high rating on the Eco-Scorecard (D12-13).

Ms. Hamm explained the Monadnock Paper Mills' Strive Process as a team-based, discovery process for problem solving issues. Different meeting times are scheduled for full staff participation in generating new ideas on an annual basis. Key focus areas are identified as part of their ISO 14001:2004 commitment to ensure environmental projects are a priority. After the initial meeting, participation is on a voluntary basis to work on a focus team with a team leader and sponsor for each project identified. For instance, in evaluating improvement areas for air emissions, they would discuss specific projects while exploring how to accomplish tasks, assessing ways to reduce emissions and by what percentage.

With successfully implemented projects, employees receive recognition via a thank you from the executive management team, and are formally recognized and compensated (B-5-6). The Strive Process acknowledges that volunteers from Production (employees on the floor) are the ones dealing with these issues on a daily basis; hence, they are resourceful when coming up with the best solutions to problems. Ms. Hamm stated, "We ask employees to take a moment, to stop and ask how my actions will have a positive effect" (B-5-6).

In addition, Ms. Hamm credits the Strive Process as an excellent method for managing environmental innovations within the company. The process fulfills several objectives including full executive management support. ISO 14001:2004 requires strong management oversight including resource allocation, and a cost/ benefit analysis by teams. Ms. Hamm acknowledged innovation occurs throughout the organization from the plant floor, IT, environmental management, marketing and sales to research & development (B-4).

In applying the Eco-Sustainability Conceptual Framework, Ms. Hamm rated the category of Eco-Advantage Mindset (E) highest followed by Eco-Tracking (D), Eco-Culture (B), and Eco-Redesign (C). We see from the baseline year of 2008 to 2010 in the Total Scores, an increase from 72% to 84%. Within the key performance indicators, she gave the highest ratings across all three years to (E15): CEOs commitment to sustainability and environmental strategy and doing the right thing that reflects values do matter within the organization. Ms. Hamm said, "I have never seen an organization quite like ours where the Chairman, CEO, and Senior Management are so committed to eco-sustainability and they have been doing this for a long time. It is a core business value, which is very rare."

Monadnock Paper Mills has an impressive portfolio of sustainable paper products. For example, the Envi® Card Stock, also known as "The Un-Plastic," is a renewable wood fiber alternative to PVC card materials. Monadnock Paper Mills Envi® Card Stock is recommended for gift cards, loyalty cards, membership cards, hotel keys, and signage. It is durable, recyclable, and prints using offset, thermal, or digital printing techniques. It can be embossed, foil stamped, laminated and accepts magnetic stripes, signature panels,

scratch-offs, bar codes, and holograms. Monadnock Paper Mills Envi® Card Stock is Forest Stewardship Council (FSC) certified, which assures that the forest products contained in the card stock are responsibly harvested. It is also manufactured carbon neutral through the acquisition of Verified Emission Reductions (VERs) using 100% Green certified electricity through Renewable Energy Certificates (RECs), and is recyclable. Finding sustainable solutions to their customers' challenges is a core competency for Monadnock Paper Mills and these competencies are distinguishing the company, while advancing their commitment to ecological sustainability.

Eco-Scorecard Results

The results of the participant evaluations on the Eco-Scorecard were compiled and presented on the following Eco-Scorecard. The ratings offered by participants were converted to percentages, as noted in the methodology.

Monadnock Paper Mills Eco-Scorecard Results

A.	Key Performance Indicators for Sustainable Enterprise	Baseline 2008	Year 1 2009	Year 2 2010
1.	A sustainable enterprise is one that produces profits, while protecting and restoring the environment, and improving the lives of the stakeholders with whom it interacts.	50%	58%	75%
2.	Company operates within the carrying capacity of the Earth.	58%	75%	75%
	SUB-TOTAL	54%	67%	75%
B.	Key Performance Indicators for an Eco-Culture			
3.	Eco-expense reduction to cut environmental costs by not wasting natural resources and by avoiding regulatory burdens due to pollution or waste disposal.	67%	75%	75%
4.	Company uses Stretch Goals as a driver for innovation and eco-sustainability. *Company applies a sustainability lens to getting things done.	67%	67%	75%
5.	CEO and Senior Management have a commitment for sustainable practices and environmental stewardship. *Money and incentives tied to eco-accomplishments. *An environmental ethos reflected in the mission/vision/values.	83%	83%	83%
6.	Storytelling of the eco-successes and lessons learned in CSR/Sustainability/EHS Reports. *Eco-training, a form of knowledge sharing which contributes to innovation is available. *Jobs titles reflect responsibility for sustainability.	50%	75%	83%
	SUB-TOTAL	67%	75%	79%
C.	Key Performance Indicators for Eco-Redesign			
7.	Utilizes Design for the Environment (DfE) to help customers reduce their ecological footprints and designs out environmental problems. *Company understands the environmental market drivers.	50%	62%	83%
8.	Use of Closed-loop Systems	50%	54%	67%
9.	Green Building and LEED Certification, *Retrofitting existing buildings for energy efficiency.	58%	58%	58%
10.	Supply Chain Audits	75%	75%	75%
	SUB-TOTAL	58%	63%	71%
D.	Key Performance Indicators for Eco-Tracking			
11.	Company uses Life Cycle Assessments to measure ecological footprints and understand environmental impacts and ecological consequences of the products/processes along the value chain. *Supply chain adjustments.	50%	50%	71%
12.	Develop a Core Set of Environmental Indicators that track energy use, water and air pollution, waste generation and compliance. *Data/Metrics of Inputs and Outputs are used.	83%	83%	92%
13.	Establish a Materials Database to determine what is in your products or connected to your processes.	83%	83%	92%
14.	Environmental Management Systems (EMS) for environmental and risk assessment or *Environment, Health & Safety practices.	66%	71%	56%
	SUB-TOTAL	71%	72%	84%
E.	Key Performance Indicators for Eco-Advantage Mindset (Genesis/Organic Process)			
15.	CEO's Commitment to Sustainability and Environmental Strategy – top down support. *Doing the right thing that reflects values do matter within the organization.	92%	100%	100%
16.	Company is using a sustainability lens to ID new opportunities. *Company is placing a focus on Innovation.	75%	79%	83%
17.	Company establishes dialogue with both friends and foes. *SME engages in local community building. *SME is involved with Stakeholder engagement and eco-activities.	67%	75%	75%
18.	Leadership makes decisions with the long-term in mind for a tighter regulatory framework, rising customer expectations and market realignment driven by natural constraints. *SME places a value on higher employee retention, stronger customer loyalty and higher brand value. *Leadership looks at the whole value chain from raw materials to suppliers who meet customers' environmental needs, to product end of life.	66%	79%	82%
	SUB-TOTAL	75%	83%	84%
F.	Key Performance Indicators for the Triple Bottom Line (TBL)			
19.	The Triple Bottom Line Approach, which encompasses sustainability as the intersection of economic, social and environmental performance is used.	62%	75%	79%
20.	Corporate Social Responsibility (CSR) is a concept whereby organizations take responsibility for their impact on society and the environment.	58%	71%	79%
	SUB-TOTAL	60%	73%	79%
TOTAL SCORE		66%	72%	79%

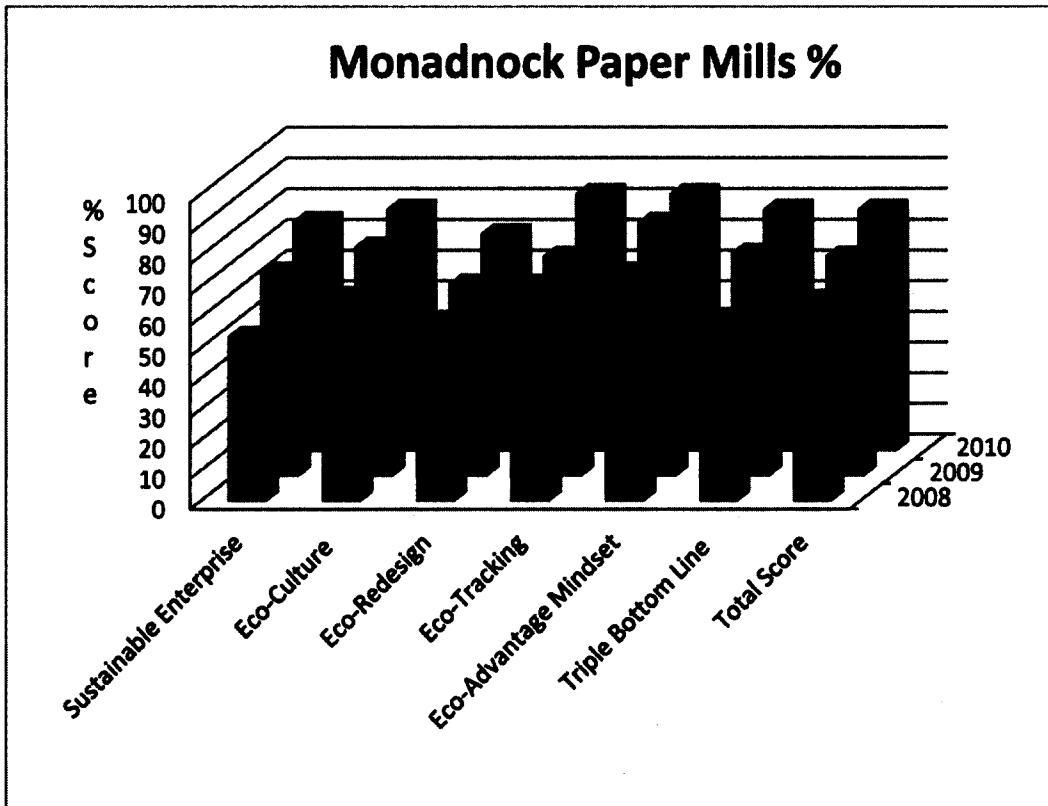


Figure 16. Monadnock Paper Mills Scorecard Percentage Scores

Analysis of Interview Data

Qualitative analysis of the three Monadnock Paper Mills transcribed interviews was used to identify themes as they relate to the Eco-Sustainability Conceptual Framework and Eco-Scorecard. The key invariant constituents are provided in Table 7-1 below as they relate to the Eco-Sustainability Conceptual Framework. Tables' 7A-7F in the Appendix H represent the full variety of participant responses, inclusive of the single responses, used in the cross-case analysis in Chapter 9.

Table 7-1

Key Invariant Constituents of the Eco-Sustainability Conceptual Framework by Category: Monadnock Paper Mills

Themes and Key Invariant Constituent	# participants to offer this experience (n=3)
<i>A. Key Performance Indicators for Sustainable Enterprise</i>	
(A-1) Characteristic of company/ingrained in the company/natural way of doing business for the company	2
(A-1) Commitment to local sustainability (employees and leadership dedicated to achieving sustainability)	2
(A-1) Educational function	2
(A-1) Provides a competitive advantage/ niche in the marketplace	2
(A-2) International Organization for Standardization (ISO) ISO 14001	2
(A-2) Balance of inputs and outputs to neutralize impact	2
<i>B. Key Performance Indicators for an Eco-Culture</i>	
(B-2) Reinventing the products	3
(B-3) Mindset/culture of reducing carbon footprint (core business value/team based approach)	3
(B-2) Need for new direction sparks innovation	2
(B-6) Incentive from having distinction through having environmental conscience/leading in the field	2
(B-4) Focus on new innovation, seeking out new certification to provide competitive advantage	2
<i>C. Key Performance Indicators for Eco-Redesign</i>	
No common invariant constituents found among interview participants*	
<i>D. Key Performance Indicators for Eco-Tracking</i>	
No common invariant constituents found among interview participants*	
<i>E. Key Performance Indicators for Eco-Advantage Mindset</i>	
(E-16) Company is focused on innovation to create new product directions that remain in line with sustainability practices	3
(E-15) Employees and owners/leadership dedicated achieving sustainability	2

Themes and Key Invariant Constituent	# participants to offer this experience (n=3)
<i>F. Key Performance Indicators for the Triple Bottom Line (TBL)</i>	
(F-19) Management/leadership that buys into the Triple Bottom Line approach, incorporating social, environmental, & financial effects	2
(F-20) Commitment to corporate social responsibility demonstrated by support for company foundation and wildlife support	2

**Note:* The lack of common invariant constituents does not convey that the company is not covering aspects of the category, only that no common, invariant constituents were revealed among the three interview participants (see Appendix H for all single mention invariant constituents related to this category).

A. Sustainable Enterprise

Common statements among interview participant perceptions included (a) eco-sustainability as a characteristic of the company/ingrained in the company (2 of 3 participants), (b) company commitment (employees and leadership) to local sustainability (2 of 3 participants), (c) fulfilling an educational function to clients and the community (2 of 3 participants), (d) provides a competitive advantage or niche in the marketplace (2 of 3 participants), (e) achievement of ISO 14001 (2 of 3 participants), and (f) balance of inputs and outputs to neutralize impact (2 of 3 participants). In addition to these key characteristics, individual interviewees offered insights into this thematic category. Table 7-A (Appendix H) provides the elements mentioned by interview participants within this theme and the associated frequency of occurrence among the three participants.

Interview participants noted that the eco-sustainability is primary to the company as a characteristic, is a commitment of leadership and employees alike, and a continuous process. Mr. Lunati noted, “It is one that I believe is ingrained, not only in the mill’s ownership, but also in the employees. It is small incremental improvements over time.” For Monadnock Paper Mills it is a continuous process towards this goal. Mr. Lunati also

noted, "I think it is characteristic here at Monadnock Paper Mills and evident in the way we have succeeded over the last couple of years. This mill has gone through somewhat of a transformation during very difficult economic times and I think we are better for having adopted a Triple Bottom Line approach."

The company commitment to sustainability extends to their clients, as noted by Ms. Hamm:

Over the past two years, we have seen an increase in how we interact with our customers. Collaborating with our customers can begin with a plant tour, to educating them about our manufacturing process so they understand what we do as a sustainable manufacturer. We have always taken into consideration how our operations interact with the environment. As a result, we have reduced our air emissions, and water consumption.

Our company serves an educational value to the community, in teaching customers how to advance sustainability processes on their own.

Another perception revealed by the interview participants dealt with the concept of balancing inputs and outputs, which serves to neutralize the impact on the environment.

We are trying to neutralize our impact, if not, improve upon it. If everybody did that then I think we would be well within the carrying capacity of the Earth. Not that everybody does it, but I think we are trying with our International Organization for Standardization (ISO), ISO 14001 Environmental Management System. We measure and quantify our impacts and we have programs in place to improve upon them. (Mr. Lunati)

Interview participants discussed how the market is demanding environmentally friendly products, which provides an opportunity for them to supply sustainable products in the current market:

There is a renewed environmental movement today. For a while there, I think the interest waned, that is not the case anymore. I think there is a whole new generation that wants everybody to do more. (Mr. Verney)

The marketplace is asking for it, especially large companies and they are looking for people who can help them answer questions around sustainability. Every one of these companies has a committee of ten trying to figure out how to go green and we are in a prime position to help them. We found a niche in the marketplace not only to provide environmentally preferable products, but we also serve an educational need for customers on how to go through this. (Mr. Lunati)

In terms of eco-sustainability, interview participants noted advantages on all sides, revealing an “everyone wins” mentality. Mr. Lunati stated:

Everyone wins. For us, we win because it allows us to differentiate ourselves in a very competitive and ugly marketplace. Even though this industry is suffering throughout the country, we have seen almost a renaissance of business because of all of the environmental things we are doing. Across all of our market segments, we are riding it and maximizing it. While still trying to do the right thing, still trying to be humble about what we do and not trying to mislead people. There is a tremendous amount of green washing going on. Our position as consultative resources to our customer is well-received.

Finally, the company demonstrates a commitment to sustainability from a local to a global level. The second interview participant termed this, “glocal” sustainability. Mr. Lunati stated, “There is a term called “glocal” meaning global and local. It is about starting locally and going globally because there is a global need. This glocal thing is what we practice at Monadnock Paper Mills. Grass roots efforts that have significant, meaningful impact to large global companies. Companies want to align with environmentally conscious suppliers.

B. Eco-Culture

Several key statements emerged from the analysis of the interview data related to this thematic category. Table 7-B (Appendix H) illustrates the variety of responses given by Monadnock Paper Mills interview participants relating to this thematic category. The data demonstrate the key common themes of (a) re-inventing the products (3 of 3 participants), (b) mindset/culture of reducing carbon footprint as a core business value (3

of 3 participants), (c) need for new direction sparks innovation (2 of 3 participants), (d) incentive from having the distinction as an environmentally conscious company and leading the field (2 of 3 participants), and (e) focus on innovation and seeking out certifications to provide a competitive advantage (2 of 3 participants) (Table 7-1).

The dedication of the company and its employees is evident in the re-inventing of products, and culture of reducing their carbon footprint. Mr. Lunati described this commitment in terms of continually striving for better. He stated, “What is the next thing? Are we satisfied just being carbon neutral? Can we be carbon positive? Can we start taking the needle back for others instead of just offsetting what we are doing?” In that light, Mr. Verney noted, “We will not be manufacturing the same products three years from now that we are manufacturing today.” Indeed, that is what the company has shown over time. Mr. Lunati described an example reflecting their transition to sustainable products, “We did our customer research and found out there was this growing need for environmental products where you did not have to compromise on aesthetics or performance in going green.”

Ms. Hamm commented on innovation, giving an example of one she is particularly proud of:

I would have to say the development of our eco-packaging products. The challenge was coming up with a sustainable, higher post-consumer recycled content product that satisfied a demand in the marketplace, while maintaining top quality and not sacrificing performance. It was an organization wide mission with the Marketing Department letting us know there was a high demand for this type of product in the marketplace.

The interview participants from Monadnock Paper Mills expressed the importance of leadership, particularly when it comes to innovation. “I think innovation starts from having ownership that tells you this is the way we are going” (Mr. Lunati).

He also described the external pressures on companies to provide sustainable products.

This is associated with the need for leadership that is dedicated to sustainability and social responsibility:

There is innovation that is forced from outside, by big influencers in the value chain that we are selling into. I would argue that in those organizations, it also requires a directive from the top. The key here is that it starts from the top and trickles down, because when I am trying to sell to those companies for me it is a lot easier when there is a mandate from up above that they need to improve and they have shareholders that are looking at their corporate environmental and social responsibility. (Mr. Lunati)

Innovation sometimes comes from necessity, or from finding a new way to use something. Mr. Verney gave an example of when they had a material that was no longer profitable and how that was turned into something else, which was profitable.

We found some other uses for this material. It turns out it is a very good acoustical insulator. Now we have a significant position in the automotive industry with this material used to insulate cars and sound instruments. Fortunately, some of our better customers are Ford, not some of the other car companies and the business is growing very well. (Mr. Verney)

Ms. Hamm described using critical thinking on innovative ways to reduce the company's eco-expenses:

Our focus is to optimize natural resources, which is specifically the raw materials; our fibers, our water, so, I would rate us 3's (75%) across the board because that has been part of our culture and people understand it. We have the mindset that every time you dump a pumper it is not only that you just wasted \$350, you just had to cut down a tree to replace the 300 pounds that you just dumped into the hole.

Mr. Verney specifically described energy and water as critical components for his company: an area in need of innovation, which is a primary focus of the organization. He expressed the importance of energy and water to the paper industry and for Monadnock

Paper Mills:

Energy for our particular industry is one of the biggest environmental issues. In the future in my opinion, it is going to be water. People are realizing that water is not free. In New Hampshire, you get people who do not like bottled water plants. It will affect

Monadnock Paper Mills at some point. My argument is we take the water, we use it, we clean it and we put it back. It is not entirely a consumptive use; it is sort of a passive use. Water and energy, yes, those are the two biggies. If the mill had natural gas available, we would have a co-generation plant here, but we do not. Thus, we are looking at crazy things like; pig manure converted to crude oil. I did not even know they were making such a thing.

Solutions for reductions in eco-expenditures as well as re-use of waste matter are addressed through a team approach:

In 2009, Monadnock Paper Mills made a commitment to purchase a cleaner fuel oil to burn with less sulfur so that we could come up with fewer emissions. We used a team-based approach called the Strive Process to brainstorm ideas on what we could do to reduce emissions. An employee had the idea of burning less oil by optimizing the steam. The question became; can we reuse it somewhere else? (Ms. Hamm)

This type of approach generated an interest in certifications like the International Organization for Standardization (ISO), which has made the company an industry leader. Mr. Verney noted, “We made the decision to go to ISO 14001; it helped us differentiate ourselves. That is when we became carbon neutral and got all of the certifications that we now use. Although, being a good steward of the environment is no longer a differentiator, it is expected.”

C. Eco-Redesign

No strong themes emerged from the data within this category. The variety of invariant constituents provided by the interview participant data is provided in Table 7-C (Appendix H). According to interview participants, Monadnock Paper Mills conducts supply chain audits frequently to assess the development of the processes. Ms. Hamm stated, “We audit our supply chains quite frequently. We audit our raw material suppliers and use surveys to see how we are doing with our customers.” The audit does not simply entail accounting for the cost of the project and the monetary returns. Ms. Hamm said, “Some of the projects are environmental improvement on products, they may cost, but

our benefit at the end of the day may be an improved place in the market sector.” These audits and ISO 14001 compliance have affected everyone in the company by changing the way we do things, and how we think about our actions. Ms. Hamm noted:

We introduced ISO 14001 in a way that has people stopping and looking at what they are doing in their job position every day. Every action they have in that job position has a potential impact on the environment. We ask people to stop and ask themselves, how are my actions? What can I do next to have a positive reaction?

With regard to Design for the Environment (DfE), Ms. Hamm said even though we do not use this specific EPA program, we have an intense research & development effort in utilizing closed loop systems and LEED.

Designing environment-friendly products is part of our research & development (R&D) system here. We have a series of eco-products that we are looking to improve on. There are specific R&D aspects tied into it. Right now, we are at 80% post-consumer waste, which is the highest we can get on the shopping bags, we want our R&D Team to see if we can get it to 90%.

Ms. Hamm went on to discuss closed-loop systems within the company being used where possible and how R&D continues to find innovative ways to reuse their raw materials.

“We have made many improvements with closed loop systems, specifically with recycling raw materials, recycling our own paper, and recycling our own water.”

In terms of LEED, Ms. Hamm felt improvements could be made; however, certain obstacles have hindered Monadnock Paper Mills from retrofitting some of their existing buildings due keeping the historical integrity and value of the facility intact.”

D. Eco-Tracking

No strong themes emerged from the data within the Eco-Tracking category. The variety of invariant constituents is provided in Table 7-D (Appendix H). Evidence from the interviews demonstrated the use of Life Cycle Assessments and indicators to track

energy use and waste generation. Ms. Hamm discussed these aspects of the operation, stating:

Yes, we have a significant material database. It tracks every material that comes into the facility, it tracks it by a resource number so we can constantly track what we have on-hand and what is consumed at any time. We are looking at not only inventories, but also consumption. Our computer program here is amazing. It tracks the amount of chemicals and raw materials added to the process at any given moment. We can track and trend all of our water flows, and we can print a report as a snapshot at any time. The process itself is completely computerized and monitored at all times, including raw materials usage, inventories, in/out, sales you name it.

E. Eco-Advantage Mindset

Two key elements (invariant constituents) were commonly noted among Monadnock Paper Mills interview participants, which included (a) a company focus on innovation to create a new direction in line with sustainable practices (3 of 3 participants), and (b) employees and ownership dedicated to achieving sustainability (2 of 3 participants). The variety of invariant constituents related to this thematic category is provided in Table 7-E (Appendix H).

These statements of the Eco-Advantage Mindset were evident throughout the company, as described by the interview participants. Starting with leadership commitment to sustainability, throughout the various employees in the company, Monadnock Paper Mills is dedicated to eco-sustainability, according to the interview participants.

This is not a fad; this completely green thing is not going to go away. I think it is only going to pick up speed. Those companies creating brands people can trust as it relates to this sustainability journey that we all are on. Monadnock Paper Mills has a long-term approach to this and I think it builds trust and it builds credibility as we advocate for change and we show in proof. We talk it, but we also walk the walk. (Mr. Lunati)

Leadership has consistently demonstrated an ability to look to the long term, particularly with regard to sustainability. Mr. Verney described such previous conditions and

provided an example of such forward thinking in how the decision was made to incorporate hydropower:

When we started to have some structural issues with the dams, the question was if we buy electricity for so little, why spend money to repair the dams and keep them up. We sat back and said; we are not sure that electricity is always going to be this cheap. To make a long story short, we invested in the hydraulic power based on the long-term assessment that eventually someday, we would be happy having those dams because they would save us a lot of money.

The interview participants described the shift from a concern with the bottom line to a Triple Bottom Line approach:

We found a shift from the mindset of what our bottom line is as far as profit of each product, to actually looking at the makeup of the product and how it is manufactured in a sustainable manner. What we found is that over the past two years, we have seen an increase in how we participate with our customers. In partnering with them from the beginning, to educating them about the entire process so they understand what a sustainable manufacturer is all about, and what they can do to bring it back to their own consumers with sustainable practices. (Ms. Hamm)

From this commitment to sustainability, a focus on innovation has developed in order to further the business and new product development. “Now we have to focus back on the innovation and what I would call the technical side of the business, which is the new product development sect. Just having a recycled or environmentally friendly product is not necessarily the solution” (Mr. Verney). To spur innovation, Monadnock Paper Mills promotes employee development; “If someone wants to go finish their degree or get a graduate degree, we fund it with the understanding that they owe us at least one or two years after they complete their degree. It is in the company’s best interest since they become more proficient, they know more and can contribute more” (Mr. Verney).

The company leadership’s concern for the employees has remained steadfast over time. Even during difficult economic times, the leadership was “looking at profitability, but also, how to keep our employee retention” (Ms. Hamm). The company has also

realized, more recently, the need for an individual, whose job is devoted to the importance of safe and healthy practices within the company; for example, this employee is now looking at “the raw material approval process and looking at the raw materials from a health and safety perspective” (Ms. Hamm).

F. Triple Bottom Line

This category is formed from two key responses related to these key performance indicators: commitment to and use of the Triple Bottom Line and commitment to Corporate Social Responsibility, both mentioned specifically by two of three participants. Table 7-F (Appendix H) provides the variety of interview participant responses within this category and the associated frequencies.

Repetitively, interview participants cited the company culture of dedication to eco-sustainability. Interview participants felt this stemmed from the dedication of the leadership at the top. For example, Mr. Lunati suggested, “You have to have senior management, ownership and leadership at the top level that buys into the Triple Bottom Line. At Monadnock Paper Mills, we have had that. When you have it as a way of doing business, it permeates the entire organization.” Similarly, Ms. Hamm described the level of support from the senior leadership for the Triple Bottom Line approach, “We could not do any better. From top down support, we are doing 4’s (100%) across the Eco-Scorecard.”

Mr. Lunati described the importance of this through the years at Monadnock Paper Mills, such that it is a characteristic of the company; “I think that is characteristic here at Monadnock Paper Mills and evident in the way we have succeeded over the last couple of years. This mill has gone through somewhat of a transformation during

difficult economic times and I think we are better off for having adopted a Triple Bottom Line approach.” Ms. Hamm stated, “Now, we are looking at it from a social, environmental and financial aspect when we approach anything. New products, customers, projects, we are taking those three things to go absolutely hand in hand this year.”

Corporate Social Responsibility is taken seriously at Monadnock Paper Mills.

According to Ms. Hamm:

[Leadership has] always been very committed to social responsibility but up until this year, it has remained at that level. Whereas this year we are seeing it more across the organization and not just coming from [the CEO] signing over a check. That is relevant in everything. Like this year, we had a volunteer environmental clean-up day. We asked our employees to pitch in and ended up with 24 of our employees helping on their day off to go pick up trash along roadways.

Ms. Hamm also discussed the CEOs willingness to contribute resources and financial support to various social endeavors and volunteer projects.

I have to say that [the CEO] is very open to allowing us to use Monadnock Paper Mills’ resource to assist in other areas. For example, I chair our local river advisory committee, which is a volunteer organization. [The CEO] allows us to hold the meetings here. He provides financial support when we need it. At the committee level he helped buy ‘Protect our River’ signs to put around. Mr. Verney provides strong support in allowing us to use company resources to assist with volunteer efforts

Summary of Findings and Conclusions

Through the analysis of the interview data providing invariant constituents related to each category, several overarching themes were revealed. These themes represent overall commonalities of the perceptions and experiences of the Senior Management participants related to the Eco-Sustainability Conceptual Framework and Eco-Scorecard.

Theme 1: Sustainable enterprise perceived as a core characteristic of the company, ingrained into the company culture as a natural way of doing

business and therefore, sustaining a commitment to local sustainability, which was felt to provide a competitive advantage to the company.

Theme 2: The culture and general mindset of reducing the carbon footprint of the company and its clients perceived to inspire innovation for new directions of product development, distinguishing the company as an eco-leader and providing a niche in the marketplace.

Theme 3: Eco-Tracking and Eco-Redesign incorporating the use of key indicators, materials database management, and closed loop systems to reduce the company's local environmental impact.

Theme 4: Leadership/management commitment to the Triple Bottom Line approach to operations, accounting for social, environmental, and financial (economic) rewards and consequences, inclusive of Corporate Social Responsibility, and evidence of personal involvement with the company located "in our own backyard."

Monadnock Paper Mills' commitment to sustainable practices is not only commendable; it is an advantage in the global market. Innovation in recycling and reuse of materials, use of closed loop systems, and energy reduction, has enabled Monadnock Paper Mills to reduce costs while preserving natural resources. They have become a leader in sustainable practices as well as afforded the company a competitive advantage.

Analysis of the three interviews revealed common themes that served to provide insight into the company itself. The concept of sustainable enterprise was viewed as ingrained in the culture of the organization. The interview participants expressed how the culture and Eco-Advantage Mindset of the company inspired innovation that has resulted

in the company taking a leadership role in eco-sustainability and creating a niche for the company and a competitive edge in the market. The participants further described the use of Eco-Tracking and Eco-Redesign indicators as a means to ensure reduction of the company's environmental impact. The dedication to this ideology was witnessed on a personal level for each of the interview participants, and was felt to stem from the leadership and management commitment to the Triple Bottom Line approach.

CHAPTER 8

CASELLA WASTE SYSTEMS

RESEARCH CASE STUDY

Casella Waste Systems has been conserving, renewing, and sustaining the planet's most precious resources by providing resource management and expertise in the areas of solid waste collection, transfer, and disposal and recycling services. Operating in 14 states, Casella Waste Systems delivers quality garbage pickup, dumpster rental, and recycling services that are safe and environmentally responsible to residential, commercial, municipal, and industrial customers. With 32 solid waste collection operations, 31 transfer stations, 37 recycling facilities, nine-Subtitle D landfills, one landfill permitted to accept construction and demolition material, and one Waste-to-Energy Facility. Through research and development (R&D) efforts, Casella Waste Systems is well on their way to a long-term goal of transforming traditional solid waste streams into renewable resources. Casella is 37 years old and the only publicly traded, case study offering insight into applying the Eco-Sustainability Conceptual Framework and using the Eco-Scorecard. .

Company Overview

The mission of Casella Waste Systems is to better people, business, and communities by helping them to protect and enhance the environment and natural resources. Casella is a vertically integrated company providing resource management expertise and services to residential, commercial, municipal, and industrial customers primarily in the areas of solid waste collection, transfer and disposal, and recycling

services. Casella is in 14 states and operates solid waste operations in Vermont, New Hampshire, New York, Massachusetts, and Maine, with stand-alone material processing facilities in Connecticut, Pennsylvania, New Jersey, North Carolina, Tennessee, Georgia, Florida, Michigan, and Wisconsin.

As of May 2010, Casella owned and/or operated 32 solid waste collection operations, 31 transfer stations, 35 recycling facilities, and 8 landfills. Subject to the Subtitle D regulations that govern solid waste landfills, one landfill has a permit to accept construction and demolition materials, and one is a waste-to-energy facility. In addition, Casella holds a 50% interest in U.S. Green Fiber, which is a joint venture that manufactures cellulose insulation made from recycled fiber.

Casella manages their solid waste operations on a geographic basis through three regional operating segments, designated as the Eastern, Central, and Western Regions, and each includes a full range of solid waste services. Their fourth operating segment is FCR Recycling, which comprises larger-scale, non-solid waste recycling and brokerage operations. The vision of the organization is to build a sustainable and profitable company by transforming traditional solid waste streams into renewable resources. Casella believes that global competition for limited resources is creating significant business opportunities for companies that can sustain and extract value - in the form of energy and raw materials from resources previously considered an irretrievable waste stream. Since opening its first recycling facility in Vermont in 1977, the company's business strategy remains strong to creating a sustainable resource management model.

According to the Casella Waste Systems *2010 Annual Report*, the company strives to create long-term value for all stakeholders (i.e. customers, employees,

communities and shareholders) by helping customers and communities manage their resources in a sustainable and financially sound manner. Casella's long-term strategy is to create economically beneficial uses for waste streams through resource transformation solutions. Since the value of commodities after processing costs is typically higher than other disposal options, such as landfilling or incineration, Casella believes this strategy will be effective long-term. However, the company recognizes that implementation of this strategy is dependent upon the broader commodity and disposal pricing markets, which will continue to be impacted by global financial markets and economic activity.



Figure 17. Landfill gas to energy generator in Coventry, Vermont
(Photo Courtesy of Casella Waste Systems)

Company History

John and Douglas Casella are brothers who founded Casella Waste Systems in 1975 as a single truck operation in Rutland, Vermont. Today the company's existing footprint comes from a combination of organic growth and strategic acquisitions. In 1977, Casella built and opened their first recycling center in Vermont; it was an early implementation of an environmentally and socially sustainable component to their overall

business model. According to their website, Casella is a leader in the solid waste industry with an innovative business strategy seeking to create sustainable value beyond the traditional disposal model. They view waste as a resource for producing renewable energy and raw materials for manufacturing new products (www.casella.com).

Until the late 1990s, company growth was focused in the northeast United States with a mission to address the region's waste management challenges intelligently, through an integrated solid waste platform, including waste collection, transfer, disposal, and recycling processing. On October 29, 1997, the company went public at an Initial Public Offering price of \$18.00 per share (NASDAQ: CWST). In late 1999, Casella acquired KTI, an integrated provider of waste processing services, which extended their footprint to cover much of the eastern United States. In 2002, they recognized additional disposal capacity was required to meet a large, unmet need in the northeast. To develop capacity, they sought to differentiate the company in the solid waste market by linking recycling and other leading-edge resource transformation solutions to the solid waste disposal needs of municipalities.

With the launch of the Sustainable Environmental and Economic Development (SEED™) program, Casella implemented a framework in developing disposal capacity in a responsible manner that aligned with the interests of their stakeholders. With the SEED™ initiative, Casella built a sustainable infrastructure around disposal projects adding economic and environmental value past the traditional landfill business model. The concept of sustainability is the foundation upon which Casella successfully manages and conserves environmental resources for customers and communities combined with a viable economic business model.



*Figure 18. Compressed Natural Gas (CNG) Truck from Casella
(Photo Courtesy of Casella Waste Systems)*

Throughout its 37-year history, Casella has remained committed to protecting environmental resources, investing in their people, and working to improve the communities that host them. Casella's 'Core Values' are listed on their website and include the following (www.casella.com):

Integrity: We thrive when we do the right thing. We believe there are enduring principles for everything we do and we strive, in our deeds, to meet or exceed those standards.

Innovation: We prosper when we learn, understand and improve. We invest deeply in creativity, autonomy and the willingness to take risks and embrace change. We look for opportunities to improve everything we do from our everyday operations to reinventing the way the world manages its resources.

Service: We win when we help others. We are willing servants. We are sensitive to needs and are eager to be a resource to everyone around us, being generous with our time, talent and energy.

Teamwork: We are more effective when we work together. Our impact is consistently stronger when we respect, support and view each other as partners and value our diversity of backgrounds, insights and opinions.

Responsibility: We succeed when we balance our freedom to act with a sense of accountability. Our work bears the greatest fruit when exercised within a framework of disciplined boundaries, and with an urgent sense of purpose and ownership.

Trust: We excel when we assume the best in each other. Mutual respect and an open, honest environment mark our interactions with others. We acknowledge each other's contributions, we practice active listening, and we deliver on our promises.

Casella knows well enough, the world's natural resources are limited. Global population growth and increasing economic prosperity will drive soaring consumption of energy and raw materials. According to John Casella, Chairman and CEO:

We recognize that our industry is evolving towards a model that rewards an approach to resource renewal and sustainability. We are creating value from this shift by performing at the highest operational level, and developing resource transformation, business opportunities beyond the traditional waste consumption model in meeting the emerging environmental sustainability needs of our customers today and tomorrow.

With oil prices fluctuating toward record levels, growing demand for raw materials, and commodity prices on the rise, concerns over environmental sustainability are increasing. More often in this new world, waste is no longer a throwaway, but a "resource" for producing clean energy and raw material for manufacturing new products. Based on this reality, Casella is applying a viable economic model to the challenge of

resource conservation, transformation and renewal, while focusing in three major areas of innovation:

- Using innovation to rethink every aspect of their business
- Extracting additional value from the traditional waste stream with recycling innovation and
- Creating clean energy from the traditional waste stream

In 2009, Casella issued their first biennial Sustainability Report, using the Global Reporting Initiative (GRI) guidelines for Scope 1 and Scope 2. The report utilized a Sustainability Scorecard, which identified specific metrics and targets related to Casella's most significant environmental, social, and economic impacts. The Sustainability Scorecard provided a clear and concise overview of key performance indicators and targets from 2005 to 2010 in the following five areas:

- Resource Renewal
- Energy & Environmental
- People
- Communities
- Customers

A conference call with Abbie Webb, Senior Environmental Analyst provided background information on the Casella Sustainability and Progress Reports, and the methodology used to complete them. Casella utilized SAP® Carbon Impact software to monitor GHG emissions and to generate reports for other programs and agencies as well.

In addition, Ms. Webb completed an Eco-Scorecard and along with the three interview participants, confirmed Casella's sustainability business model has commonality with the Eco-Sustainability Conceptual Framework. Although terms like Corporate Social Responsibility and the Triple Bottom Line are not used in the Casella Sustainability Report, they are acknowledged through key performance indicators in

close alignment with the Eco-Scorecard categories of Eco-Tracking and Eco-Culture (Casella Waste Systems, 2010).



Figure 19. Managing Organics with Anaerobic Digestion
(Photo Courtesy of Casella Waste Systems)

Individual Interview Narratives

The following selected responses from the interview data collected provide an in-depth look at the interviews with each individual participant. The data provide examples in support of the themes identified during the analysis. As noted, interview data were collected from three senior representatives from Casella Waste Systems.

Interview with Stephen McDonnell, Director of Sales & Marketing

Stephen McDonnell is the Director of Sales & Marketing. He started at Casella as a financial analyst and presently leads the sales and marketing efforts of the company.

To his credit, he originally penned the name “Zero-Sort® Recycling.”

When asked to define some of the different ways Casella operates within the carrying capacity of the Earth (A-2), Mr. McDonnell replied:

In the field, we are trying to get our customers to divert every piece of waste they can, we like to call it ‘material’ and we can retire it or renew it. When I say retire, that means putting it into a landfill where it takes a long time to break down. With our resource optimization model, we are always encouraging our customers to think

outside of the box with waste disposal (landfill) while driving the diversion of recyclables. For instance, we encourage restaurants to become part of our program to recycle organic materials (such as food scraps & food processing residuals) at our new Anaerobic Digester in Rutland, MA. We converted five of our eleven operating landfills, now they are landfill gas to energy sites. We are actually using the methane gas to produce electricity, so even our traditional retired waste in the landfill has a renewal aspect. When talking about the carrying capacity of the Earth, we contribute to that by digging fewer holes in the Earth for waste disposal. In addition, we are trying to lengthen the life of our landfills for increased disposal capacity, so that the landfill becomes ongoing. Let us say when a landfill is closed, wind turbines are placed on top of it, then the land can be used for another purpose. Landfills using double-lined technology make it possible for gas collection systems to collect methane for either converting to electricity or flaring it into carbon dioxide, which is obviously less harmful to the atmosphere. The idea being that landfills, are like a cat with nine lives, and we are continuously asking ourselves what are the next steps, what is the next frontier for landfills? Can we actually open landfills up to mine them for recyclables, which is not actually that far-fetched and probably the highest form of renewal.

During his interview, Mr. McDonnell demonstrated the benefits of Casella's Intranet, dedicated to educating employees about resource optimization, resource renewal, and greenhouse gas emissions (B-3). Their Intranet provides several discovery paths for staff to learn about safe operating practices, management and marketing techniques. New employees can complete part of their orientation online, facilities can post their communications, and a wide selection of other training opportunities are available (B-6). The Intranet contributes to Casella as a knowledge-based company. On the Intranet, Mr. McDonnell showed what a plan looks like to take customers beyond traditional waste disposal to recycling and the other types of customized programs tailored to specific needs. For example, in year-one; customers recycle more, in year-two; customers might start an organics program, in year-three; Casella will evaluate a customer's supply chain, and in year-four; the focus is on e-waste disposal. With all of these programs, Casella can optimize the waste stream at the customer level, enabling the company to reduce their own carbon footprint along with that of their customers.

Next, we discussed Casella's primary market segments of residential households, commercial businesses, and municipalities. With municipalities, they can control their own waste, or Casella will service an entire contract for them. Mr. McDonnell said:

With many municipalities, we have gotten traction with a waste diversion message, because when they recycle there is less waste thrown away and the economics of waste diversion behoove a town or a municipality to divert as much material from a landfill as possible. When we take in a ton of recycled materials, we charge a municipality less per ton than to put the waste into a landfill, because we are paid for the commodity value of their recyclables. There is a cost savings when a municipality diverts its waste and it is good for the environment, which is a positive marketing message. The incentive for the municipality is to recycle for economic reasons. When you retire waste, there is a price paid, when it is renewed there is revenue. Casella has created business models for customers where we are renewing their waste while creating a product for sale. A perfect example is through New England Organics (NEO), we are working with a company (unnamed) to take their food waste, process it into compost, and then sell it under a private label. That is a closed loop example for sure. There has been an industry shift in philosophy from five to seven years ago when being green was not considered sustainable from an economic standpoint, and you were on the bleeding edge instead of the leading edge. All of our business models are proving that you can do the right thing, environmentally speaking and actually make money doing it. The idea of the Triple Bottom Line is very true for us.

This perspective from Mr. McDonnell demonstrated how entrepreneurship could combine an environmental and social mission by the nature of their business model.

According to Mr. McDonnell:

Projecting five to ten years out Casella will be there, right now, we have all these competing technologies going on and eventually we will end up settling on one of them. Whether it is extracting methane gas from the landfill to power trucks with CNG or doing the waste to liquid fuels program we have explored. Trash is going to become marketable, something people will not think of tossing away. A very subtle shift will occur, but when it happens, you will see a lot more technologies emerging. Presently, we do not charge people to dispose of recyclables and in some cases, we pay them to bring recyclables to us, eventually you will see the same with trash. The price of trash disposal will probably go down, since there will be so many alternatives for trash transformation solutions whether it's engineered feedstock, waste to liquid fuels or landfill gas to energy. For example, we have a pipeline project under development off one of our landfills going to the University of Maine (with methane). Waste Management does the same with the University of

New Hampshire. These types of projects are happening more often and at our South Carolina BMW facility, the whole plant is fueled with their landfill gas.

After discussing future predictions, we turned to how Casella leadership contributes to a culture of environmental sustainability (B-5, E-15). Mr. McDonnell described executive management as leaders in the whole resource optimization strategy. They also place a high priority on manager training with both time and money spent on the Bell Leadership and Team Building Training. Mr. McDonnell spoke highly of its holistic approach in identifying key personality traits for nurturing solid achievement skills through personal and professional leadership development.

The process of introducing a new employee into the company begins during the initial interview with a “Caliper Test” based on a job design for making the best match in terms of personality and professional experience. Another feature of the interview process is actually riding on a Casella truck, “which requires you get up at 2:00 a.m. for the ride.” According to Mr. McDonnell, he felt this experience was important in understanding the company culture and what is going on with customers on the street level; “you have to understand it.” The final step for a successful hire is getting unanimous approval from the “Selecting the One” Committee that serves like a jury. After graduating from Purdue University with a MBA, Mr. McDonnell wanted to return home to VT/NH. Casella was a company he was very familiar with and he wanted to work for them “because of the vision they had” and with an “environment direction he couldn’t imagine going to work for any other waste company.” The interview participants confirmed Casella has the ability to recruit and retain talent based on their mission, vision and values.

In relating how the company culture is a source of innovation (B-4, E-16), Mr.

McDonnell responded:

We have many patents on how we collect gas at landfills and patented technology at our recycling facilities, our patent portfolio is robust. We even have a contest within the company for *Innovator of the Year*. The last person to win was Wayne Poland, he figured out a way to design a diesel-powered compactor for use in remote Maine so trucks could make fewer trips to retrieve waste from half-empty containers. Plus, you probably could convert that compactor to run off biodiesel.

The innovation Mr. McDonnell was most proud of is creating the name “Zero-Sort®, the single stream recycling process, which means customers don’t have to sort recyclables anymore. “Zero-Sort® is a brand unifier among all of Casella’s acquisitions,” explained Mr. McDonnell, who stated, “It has helped our ability to move our non-branded companies with Casella and it provides us with a consistent look and feel on marketing pieces. The next innovation he was most proud of is Casella’s exploration into alternative fuels.”

Within the Eco-Tracking domain (D), Mr. McDonnell talked about compliance & engineering and the work of Abbie Webb, Senior Environmental Analyst with SAP® (a solutions-based provider), in tracking and analyzing greenhouse gas emissions.

Greenhouse Gas Inventory Training Part II is on the Intranet for employees to learn how to catalog GHG, from the hauling companies to transfer stations and landfills. Mr.

McDonnell said:

I would give us a rating of 4 or 100% (D-14), although we need to do a better job communicating about reducing our carbon footprint. We are very sophisticated and consistent in monitoring greenhouse gas emission the next step will be articulating to customers how we can reduce their ecological footprints. This would be helpful since we are turning into consultants with our customers, which is a very nice space to be. As I was talking earlier about de-commoditizing waste when we use a consultative approach, you make yourself stick with customers - they need you.

Monadnock Paper Mills also echoed this sentiment in their case study.

As we turned to the last questions pertaining to the Triple Bottom Line (F-19) and Corporate Social Responsibility (F-20), Mr. McDonnell commented:

We have used the Sustainable, Environmental & Economic Development (SEED®) model to create a 'win-win' for our communities and for the company. We are giving scholarships to students in communities where we operate landfills and, the towns receive a royalty based on the number of tons that pass through the gate toward their tax base. The gas pipeline in Old Town, ME to the University of Maine is a great SEED® partnership, even though some people are not necessarily doing cartwheels over having a landfill in their backyard." Mr. McDonnell added; "I see opportunities in creating a Casella Waste Systems Foundation to formalize our Corporate Social Responsibilities priorities within our host communities.

In concluding our interview, we discussed the waste industry in general as being conservative and not very progressive, Mr. McDonnell said; "If you use the business school concept of early adopters in our industry we (Casella) are early adopters."

Interview with Dr. Dingrong Bai, Senior Process Engineer

Dr. Dingrong Bai is the Senior Process Engineer and has a Ph.D. in Chemical Engineering. He works in research & development (R&D) on a convergent technologies project; which involves converting post-recycled material into useful products like power, thermal energy or chemicals. Thermal energy is simply heat for space heating, space cooling or steam used in industrial processes. He had been at Casella for two years at the time of his interview and brought a new employee perspective to the case study.

Dr. Bai described Casella as having a strong commitment to sustainability and environmental protection (B-5) by focusing on greenhouse gas reductions and the material re-use and recycling, giving waste material a second life (B-3). He thinks the company has a very strong commitment to optimization and the company philosophy speaks strongly for sustainability, which were factors that appealed to him in working for Casella.

When asked whether Casella is a sustainable enterprise (A-1) and operates within the carrying capacity of the Earth (A-2), Dr. Bai replied:

Solid waste is collected and sent to our material recovery facility and the case may be a portion of recovered materials goes to the recycling market, then we have some materials due to their physical properties are too small or can't be separated from the waste stream or there is no central market to take the material. In these cases, we still end up with a huge amount of material buried in a landfill. From a material optimization standpoint, we can give all of those waste materials a second life and perhaps generate revenue from them.

In explaining the chemical process in more detail, Dr. Bai continued:

The chemical part involves trying to convert recycled materials through a chemical conversion process that involves gasification. The material is converted into hydrogen and carbon molecules, which are building blocks for a number of chemical reactions. For example, if you get the right form of carbon and hydrogen you can make polymers, you can make plastics or fibers, which gives recycled materials a new form. That is how I see the chemical conversion process. You cannot look at recycling only as a physical act; you have to look at it from a chemical/molecular level for material recycling. According to conservation law, hydrogen is always hydrogen and carbon is always carbon. Recycling to re-use is a very important concept and is motivating to both Casella and me.

At this point, Dr. Bai referred to the *first law of thermodynamics*, which states that matter and energy are not created or destroyed according to the laws of energy conservation. This made an important connection to the underlying scientific principles within the Eco-Sustainability Conceptual Framework, and for Casella it meant recycled materials could have a second, third, or fourth life. Dr. Bai continued:

Yes, you can really do this. There is no finite for this material. Hydrogen is always hydrogen, and carbon is always carbon, it cannot be destroyed, no matter how many times you recycle it. Please make a very clear distinction between the physical/conventional recycling, and a chemical/ molecule level of recycling. It is like taking recycled materials back to its original form, to the molecules itself and fast-forwarding what would take nature millions of years to make in hydrocarbons like a fossil fuel. Other companies have traditional options, but we are looking beyond this. Casella is probably the only company looking at these solutions, that is why I give the company a 4 rating (100%) as a sustainable enterprise and a 3 rating (75%) rating for operates within the carrying capacity of the Earth.

When addressing how the company culture has been a source of innovation (B-4, E-16), Dr. Bai stated:

I think innovation has been important for this company from what I can see in R&D to how the company is promoting the single stream Zero-Sort® Recycling. All of these innovations are put into practice. One of my jobs working in R&D is using post-recycle residues to make a useful engineered feedstock (fuel). We have filed three U.S. patents to see if our engineered approach in terms of physical and chemical properties is solid and we have received intellectual property (IP) in this area. Another thing I am proud of is our engineering post recycling material IP. We can make the fuel with higher useful values, like the heat content or chemical properties from waste.

Next, we discussed the CEO and senior management team having a commitment for sustainable practices (E-15) to which Dr. Bai responded:

If you talk about senior management, it should be a 4 rating (100%). At the end of the day it is still a business, you are driven by shareholders satisfaction for your business performance so sometimes in R&D you respond to this approach, sometimes you don't, but that does not mean that senior management is less supportive just because of the business situation. In that way, I would give us a 3.5 rating (88%).

In each interview, Casella's Intranet was discussed as a key communication tool, with training modules and news and information from their different locations. With over 150 facilities, their Intranet serves a critical need to stay in touch and keep up on the latest technical training and protocols within Casella. Dr. Bai said, "Training employees is a big area with safety, the environment and all those work-related areas. We are constantly updating the Intranet providing a very nice explanation. I think the rating should be 3.5 (88%)."

Around the topic of LEED efforts and retrogrades to older buildings (C-9), Dr. Bai talked about Casella's activities in renewable energy, including wind power, solar PV technologies, and landfill gas to energy as options in generating electrical power. Dr. Bai

had personally visited a solar supplier on a project to install solar arrays to offset Casella's grid power usage.

Under the Eco-Tracking (D) activities, Dr. Bai noted:

When I worked on a project, a very common tool is using life cycle analysis. We start from the conceptual development to look at it from the life cycle perspective, examining effects on the carbon footprint, any air pollution compounds and effects on the environment. Much of our work before was to optimize waste management options, now we look at what is more beneficial in terms of social, environmental and economic benefits. We look at all three aspects along with how to utilize waste. We examine if it is going to be better to simply burn it, send it to the landfill or to a conversion process to make a methanol into bio-diesel. For each aspect, we have developed methodologies to evaluate and to assess optimizing material usage and resource optimization.

In the Eco-Advantage Mindset category (E), we discussed how Casella applies a sustainability lens to identifying new opportunities (E-16). Dr. Bai shared:

The multi-material processing platform we are working on takes post-recycling residues to make a beneficial use. This represents a huge business opportunity, huge benefit for the environment, and huge benefit for energy security to the company especially when you consider almost 60% of waste generated in the U.S. is buried in landfills. If you can use this material as an energy source, it adds resources. Energy has value, when we look at it as a chemical compound.

In addition, Dr. Bai shared: "We are a participant in the EPA's Climate Leaders program as a charter member. Not only was Casella the first solid waste recycling company, we were the only one in the whole country. That is why I am saying Casella is really taking a leading role with resource optimization."

When we covered how Casella manages and evaluates for innovation Dr. Bai replied:

I am a chemical engineer and at this stage in our work process, we are trying to establish a leading role in developing intellectual properties (IP) to protect our technology. You have to be innovative. For example, our role is to control emissions; to prevent and minimize emissions generated from the conversion process. Traditionally, you generate emissions first, and then deal with the emissions controls and removal processes. We are focusing on reducing the

emissions generated from the very beginning. If we do that, we will save a lot of money on emission controls. It is good economically and it is good for the environment as a result. That is why we are so proud of our engineered feedstock (fuel) development.

In concluding our interview, Dr. Bai summarized:

This is a legacy business, we are doing something for people, and for society even though sometimes people do not like us because we are in the waste business. Everybody should take responsibility for their waste and its impact on people's lives, the economy and the environment. We are working hard to find ways to manage waste, to give waste a second or third life to maximize this material. We are doing a good job contributing to this development process and environmental protection, and we contribute to energy security. It has really motivated me to work for this company...You would not think of it as boring here because it is so diverse. As a chemical engineer, I am always dealing with materials and I get a chance to deal with gases, solids and liquids, all three phases of materials on a daily basis. I am dealing with environmental issues, people's perspectives, social and general public issues. I have the ability to find solutions to treat this material, not to pollute and at the same time generate an economic benefit to the company. It is not to create any pressures on society and at the same time, it is good for the shareholders. It is really a challenge, when we have to do everything to make everybody happy. People do criticize about the recycling sorting, that is why Casella has the Zero-Sort® Recycling and the material recovery facilities. All of our approaches are a means to increase the recycling rate here in the U.S. because as a nation, on average we only have a 30% recycling rate. We can do much better than that.

Interview with Paula Calabrese, Director of Strategy & Intellectual Property

Paula Calabrese, Director of Strategy & Intellectual Property is responsible for developing a climate change policy and for collaborative efforts with State and local partners in this area. Prior to coming to Casella, she was a Vice President at Tokyo Electron America leading intellectual property and strategic programs where she worked in global IP rights, innovation and the development of Environmental Management Systems.

When asked to describe Casella as a sustainable enterprise that produces profits while protecting and restoring the environment and improving the lives of the stakeholders with whom it interacts (A-1), Ms. Calabrese responded: "It certainly is close

to our mission statement. To give resources new life, with resource renewal where we balance the economic and environmental costs associated with choices our customers make in waste management.” In defining ways Casella operates within the carrying capacity of the Earth (A-2) Ms. Calabrese answered:

We have service offerings that are heavily weighted towards recycling. We do all we can in terms of processing material to get it back into the manufacturing stream so it can displace virgin materials, which is a huge benefit from an energy and resource scarcity perspective. We are moving very quickly in advancing changes to our truck fleet to protect the environment related to associated particulates in the air. Right now, we are working in a R&D capacity with a company that has a dual fuel technology for heavy-duty trucks. Whereas a truck can run on diesel fuel and CNG, all geared towards reducing emissions. The fact is we design and build gas collection systems in landfills to collect more gas than is necessary by permit conditions for having low emission landfills. It means investing capital earlier in the lifecycle of the landfill to capture the gas for reducing methane emissions, which has global warming potential; methane is 23 times of that total.



Figure 20. Casella Site (Photo Courtesy of Casella)

When asked to describe how Casella’s leadership contributes to a culture of environmental sustainability (B-5, E-15), Ms. Calabrese replied,

I think it is obvious. John Casella, Doug Casella and the rest of the senior leadership team are absolutely committed to it. A day doesn’t go by when you don’t hear one of them say, “should we be doing that or why should we be doing it that way?...They are supportive of our work as climate leaders and being the first solid waste recycling company to join EPA’s Climate Leaders Program. There is a recycling company in the program now, but Casella is still the only solid waste and recycling company in EPA’s Climate Leaders Program. John and Doug are absolutely 100% leading the charge. It is nice that it is actionable and not just talk. I believe we are industry leaders with everything from our low emission landfills to

focusing on making recycling economically and environmentally sustainable. Our competitors struggle to do that. For many years, recycling was viewed as a loss leader. You only offered recycling when you had to keep the waste customer. Our philosophy is entirely different; we lead with recycling for our customers.

Concerning Casella's business strategy to lead with recycling as a competitive advantage, Ms. Calabrese said,

Yes, I still think the legacy industry is very cost-sensitive. When customers want to dispose of something, they want to dispose of it at the least possible cost. Our customers have changed over the years, especially in the last few years in particular. Now we see customers wanting to get rid of something at the lowest cost, but in an environmentally responsible way. They do not want to see tires on the side of the road; they want to see waste managed responsibly. Each year customers are moving a little bit closer to understanding the importance of sustainability, which is reflected in the decisions they make about their own waste disposal and recycling impact. Hence, we are hearing and seeing a lot of movement in the customer domain, still, cost is a big factor.

Ms. Calabrese identified their customer base as primarily located in rural areas in residential and commercial markets. Casella's geographic focus is in New England and New York State where the company got started. In describing how Casella applies an environmental sustainability lens to their activities, she summarized:

I think from our solid waste operations to our landfill operations we look for ways to minimize landfill gas emissions. We understand how important this is to the world's greenhouse gas footprint, so we make capital-spending decisions based on what we can do to mitigate greenhouse gas emissions. We make decisions about our truck fleet not only based on greenhouse gas emissions, but also particulate emissions. Our capital investments are in recycling facilities where we can drive significantly higher recycling participation. These decisions dictate where capital allocation would happen sooner, than in areas where we cannot drive the same recycling performance. Even though, we are not Triple Bottom Line by a formal public statement, we think about it and use it in our decision-making.

When asked to discuss how the company culture has been a source of innovation, Ms. Calabrese responded:

The company founders were innovators in delivering services and solving problems from a small business level to now, it has been in the DNA of this company from the very beginning. It is about 'how' can we do it and do it faster and better than

our competitors, I think it is embedded in the fabric of our company. As the business has grown and things have gotten more complex with public company reporting requirements, innovation has not been lost. We are innovating to solve problems and that is an exciting part of this company. Innovation is always exciting and you innovate to make a product better, but from a personal perspective, people here are innovating for solving environmental problems that will make a difference not only during their life but also for their children and for future generations. Internally we are seeing a completely different mechanism and feeling for innovating in a space that is so personal as opposed to a space that is going to generate the next dollar in profit. Not that they are mutually exclusive, but there is a different inner motivation in people to spur the type of innovation we are seeing.

Next, Ms. Calabrese spoke about the innovation she is most proud of at Casella:

The innovation that is important to me is our 'engineered feedstock' (a proprietary term), in taking waste material and making it into hydrocarbon substitutes; materials used to generate energy and not discarded in landfills. Being able to characterize this material, to understand what its carbon and hydrogen content are and being able to put that into a form to generate energy while displacing fossil fuels. Whether it goes into a process boiler for fuel, gasified to make a synthesis gas to create electricity, or however you use it, I think this area of innovation is personally the area that I am most proud of and find rewarding.

Related to this innovation and others, are intellectual property issues and patents. Ms. Calabrese confirmed Casella has 13 issued patents and an estimated portfolio of pending patents of 50-60, which has occurred in a fairly, short five-year period, serving as a tribute to Casella's ability to innovate as a competitive advantage, particularly in an industry that doesn't traditionally have patent portfolios.

In the Eco-Scorecard category of Eco-Redesign (C), Casella does not use Design for the Environment (DfE) since they are service-based, although their R&D efforts in engineered feedstock holds potential and the methane they produce could both be considered as products and closed looped systems (C-8). Another closed looped example is Casella's 50% joint venture partnership with Louisiana Pacific in a company called U.S. Green Fiber, LLC that makes cellulose insulation out of recycled newspaper used as a green building product. In addition, Casella sells recycled materials to manufacturers

like Procter & Gamble and other companies that use this type of material. In their Sustainability Report, Casella does document Global Reporting Initiative (GRI) Scope 1 and Scope 2, direct and indirect emissions. Since 2009, Casella has been measuring their Scope 3 footprint using a hybrid life cycle analysis based on purchasing data utilized by an external consultant that specializes in this type of work.

Under Green Building and LEED activities (C-9), Casella has installed all new energy efficiency lighting using motion detectors and have zoned their building for heating and cooling optimization. In addition, they are doing a renovation/expansion at their Customer Care Center that will be LEED certified along with indoor/outdoor lighting improvements made at the Material Recovery Facility in Rutland, VT. On the Eco-Scorecard, high rating under the Eco-Tracking category reflected Casella's use of a material database, Life Cycle Assessments, risk management and close monitoring of environmental indicators. In addition, Casella uses internal audits for compliance purposes, with over 150 facilities included in their ecological footprint, each one gets a compliance audit depending on the type of facility (i.e., sales office are audited once per year, while transfer station are audited on a quarterly basis). Casella is considering an alternative Environmental Management Systems like the International Organization for Standardization: 14001 for future use. Eco-Scorecard (percent) ratings were highest in the categories of Eco-Culture, Eco-Advantage Mindset and Eco-Tracking with lower ratings for Eco-Redesign, Sustainable Enterprise and the Triple Bottom Line.

Our last question dealt with Casella taking responsibility for their impact on society and the environment. Ms. Calabrese shared:

We are strategic in being responsible to the communities that host us. In some communities, we do recycling education and in others, they prefer our help with fire

drills or donations of electronic defibrillators. We really listen to our host communities so we can best meet their needs. That speaks to how we have designed our Corporate Social Responsibility program, it is not a one size fits all. The entire management team supports these efforts and if you pushed me to say who oversees Corporate Social Responsibility, I would say it is John Casella, our Founder & Chairman of the Board. The senior leadership team has empowered all of our local operating divisions to be involved in the fabric of their communities including; employee volunteering and making individual donations at the divisional level as opposed to everything send to corporate. We would like to do more with contributions for environmental scholarships to students.

In conclusion, Ms. Calabrese said, “I think your Eco-Sustainability Conceptual Framework is very interesting and insightful. When I sat back and really looked at it, I thought Shelley really cut across all kinds of dimensions within our business, and how we design our strategy and execute against it. It is hard to do that with a service-type offering as opposed to a company manufacturing a product.”

Eco-Scorecard Results

The results of the participant evaluations on the Eco-Scorecard were compiled and presented on the following Eco-Scorecard. The ratings offered by participants were converted to percentages, as noted in the methodology.

Casella Waste Systems Eco-Scorecard Results

A.	Key Performance Indicators for Sustainable Enterprise	Baseline 2008	Year 1 2009	Year 2 2010
1.	A sustainable enterprise is one that produces profits, while protecting and restoring the environment, and improving the lives of the stakeholders with whom it interacts.	71%	81%	84%
2.	Company operates within the carrying capacity of the Earth.	63%	66%	66%
	SUB-TOTAL	67%	73%	75%
B.	Key Performance Indicators for an Eco-Culture			
3.	Eco-expense reduction to cut environmental costs by not wasting natural resources and by avoiding regulatory burdens due to pollution or waste disposal.	75%	80%	80%
4.	Company uses Stretch Goals as a driver for innovation and eco-sustainability. *Company applies a sustainability lens to getting things done.	79%	88%	88%
5.	CEO and Senior Management have a commitment for sustainable practices and environmental stewardship. *Money and incentives tied to eco-accomplishments. *An environmental ethos reflected in the mission/vision/values.	88%	75%	75%
6.	Storytelling of the eco-successes and lessons learned in CSR/Sustainability/EHS Reports. *Eco-training, a form of knowledge sharing which contributes to innovation is available. *Jobs titles reflect responsibility for sustainability.	66%	72%	75%
	SUB-TOTAL	77%	78%	80%
C.	Key Performance Indicators for Eco-R redesign			
7.	Utilizes Design for the Environment (DfE) to help customers reduce their ecological footprints and designs out environmental problems. *Company understands the environmental market drivers.	71%	75%	75%
8.	Use of Closed-loop Systems	62%	58%	62%
9.	Green Building and LEED Certification, *Retrofitting existing buildings for energy efficiency.	54%	62%	62%
10.	Supply Chain Audits	50%	52%	52%
	SUB-TOTAL	59%	62%	63%
D.	Key Performance Indicators for Eco-Tracking			
11.	Company uses Life Cycle Assessments to measure ecological footprints and understand environmental impacts and ecological consequences of the products/processes along the value chain. *Supply chain adjustments.	71%	72%	75%
12.	Develop a Core Set of Environmental Indicators that track energy use, water and air pollution, waste generation and compliance. *Data/Metrics of Inputs and Outputs are used.	71%	80%	84%
13.	Establish a Materials Database to determine what is in your products or connected to your processes.	67%	75%	78%
14.	Environmental Management Systems (EMS) for environmental and risk assessment or *Environment, Health & Safety practices.	71%	75%	75%
	SUB-TOTAL	70%	76%	78%
E.	Key Performance Indicators for Eco-Advantage Mindset (Genesis/Organic Process)			
15.	CEO's Commitment to Sustainability and Environmental Strategy – top down support. *Doing the right thing that reflects values do matter within the organization.	83%	77%	94%
16.	Company is using a sustainability lens to ID new opportunities. *Company is placing a focus on Innovation.	83%	77%	77%
17.	Company establishes dialogue with both friends and foes. *SME engages in local community building. *SME is involved with Stakeholder engagement and eco-activities.	62%	68%	68%
18.	Leadership makes decisions with the long-term in mind for a tighter regulatory framework, rising customer expectations and market realignment driven by natural constraints. *SME places a value on higher employee retention, stronger customer loyalty and higher brand value. *Leadership looks at the whole value chain from raw materials to suppliers who meet customers' environmental needs, to product end of life.	71%	80%	80%
	SUB-TOTAL	75%	81%	83%
F.	Key Performance Indicators for the Triple Bottom Line (TBL)			
19.	The Triple Bottom Line Approach, which encompasses sustainability as the intersection of economic, social and environmental performance is used.	58%	72%	75%
20.	Corporate Social Responsibility (CSR) is a concept whereby organizations take responsibility for their impact on society and the environment.	66%	75%	75%
	SUB-TOTAL	62%	73%	75%
TOTAL SCORE		69%	74%	76%

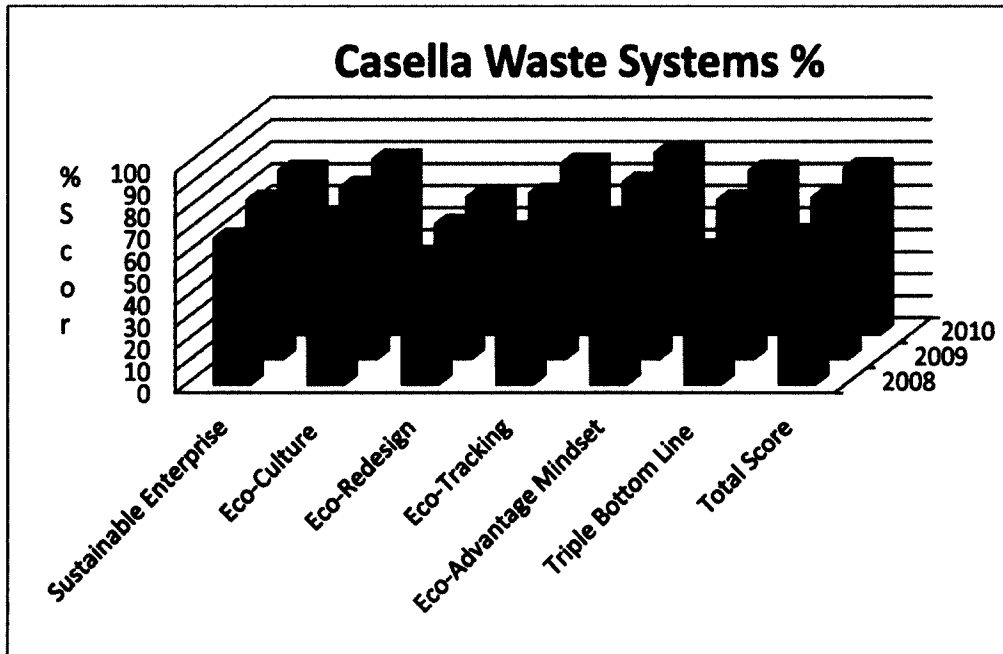


Figure 21. Casella Waste Systems Scorecard Percentage Scores

Analysis of Interview Data

Qualitative analysis of the three Casella transcribed interviews was used to identify themes as they relate to the Eco-Sustainability Conceptual Framework and Eco-Scorecard. The key invariant constituents are provided in Table 8-1 below as they relate to the Eco-Sustainability Conceptual Framework. Tables' 8A-8F in Appendix I represents the full variety of participant responses, inclusive of the single responses, used in the cross-case analysis in Chapter 9.

Table 8-1

*Key Invariant Constituents of the Eco-Sustainability Conceptual Framework by
Category: Casella Waste Systems*

Themes and Key Invariant Constituents	# participants to offer this experience (n=3)
A. Key Performance Indicators of Sustainable Enterprise	
(A-1) Innovation and commitment to optimization and focus on diversion with recycling	2
(A-2) Use of gas collection systems in landfills and converted trucks to operate within the carrying capacity of Earth	2
(A-2) Purpose to reduce carbon footprint	2
(A-2) Service weighted toward recycling, processing material to return to manufacturing stream	2
B. Key Performance Indicators for an Eco-Culture	
(B-3) Company focused on/committed to recycling	2
(B-4) Mainstreaming Eco-Culture through innovation for customer ease	3
(B-5) Very strong leadership committed and have a vision	2
(B-5) Lead with recycling; customers moving more to environmental responsibility	2
(B-5) Investment in the employees	2
(B-5) Company mission aligns with eco-sustainability goals	2
C. Key Performance Indicators for Eco-Redesign	
(C-8) Utilizing recycling to create closed-loop systems	2
(C-9) LEED certified	2
(C-9) Trading out fluorescent light bulbs	2
D. Key Performance Indicators for Eco-Tracking	
(D-11) Use a lot of life cycle analysis	2
(D-13) Use of materials database to analyze the processes and waste	3
E. Key Performance Indicators for Eco-Advantage Mindset	
(E-15) CEO is committed and supportive	3
(E-16) Focus on innovation with processes aligned with the idea of resource optimization	2
F. Key Performance Indicators for the Triple Bottom Line	
(F-19) Company subscribes to the Triple Bottom Line approach	2
(F-20) Company does well in terms of corporate social responsibility, especially on the local level	2

A. Sustainable Enterprise

Common statements among interview participant perceptions included; that the company is committed to innovation in terms of optimization and a focus on diversion with recycling (2 participants), the service weighted toward recycling and processing material to return to the manufacturing stream (2 participants), a purpose of reducing the carbon footprint (2 participants), and gas collection systems in landfills and conversion of trucks to help operate within the Earth's carrying capacity (2 participants). In addition to these commonly mentioned statements, interview participants offered unique insights into this thematic category, which included that the process enabled returns for the customer, material recycling at the molecular level and the possibilities for infinite reuse.

There were four invariant constituents commonly noted by the interview participants at Casella related to this first section of sustainable enterprise, each noted by two participants. Interview participants described the company's commitment to optimization of resources with innovative recycling. "Casella has a very strong commitment to sustainability and environmental protection by taking seriously the greenhouse gas reductions and the material re-use and recycling. Casella is giving waste material a second life. The company has a very strong commitment to optimization. The company philosophy speaks strongly" (Dr. Bai). "We do a very, good job with balancing the need to have a sustainable business model not just from a profit standpoint but from an environmental standpoint as well. Obviously, our focus on diversion with recycling is at the core of what we are, and what we do and how our customers know us" (Mr. McDonnell).

The services offered through Casella to the customer remain focused on recycling and returning material to the manufacturing stream. For example, Ms. Calabrese and Mr. McDonnell spoke to this:

We have service offerings that are heavily weighted towards recycling, so we do all that we can in terms of processing material to get it back into the manufacturing stream so it can displace virgin materials, which is a huge benefit from an energy and resource scarcity perspective. We are generally moving very quickly to advance changes to our truck fleet to protect the environment from particulates and associated air emissions. (Ms. Calabrese)

The carrying capacity of Earth is the way I always think that we operate. In that area, we are trying to get our customers to divert every piece of waste that they can, we do not like to call it waste, so we call it material. You can do one of two things with waste, you renew it or you retire it. When I say retire it, you are putting it into a landfill where it takes a long time to break down. With our resource optimization model, we are always encouraging our customers to think outside the box of normal waste disposal, i.e. a landfill and try to drive diversion of recyclables. (Mr. McDonnell)

The company has instituted changes in operations, such as capping old landfills, gas collection systems at landfills, and conversion of trucks to use compressed natural gas (CNG). For example:

We are working right now in a R&D capacity with a company that has a dual fuel technology for heavy-duty trucks. Therefore, a truck that can run on diesel fuel and CNG reduces emissions. The fact is we design and build gas collection systems in landfills to collect more gas than is necessary by permit conditions in order to have low emission landfills. This means investing capital earlier in the lifecycle of the landfill to be able to capture that gas to reduce methane emissions, which has global warming potential. (Ms. Calabrese)

These changes are incorporated to help reduce the carbon footprint, not only of the company, but also of our customers, as noted by Dr. Bai, “The purpose of course is to reduce our carbon footprint for the benefit of the environment and economically; natural gas is cheaper. So not only are we reducing our carbon footprint and waste, we are reducing our customer’s carbon footprint and waste.”

Interview participants offered insight into company initiatives for innovative recycling processes. Dr. Bai explained:

The chemical part involves trying to convert recycled materials through a chemical conversion process that involves gasification. The material is converted into hydrogen and carbon molecules, which are building blocks for a number of chemical reactions. For example, if you get the right form of carbon and hydrogen you can make polymers, you can make plastics or fibers, which gives recycled materials a new form. That is how I see the chemical conversion process. You cannot look at recycling only as a physical act; you have to look at it from a chemical/molecular level for material recycling. According to conservation law, hydrogen is always hydrogen and carbon is always carbon. (Dr. Bai)

B. Eco-Culture

Several key statements emerged from the analysis of the interview data related to this thematic category. The data demonstrated the common invariant constituents of (a) a company focus on and commitment to recycling (2 participants), (b) the company serving to mainstream Eco-Culture through innovation for the customer (3 participants), (c) a very strong leadership commitment and vision for sustainable practices (2 participants) and investment in the employees (2 participants), (d) moving customers toward more environmental responsibility (2 participants), and (e) a company mission that aligns with eco-sustainability goals.

Pertaining specifically to the Eco-Culture, five themes were identified from the interview data. Interview participants commented on the leadership commitment to and a vision for environmental sustainability and practices, along with a company focus on recycling, not only for the company, but also in addition to moving customers toward a greater level of environmental responsibility. The following statements best described these perceptions:

I think it is obvious. John Casella and Doug Casella and the rest of the senior leadership team are absolutely committed to it. I do not think a day goes by when

you do not hear one of them say, “should we be doing it and why should we be doing it?” They are supportive of our work and being the first solid waste recycling company to join Climate Leaders. There is a recycling company in there now, but we are still the only solid waste and recycling company as a member. John and Doug are absolutely 100% leading the charge. It is nice that it is actionable and not just talk. (Ms. Calabrese)

This commitment is also evident in the investment in employees and changes in the community. Mr. McDonnell noted; “The investment in the employees has been huge from a financial and time standpoint.” Ms. Calabrese described the leadership commitment and the changes in the customers over the years, mainstreaming the eco-sustainability concepts and ideology:

For many years, recycling was viewed as a loss leader. You only offered recycling when you had to keep the waste customer. Our philosophy is entirely different. We really lead with recycling...Each year customers are moving a little bit closer to understanding the importance of sustainability and the decisions that they make about their waste disposal and recycling impact. Thus we are hearing and seeing a lot of movement in the customer domain, still cost is a big factor.

Mr. McDonnell also noted the importance of mainstreaming these concepts, noting, “You have to make Eco-Culture mainstream. The people who are purchasing our services must understand it. We work to make them understand what it does for them.”

C. Eco-Redesign

A few common themes emerged from the data within this category, which included (a) use of closed loop systems, and (b) green LEED compliance and certification. Two interview participants described examples of the use of closed loop systems at Casella. These descriptions included:

Casella is a 50% joint venture partner with Louisiana Pacific in a company called U.S. Green Fiber that makes cellulose insulation out of old newspaper. It is a green building product; you do not get any greener than that. I am thinking that is an example of closed-loop system. We recycle newspaper and then our Charlotte, NC recycling facility takes it to U.S. Green Fiber’s plant so at the end of our recycling

line is all those newspapers that dump directly into U.S. Green Fiber's manufacturing line. You will see that in our Annual Report. (Ms. Calabrese)

A perfect example is New England Organics that processes food waste. We are working with a company to take their food waste, process it into organic material i.e. compost and sell it under their private label. That is a complete closed loop system. (Mr. McDonnell)

Mr. McDonnell also noted that the innovation in the truck conversions to compressed natural gas is another example of a closed loop system.

Our exploration into alternative fuels is something I am proud of at Casella. The fact that we are pursuing a significant investment into a compressed natural gas (CNG) fleet is impressive. We launched our first CNG truck with two more we purchased on-line. CNG runs much cleaner than diesel gas. I would not call it a renewable resource, but in a way, it can be since the methane gas from our waste-to-energy landfill could be converted into CNG. Therefore, the idea of collecting waste on CNC trucks powered from our waste-to-energy landfill is impressive, and the ultimate closed loop system.

The interview participants described the efforts of the company to meet LEED, specifically in terms of trading out light bulbs, and the use of hydro, wind, and solar power as alternative energy sources. For example, Ms. Calabrese discussed LEED certification and actions:

Under the U.S. Green Building Council LEED certification, there are requirements for property owners doing a major renovation. If they want that renovation to be LEED certified, they have to deal with supply vendors like Casella that have authorized lead disposal outlets and recycling outlets. We have some of those and it is kind of a location-by-location situation, whether we have those lead certified options available for customers. In our own facilities, we have motion detectors, all new efficiency lighting and we zone quite a bit. We are doing a renovation/expansion to our customer care center, and that renovation will be LEED certified.

In addition, Dr. Bai expanded on using alternative energy sources at Casella:

We are looking at wind; we also looked at solar PV technologies. We look into how to re-use our leachate as water and how to use that for renewable energy sources. Landfill gas to energy plant to generate electrical power and all those renewable energy options we are exploring. I personally visited a solar supplier so we can install a few solar arrays for power to offset our grid power usage.

D. Eco-Tracking

Themes emerged from the data related to the use of Life Cycle Assessments and materials database to track materials use and recycling. The interview participants described the use of materials database and Life Cycle Assessments as part of their approach to Eco-Tracking. Mr. McDonnell noted the use of the materials database by saying; “Establishing a materials database connected to your process; that is the SAP® system.” Two interview participants also noted Life Cycle Assessment as follows:

When I work on a project, a very common tool is life cycle analysis. In each project, we start from the conceptual development looking at it from the life cycle perspective. What are effects on our ecological footprint, for the carbon or air pollution on the environment...A lot of our work before was to optimize waste management options. Now we look at what is more beneficial in terms of a social benefit, the environmental benefit, and the economic benefit. We look at those three aspects. How are you going to use this waste? Is it going to be better to simply burn it, send it to the landfill or to the conversion process to make methanol into bio-diesel. For all these scenarios, we have developed methodologies to evaluate and to assess optimizing material usage and resource optimization. (Dr. Bai)

We are actually training our people on how to catalog greenhouse gas emissions from the bottom-up. Therefore, it starts with the hauling companies, the transfer stations and landfills. How we are cataloging this and reporting it. I think we are very sophisticated and consistent with how we treat our greenhouse gas emission monitoring. Where I think the next step we have to go is articulating to customers how we can reduce their ecological footprints. (Mr. McDonnell)

D. Eco-Advantage Mindset

Two common statements (invariant constituents) among the Casella interview participants described the commitment of the leadership of the company and the focus on innovation with processes aligned with the idea of resource optimization. The leadership commitment is critical to the company culture and attitude. In this case, the leadership demonstrates a commitment to sustainability in practice; for example, interview participants cited:

We are always searching for new products derived from closed loop systems. At the last strategic planning session, is when that whole bagging process originated. I think we do a great job. Our CEO's commitment is supportive... Our strategic process is aligned with our resource optimization business model. (Mr. McDonnell)

The company's management team uses a sustainability lens as described by Dr. Bai, "The multi-material processing platform we are working on takes the post recycling residues to make a beneficial use. This represents a huge business opportunity, huge benefit for the environment, huge benefit for the energy security to the company if we can use this material."

F. Triple Bottom Line

This thematic category revealed common invariant constituents among the interview participants, inclusive of the company subscribing to the Triple Bottom Line and the active participation in corporate social responsibility, particularly at the local community level. The Triple Bottom Line is a commonly used term at Casella.

According to Dr. Bai, "Here people talk all the time and call it the Triple Bottom Line."

This concept of the Triple Bottom Line within Casella was perhaps most evident in the words of Mr. McDonnell:

I think there was a philosophy five to seven years ago that being green just was not sustainable from an economic standpoint. That somehow you were on the bleeding edge instead of the leading edge. Today, all of our business models are proving that you can do the right thing and actually make money. The idea of the Triple Bottom Line is very true for us.

In addition, the company rated well in terms of their Corporate Social Responsibility. According to Ms. Calabrese, this is particularly true at the local level:

We do a lot in terms of Corporate Social Responsibility (CSR) especially in the communities where we operate. We may host a landfill or a recycling center or large maintenance facility. Our senior leadership team has empowered all of the local operating divisions to be in fabric of their community and encouraging employees to volunteer. They are empowered to make donations at the division

level instead of sending it up to corporate. Because what might be one community's need is not another community's need. We would like to do more in terms of being able to support environmental scholarships. Our mindset is hearts, heads and hands all working together. Our people in the field really try to support their local communities with their specific needs. We have a SEED™ that is our trademark and we have a patent pending application to address sustainable economic and environmental development.

This Corporate Social Responsibility extends directly into education for the community in terms of eco-sustainability. Ms. Calabrese commented:

We are being strategic in our responsibility to the communities that host us. In some communities, we do recycling education, in other communities; they want help with fire drills or donating electronic defibrillators. We really try to get the community to communicate their needs to us and that really speaks to how we try to design Corporate Social Responsibility programs, it is not one size fits all. (Ms. Calabrese)

Summary of Findings and Conclusions

Through the analysis of the interview data providing invariant constituents related to each category, several overarching themes were revealed. These themes represent overall commonalities of the perceptions and experiences of the Senior Management participants related to the Eco-Sustainability Conceptual Framework and Eco-Scorecard.

The following themes represent the common responses of interview participants from Casella:

Theme 1: Company and leadership values and commitment to eco-sustainability manifest in the commitment to innovation to optimize resources and reuse/recycling to ensure the reduction of the carbon footprint of both the company and the mainstream customers.

Theme 2: Company mission aligns with Eco-Scorecard key performance indicators and the company invests in its employees and Corporate Social

Responsibility, particularly at the local level, moving the company and the customers toward greater environmental awareness and responsibility.

Theme 3: Eco-Redesign and Eco-Tracking achieved through closed loop systems and LEED certification and processes, life cycle analysis, and materials database to ensure tracking and optimal use/infinite reuse of materials and waste.

Theme 4: Triple Bottom Line approach with leadership commitment provided a focus on innovation to support the resource optimization, Corporate Social Responsibility and community outreach, and ultimately, profits for the company.

The three interview participants from Casella senior management assisted the researcher in understanding and revealing the culture, innovation, and commitment of the company to eco-sustainability. The analysis of these three interviews with senior management professionals at the company revealed a leadership and company culture focused on innovation that can optimize resources and reuse/recycle, ensuring a general reduction in the human carbon footprint where they operate. The analysis of each of the three interviews revealed themes that served to provide an understanding of a company focused on eco-sustainability goals, supporting environmental awareness and responsibility within the company and among their customers on a local level.

To reach these goals, the company demonstrates a Triple Bottom Line approach with leadership commitment to sustainability, a focus on innovation for resource optimization, and Eco-Redesign and Eco-Tracking indicators such as

closed loop systems, LEED certification, life cycle analysis, and materials database in order to ensure the tracking of eco-sustainability practices and allow for the optimal use/infinite reuse of materials and waste. Finally, the company uses the Triple Bottom Line to also provide high impact Corporate Social Responsibility and community outreach to educate others and support company goals and profits.

CHAPTER 9

CROSS-CASE ANALYSIS

Coded interview data from each of the previously presented case studies were examined across the five individual cases to reveal commonality among the group related to the Eco-Sustainability Conceptual Framework and Eco-Scorecard. This *cross-case analysis* is used to develop overarching themes and conclusions of the data analysis for all of the case studies as a whole. The individual case studies each represent a northern New England company that is successfully practicing and participating in sustainability as a business practice. The results reveal key themes contributing to their success within this realm. The five case studies include:

1. New England Wood Pellet (NEWP)
2. New Chapter (NC)
3. Hitchiner Manufacturing Company (HMC)
4. Monadnock Paper Mills (MPM)
5. Casella Waste Systems (CWS)

The findings of the cross-case analysis of the interview data from the five case studies were developed from the categories in the Eco-Sustainability Conceptual Framework and discussion of the key performance indicators in the Eco-Scorecard. Specifically, these included thematic categories of (A) Sustainable Enterprise, (B) Eco-Culture, (C) Eco-Redesign, (D) Eco-Tracking, (E) Eco-Advantage Mindset, and (F) Triple Bottom Line. The results are presented according to these headings. Recorded responses are only indicated when key performance indicators pertaining to the thematic

categories (A-F) are specifically mentioned. In some instances, the key performance indicators could be implied, but not specifically mentioned. The Eco-Scorecard was used to verify each key performance indicator and the perceived commitment/action of the company in each regard. It is noted that under each heading/thematic category, interview participants may have provided more than one response relating to different aspects in the category. The results presented in this cross-case analysis include only mentioned key performance indicators found to be common among the different cases. Strong differences between cases are mentioned at the end of this analysis; however, the analysis remains focused on the commonalities among the five case studies.

Findings

A. Sustainable Enterprise

The first thematic category is *Sustainable Enterprise* and the organization's ability to operate within the carrying capacity of the Earth. In this thematic category, interview participants discussed aspects related to the mission of the company in terms of sustainability. Table 9-1 provides an illustration of the common key performance indicators revealed across all five cases. Of particular importance are several activities that were noted by interview participants across all or most of the case study companies. These activities included (a) striving to be sustainable with sustainability seen as a continuous process and a commitment to that process (noted within 5 of the 5 company cases); (b) the use of innovation to promote sustainability (among 5 of 5 cases); (c) sustainable practices in terms of the effective use of resources (5 of 5 cases); (d) sustainability as ingrained in the culture/mission of the organization (4 of 5 cases); and

(e) a consciousness of the environmental impact of the business and trying to neutralize that impact (4 of 5 cases).

Table 9-1

Sustainable Enterprise, Operating within the Carrying Capacity of the Earth

Sustainable Enterprise Key Performance Indicators	Number of participants to mention during interview discussion:					
	Case 1: NEWP (n=3)	Case 2: NC (n=3)	Case 3: HMC (n=3)	Case 4: MPM (n=3)	Case 5: CWS (n=3)	Total all Participants (n=15)
Striving to be sustainable/ continuous process/ commitment	1	2	1	1	1	6
Ingrained in culture/ mission		1	1	1	1	4
Consciousness of environmental impact (local and global) of business; try to neutralize impact (inputs vs. outputs)/ how operations effect environment (values & operations within carrying capacity)		2		1	1	4
Local sustainability			1	1		2
Balance of economics, social, environmental to produce profits while protecting people & environment			1	1	1	3
Innovation for sustainability	1	1	1	1	1	5
Focused on growth & getting more people to see the costs/benefits of sustainable practice	1					1
Balance of increasing production and decreasing consumption of energy & resources/ efficient use of resources (recycling)	1		1	1		3
Sustainable practices (recycling, reuse, sustainable sources)/ effective use of resources	1	1	1	1	1	5

B. Eco-Culture

The second thematic category revolved around the *Eco-Culture* within the organization. This thematic category is presented according to the following three tables involving eco-expense reduction, company culture and innovation, and storytelling/knowledge sharing. Most consistent across these company cases in terms of eco-expense reduction were descriptions of efforts toward continuous improvement in sustainability, efficiency, innovation to sustain, and the use of stretch goals for this purpose (across all 5 cases). In addition, the interview participants from each company described the organization's use of and commitment to recycling, combined with a company culture of reducing and energy reductions. Table 9-2 provides the frequencies between cases.

Table 9-2

Eco-Culture: Eco-Expense Reduction

Eco-expense reduction	Number of participants to mention during interview discussion:					
	Case 1: NEWP (n=3)	Case 2: NC (n=3)	Case 3: HMC (n=3)	Case 4: MPM (n=3)	Case 5: CWS (n=3)	Total all Participants (n=15)
Recycling	1	1	1	1	1	5
Using and producing renewable energy	1			1	1	3
Culture of reducing/ energy reductions/ company focus	1		1	1	1	4
International Organization for Standardization ISO:14001			1	1		2
Eco-sustainability lens: Continuous improvement in sustainability/efficiency, innovation, use of stretch goals	2	2	1	1	3	9

An essential aspect to the theme of Eco-Culture is the company culture along with the sources and use of innovation. For most of the case study companies, interview participants described the organizational culture as demonstrating an awareness and commitment to sustainability and practices, stemming from these same qualities in the company leadership (11 of 15 total participants from all five cases). In terms of innovation, interview participants described innovation as inspired by sustainability and stretch goals, particularly in the realm of energy reduction and reuse. Innovation was noted in all five cases as being part of the overall company culture to combine with and support sustainability practices. Table 9-3 provides an illustration of all the key performance indicators mentioned along with the associated frequencies to demonstrate the high frequency items across the five cases.

Table 9-3

Eco-Culture: Company Culture and Innovation

Company culture & innovation	Number of participants to mention during interview discussion:					
	Case 1: NEWP (n=3)	Case 2: NC (n=3)	Case 3: HMC (n=3)	Case 4: MPM (n=3)	Case 5: CWS (n=3)	Total all Participants (n=15)
<i>Company Culture</i>						
Awareness of sustainability & practices infused in culture/employee understanding	1	3				4
Leadership involved with employees	1	1				2
Company cultural commitment to sustainability	2	1		1	2	6
Leadership contribution: leadership committed/dedicated to eco-sustainability	2	3	2	2	2	11

Company culture & innovation	Number of participants to mention during interview discussion:					
Leadership is leading in the field				2	2	4
<i>Innovation</i>						
Innovation as part of the organizational culture	1	2	1		1	5
Need as an innovation driver	1			1		2
Innovation in energy reduction	1		1	1	1	4
Innovation for sustainability and stretch goals	1	1	1	1	1	5

Finally, as part of the construct of Eco-Culture, the interview participants discussed storytelling and knowledge sharing within the company and to the local community and/or customers. This knowledge sharing was supported through environmental health and safety reporting, the company website and other communication tools (such as pamphlets), specific job titles directed toward sustainability and communication, and a general focus on public awareness and education with customers and communities. These key performance indicators and their associated frequencies and occurrence between cases are provided in Table 9-4.

Table 9-4

Eco-Culture: Storytelling/Knowledge Sharing

Storytelling/knowledge sharing	Number of participants to mention during interview discussion:					
	Case 1: NEWP (n=3)	Case 2: NC (n=3)	Case 3: HMC (n=3)	Case 4: MPM (n=3)	Case 5: CWS (n=3)	Total all Participants (n=15)
Use of company website to communicate and disperse information	1	2			1	4
Evidence of job titles or departments specific to sustainability		1	1	2		4
Focus on public awareness/ education	1		1	1	1	4
Environmental health and safety reporting	1		1	2	1	5
Employee training for increased understanding	1	1	1		1	4

C. Eco-Redesign

The third thematic category of the analysis incorporated key performance indicators of *Eco-Redesign*, inclusive of Design for the Environment (DfE), closed loop systems, LEED/Green Building technologies, and supply chain audits. At least one individual from all the five cases reported the use of closed loop systems through efforts in recycling and reuse of materials. Most, but not all, specifically mentioned the use of high efficiency lighting (LEED compliant) as well as the use of supply chain audits. It is noted that although three of the organizations reported not using the EPA's Design for the Environment (DfE) specifically, the individuals in these instances reported the use of a similar mechanism for designing for environment. Table 9-5 provides an overview of the

key performance indicators noted by interview participants related to the category of Eco-Redesign.

Table 9-5

Eco-Redesign

Design for Environment Key Performance Indicators	Number of participants to mention during interview discussion:					
	Case 1: NEWP (n=3)	Case 2: NC (n=3)	Case 3: HMC (n=3)	Case 4: MPM (n=3)	Case 5: CWS (n=3)	Total all Participants (n=15)
Do not actually use EPA Design for the Environment (DfE)	2	1			1	4
Helping customers reduce their ecological footprint	2		1		2	4
Closed Loop systems through recycling and reuse	1	1	2	1	2	7
Green Building/LEED: retrofitting buildings	1	2				3
Green Building/LEED: use of high efficiency lighting	2		2	2	2	8
Green Building/LEED: use of alternative energy sources			1		1	2
Use of Supply Chain Audits		1	1	1	1	4

D. Eco-Tracking

The construct of the *Eco-Tracking* category reflects the use of key performance indicators that can measure and track the environmental impact of the business (carbon/ecological footprint) and constitutes the fourth thematic category of the cross-case analysis. These key performance indicators include the use of life cycle assessments (LCAs), materials database, environmental management system (EMS), and tracking the use of energy, generation of pollution and waste, and compliance. Analyzing the data

across the five cases, the use of a materials database and Life Cycle Assessments seem to contribute to the ability to track the organizational impact on the environment. All five case study companies reported tracking energy use, pollution, waste generation, and compliance issues. Table 9-6 illustrates the frequencies of these key performance indicators related to Eco-Tracking.

Table 9-6

Eco-Tracking

Key Performance Indicators	Number of participants to mention during interview discussion:					
	Case 1: NEWP (n=3)	Case 2: NC (n=3)	Case 3: HMC (n=3)	Case 4: MPM (n=3)	Case 5: CWS (n=3)	Total all Participants (n=15)
Use of Life Cycle Assessments		2	2	1	1	6
Tracking energy use, pollution, waste generation, and compliance	1	1	2	1	1	6
Materials Database	2	1	2	1	3	9
No formal EMS	1	1				2
EMS system in place for health, environmental, and safety practices			1	1	1	3

E. Eco-Advantage Mindset

The fifth thematic category of *Eco-Advantage Mindset* is used to describe a genesis or an organic type of progress toward eco-sustainability within the organization. Results within this category that were shared across the five case studies included the CEOs commitment to sustainable practices, leadership decisions for the long-term, using a sustainability lens to reveal and push for sustainable options and solutions to successfully optimize resources and to reduce the environmental impact of the

organization. Nearly every interview participant across all five case studies noted the significant commitment and foresight of the CEO and other leadership to support sustainable practices (13 of 15 participants, across all five organizations). This leadership tended to demonstrate vision of the long-term impact when making decisions, and tended to affect the inclusion of an Eco-Culture within the organization from the top down. Linking this category to innovation, individuals noted the use of a sustainability lens when seeking options and solutions to problems, inspiring innovative recycling and reuse to optimize resources. Table 9-7 provides these key performance indicators related to Eco-Advantage Mindset and the associated frequencies within and between case studies.

Table 9-7

Eco-Advantage Mindset

Key Performance Indicators	Number of participants to mention during interview discussion:					
	Case 1: NEWP (n=3)	Case 2: NC (n=3)	Case 3: HMC (n=3)	Case 4: MPM (n=3)	Case 5: CWS (n=3)	Total all Participants (n=15)
CEO Commitment to sustainable practices	3	3	2	2	3	13
Culture comes from the top down		2		1		3
Leadership decisions for the long-term	1	1	1	1	3	7
Sustainability lens: push for sustainable options & resource optimization	1	1	1	3	1	7

F. Triple Bottom Line

The sixth and final thematic category of the cross-case analysis incorporates the key performance indicators for the Triple Bottom Line in terms of sustainability as the intersection of economic, social, and environmental performance. Although interview

participants from only 4 of the 5 case study companies specifically noted the use of a Triple Bottom Line approach, from the analysis of the data, it can be implied that all five companies indeed employed a Triple Bottom Line approach to business. While for the sake of livelihood, these companies were concerned with profits, they each also demonstrated concern and commitment to their employees, local community members, and global connections, as well as were involved in their local communities. The key performance indicator of Corporate Social Responsibility was taken seriously in all five organizations in addition to the expressed philanthropic objectives of some of the case study companies. Table 9-8 provides insight into the common responses within this category and the frequency with which interview participants mentioned these key performance indicators.

Table 9-8

Triple Bottom Line

Key Performance Indicators	Number of participants to mention during interview discussion:					
	Case 1: NEWP (n=3)	Case 2: NC (n=3)	Case 3: HMC (n=3)	Case 4: MPM (n=3)	Case 5: CWS (n=3)	Total all Participants (n=15)
Triple Bottom Line approach: considers people, planet, and profit		2	1	2	2	7
Local community involvement/ communicating with the local community	1	1	1	1	1	5
Corporate Social Responsibility: committed and is essential to company	1	2	1	1	2	7
Philanthropy		3	1	1		5

Summary of Cross-Case Findings

Several overarching themes are evident when examining the thematic categories developed from the data. Interview participants from all five companies, or in some cases, nearly all (4 out of 5) described common key performance indicators within the Eco-Sustainability Conceptual Framework. These frequent commonalities serve as the conclusions for the cross-case analysis, representing the perceptions of individuals as a whole across the five different cases:

Sustainable Enterprise, Eco-Culture and Eco-Advantage Mindset:

- Organization is striving for sustainability, with the concept of sustainability itself seen as a continuous process.
- Overall company-wide consciousness and commitment to the process of sustainability with the concept ingrained into the culture and mission of the organization.
- Eco-Expense reduction through efforts of continuous improvement in sustainability, efficiency, and innovation to sustain, recycle, and reuse.
- A commitment to recycling and energy reduction within a culture of reducing and increasing efficiency and the continuous improvement in sustainability, driven by leadership dedication and commitment to sustainable practices and long-term vision that support innovation focused on need for sustainable options and resource optimization.
- Focus on public awareness, environmental health and safety reporting and employee training.

Eco-Redesign and Eco-Tracking:

- Use of a materials database, Life Cycle Assessments, and closed loop systems with advancement in recycling and reuse in the company and use of supply chain audits.
- Tracking energy use, pollution, waste generation and compliance.

Triple Bottom Line:

- The approach describes the consideration of the impact of the company on people, the environment, and profit, from the local community to the global community.
- Commitment to Corporate Social Responsibility through local accountability and global philanthropy.

Eco-Scorecard

Percentages obtained from interview participant ratings of the Eco-Scorecard (see Table 3-1) for their organization were calculated for each company. Results are given graphically across the five case study companies. Results provide the total percentage scores for each company on the Eco-Scorecard, followed by the percentage scores in each of the Eco-Sustainability Conceptual Framework categories:

- A. Key Performance Indicators for Sustainable Enterprise
- B. Key Performance Indicators for an Eco-Culture
- C. Key Performance Indicators for Eco-Redesign
- D. Key Performance Indicators for Eco-Tracking
- E. Key Performance Indicators for Eco-Advantage Mindset
- F. Key Performance Indicators for the Triple Bottom Line

The lowest percentage score overall was demonstrated by New England Wood Pellet, while the highest overall percentages were given by interview participants at New Chapter. The remaining three case study companies demonstrated similar scores.

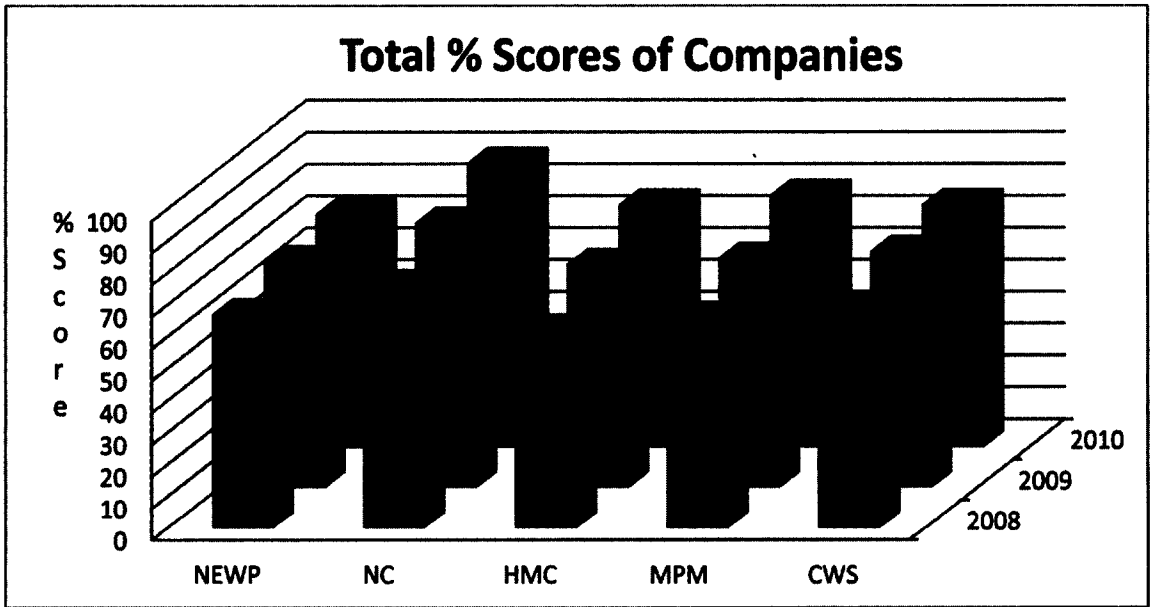


Figure 22. Total Percentage Scores of Case Study Companies.

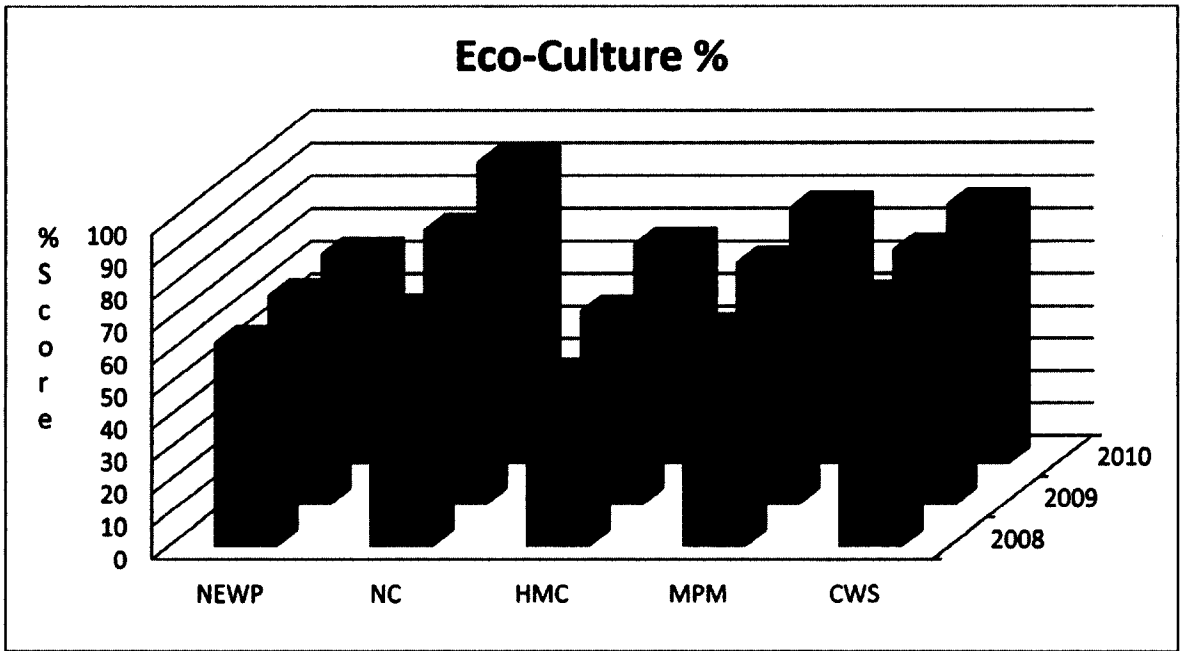


Figure 23. Eco-Culture Percentage Scores by Company

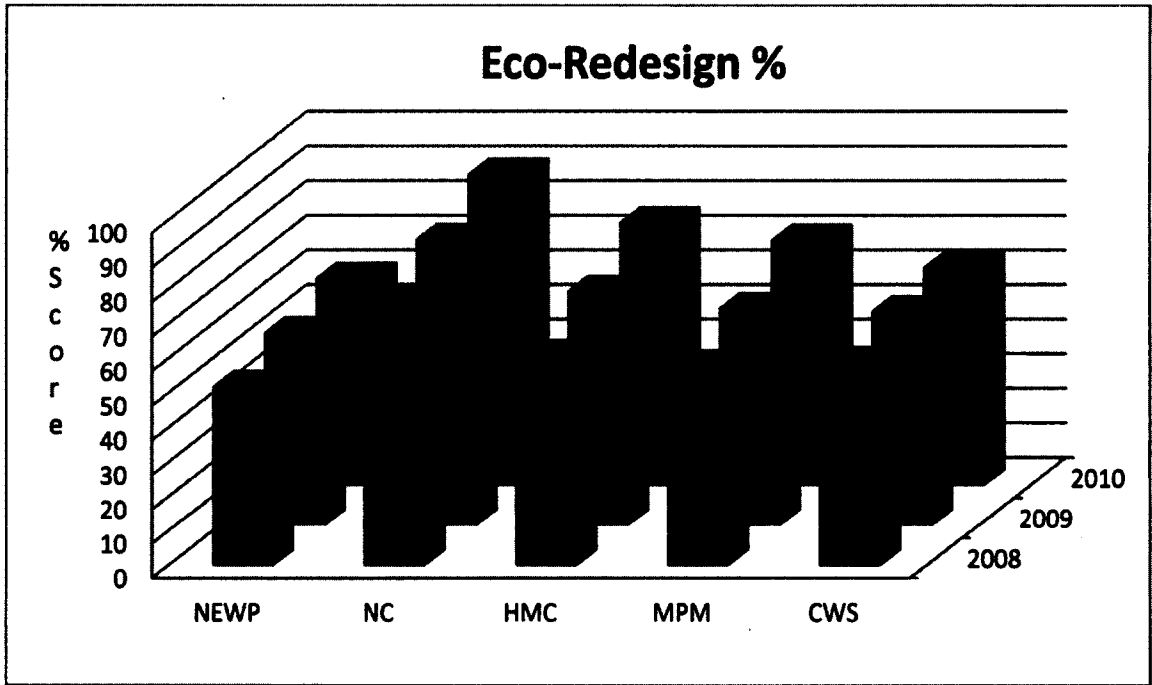


Figure 24. Eco-Redesign Percentage Scores by Company

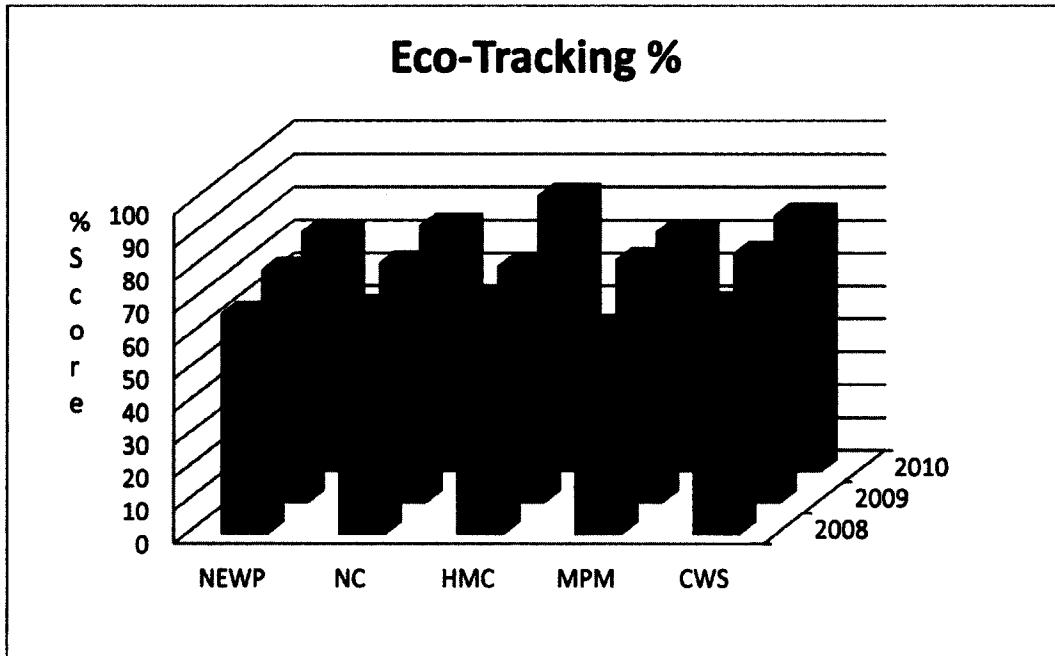


Figure 25. Eco-Tracking Percentage Scores by Company

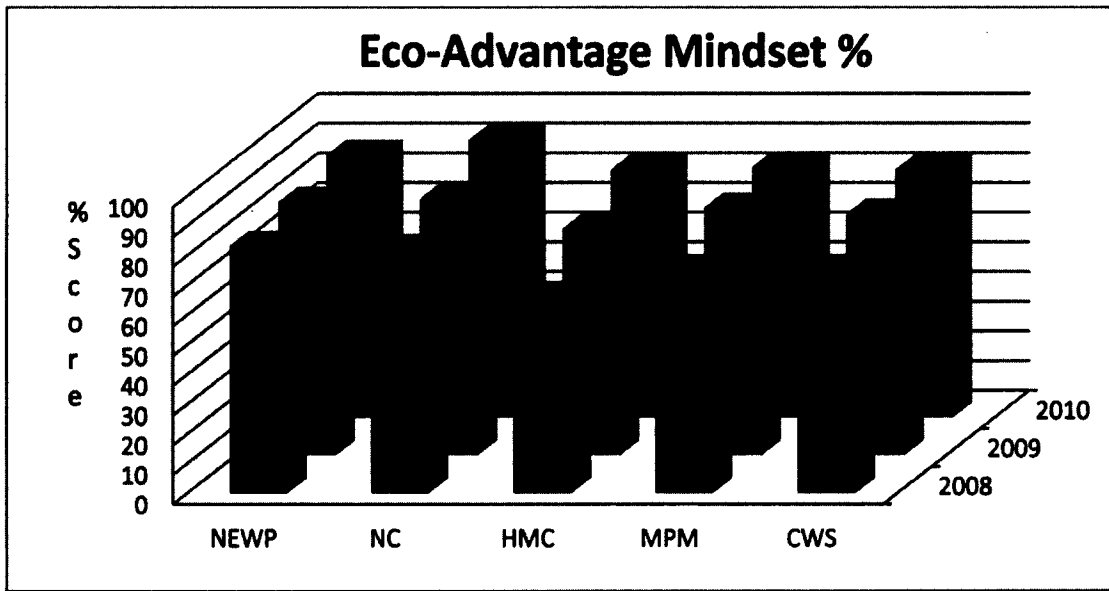


Figure 26. Eco-Advantage Mindset Percentage Scores by Company

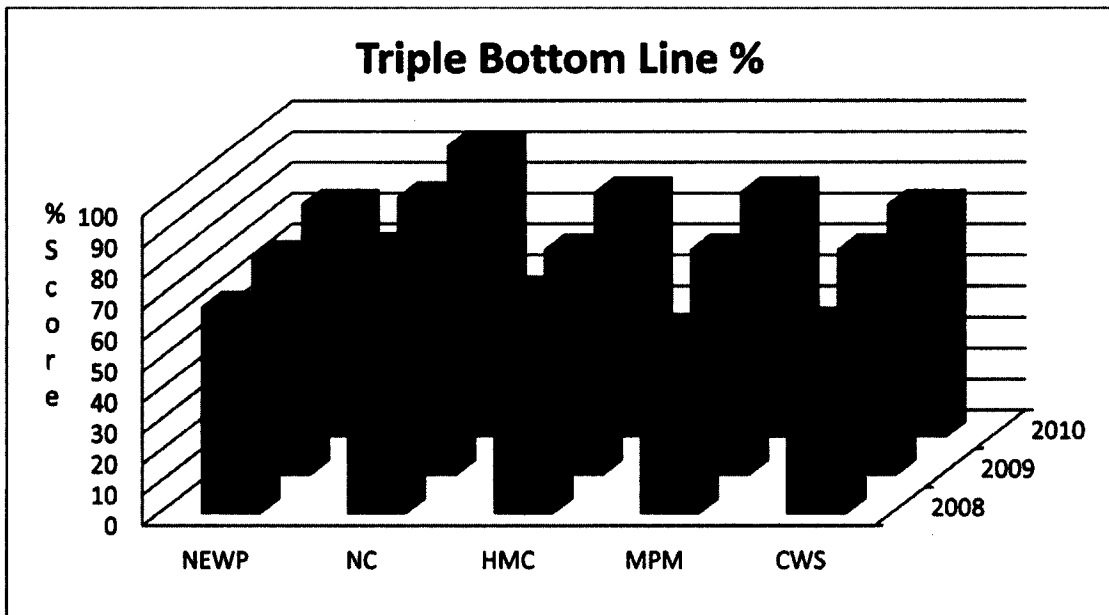


Figure 27. Triple Bottom Line Percentage Scores by Company

Chapter Summary

This chapter (9) has provided the results of the cross-case analysis of data obtained from the five case studies previously reported. Next, in Chapter 10, is a

synthesis of the results of both within case analyses as well as the cross-case analysis.

Chapter 10 includes a conclusion of the results in light of previous research and implications.

CHAPTER 10

LESSONS LEARNED

The best way to predict the future is to create it. -Peter F. Drucker

Summary

By deepening an understanding of the connections between business and the natural environment, companies can grow as resilient enterprises on the path to ecological sustainability. As demonstrated in the five case studies, value-centered business leaders and socio-/eco-entrepreneurs are leading companies that are inspiring employees and customers alike. From applying the Eco-Sustainability Conceptual Framework and Eco-Scorecard, we collected data showing how the case study companies are using sustainability strategies to spur innovative manufacturing processes, products and to provide services that generate long-term value to customers. In addition, these strategies create many synergistic effects in contributing to sustainable local communities from providing jobs to the protection and restoration of forests, rivers, scenic vistas and historical sites.

The researched small to mid-sized enterprises are linking sustainability to innovation as sellers and suppliers to large companies and multinational corporations qualified through International Organization for Standardization (ISO) 14001:2004 certifications proven by Monadnock Paper Mills and Hitchiner Manufacturing. Furthermore, this study revealed small to mid-sized enterprises are guiding their large company and multinational corporation customers in sustainable practices by creating environmentally friendly solutions for them based on evidence from Hitchiner

Manufacturing's SLIC process and Monadnock Paper Mill's Envi® specialty and packaging grades. For example, Envi® by Monadnock Paper Mills is Forest Stewardship Council certified, made with 100% renewable electricity, manufactured carbon neutral, waste fiber reclaimed/recycled process chloride free manufacturing, and uses post-consumer recycled content, which meets their clients' needs for a high quality product that is ecologically sustainable.

The significant difference between a "green business" and a sustainable enterprise, whose activities take place within the carrying capacity of the Earth, is determined at every level, from local to global (Roome, 2004). This, in itself, is a stretch goal with very few firms actually achieving this goal, covered in the Eco-Scorecard under key performance indicators (A1-A2) for Sustainable Enterprise. Recognizing innovation as a critical component for companies to remain competitive in creating long-term value (Dyer, Gregersen, & Christenson, 2011) also applies to sustainability. For the purpose of this research, we defined innovation as *the creation, development, and implementation of a new product or process with the goal of improving resiliency, sustainable value or competitive advantage*. Innovation can apply to manufacturing processes including energy reduction, recycling materials, services, organizational structure, and leadership. Another definition used in this study defined a *sustainable enterprise as one that earns profits, while protecting and restoring the environment, and improving the lives of its employees and communities with whom it interacts*, as shown by the researched small to mid-sized enterprises.

Discussion and Interpretation of Research Questions

The research questions of the study included:

Research Question 1

In the Eco-Sustainability Conceptual Framework, how do the four elements of Eco-Advantage Mindset, Eco-Tracking, Eco-Redesign, and Eco-Culture contribute to innovation?

Applying the Eco-Sustainability Conceptual Framework showed how the four thematic categories of Eco-Advantage Mindset, Eco-Tracking, Eco-Redesign, and Eco-Culture collectively contribute to innovation. The percentage scores, as descriptive statistics help to describe the sample. In addition, the data show a close correlation between all four thematic categories in contributing to sustainability capabilities with regard to the scientific technology, knowledge sharing, organizational, and social dimensions. By developing and combining these capabilities together in a unique set of competencies, each of the five small to mid-sized enterprises spur innovation in ways that create sustained value and may provide a competitive advantage. For example, through process innovation, Hitchiner Manufacturing's SLIC (several layer investment casting) holds the potential to slash mold-heating energy use over 87% and cut shell material use 70% (www.Hitchiner Manufacturing.com). From using the Eco-Sustainability Conceptual Framework, this process innovation linked to the categories of Eco-Culture (B3-6 on Eco-Scorecard) and Eco-Redesign (C7-8 on Eco-Scorecard).

Companywide, Hitchiner Manufacturing employs a rigorous and comprehensive recycling program for other process materials covered in Eco-Tracking (D11-14 on Eco-Scorecard). These are examples of how Hitchiner Manufacturing's green/sustainability strategy integrated process development with energy conservation, operational efficiencies, and scientific technology improvements. As Hitchiner Manufacturing

demonstrated by applying the Eco-Sustainability Conceptual Framework and Eco-Scorecard, it is committed to striving toward higher environmental standards in its operations and supply chains.

Research Question 2

How do these four Eco-Elements work together as sources of innovation?

Alternatively, can they work independently of one another as a source of innovation?

The four thematic categories work well together in providing fertile ground for sources of innovation. Finally, they are part of a small to mid-sized enterprise's sustainability strategy or Eco-Advantage Strategy referred to by Esty and Winston (2006). The four thematic categories of an Eco-Advantage Mindset, Eco-Tracking, Eco-Redesign, and Eco-Culture were potential sources of innovation for ecological sustainability as confirmed by interview participants from all five companies, or in some cases, nearly all (4 out of 5) described common key performance indicators within the Eco-Sustainability Conceptual Framework.

The second half of this research question asks, alternatively, if the thematic categories can work independently of one another as sources of innovation, to which the answer is perhaps, they can on a limited basis. For example, in contrasting New England Wood Pellet and New Chapter, we see two companies utilizing a renewable natural resource in the manufacturing of sustainable products. Each company had the highest ratings for Eco-Advantage Mindset of all the case study companies, followed by close ratings for Eco-Tracking. Yet, these two companies had the largest spread between Eco-Redesign and Eco-Culture ratings. New England Wood Pellet had the lowest total percentage score and New Chapter had the highest percentage score of all five

companies, illustrating how the thematic categories work best together in giving New Chapter the overall highest percentage score (see Table 10-1).

The Eco-Scorecard percentage scores do not provide statistical validation since the sample sized is too small within each case (n=3). They are simply an un-weighted rating given by the interview participants on the Eco-Scorecard key performance indicators used in combination with the invariant constituents in determining potential sources of innovation within the Eco-Sustainability Conceptual Framework. Therefore, percentage scores are used to help describe the sample.

Table 10-1

Descriptive Statistics of the Percent Score Data obtained from the Eco-Scorecard by Case

Company	A: Sustainable Enterprise	B: Eco-Culture	C: Eco-Redesign	D: Eco-Tracking	E: Eco-Advantage Mindset	F: Triple Bottom Line	Total Percent Score
New England Wood Pellet	83%	64%	60%	73%	88%	75%	73%
New Chapter	94%	93%	90%	75%	93%	94%	90%
Hitchiner Manufacturing	77%	68%	76%	73%	83%	79%	76%
Monadnock Paper Mills	75%	79%	71%	84%	84%	82%	79%
Casella Waste Systems	75%	80%	63%	78%	83%	75%	76%
Total Percent Score	81%	77%	72%	77%	86%	81%	79%

Research Question 3

How are innovations managed and evaluated for ecological sustainability?

Examples of managing and evaluating innovations for ecological sustainability within each of the case studies revealed how companies utilized portfolios of patents and

trademarks, while others used Eco-Tracking activities like Life Cycle Assessments or formal certification programs such as ISO 14001:2004 or the Global Reporting Initiative for Sustainability. For example, an ISO 14001 requirement for certification is the development of environmental management systems (EMS) to foster technological or process innovations, which are tracked and evaluated. By organizational design, Hitchiner Manufacturing integrated Research and Development (R&D) with Operations, while Monadnock Paper Mills' Strive Process empowered cross-functional teams to manage and/or evaluate innovations linked to ecological sustainability.

Summary of the Analysis

Semi-structured interviews using an Interview Guide and questionnaire with 25, open-ended questions correlated to the Eco-Scorecard for consistent data collection and analysis of the six thematic categories in the Eco-Sustainability Conceptual Framework, which connected a set of scientific principles and business theories in a harmonious manner linking key performance indicators. Within the Eco-Sustainability Conceptual Framework, the six eco-elements of (A) Sustainable Enterprise, (B) Eco-Culture, (C) Eco-Redesign, (D) Eco-Tracking, (E) Eco-Advantage Mindset, and (F) Triple Bottom Line were rated for three consecutive years on the Eco-Scorecard.

The research approach incorporated a phenomenological analysis of the qualitative data. Analysis of 15 transcribed interviews with a sample size of $n=3$ interview participants from each company's management team, identified themes revealed among the statements given by managers. The invariant constituents generate themes associated with the Eco-Sustainability Conceptual Framework, and are representative of each company. Then invariant constituents were grouped into the

thematic categories of Sustainable Enterprise, Eco-Culture, Eco-Redesign, Eco-Tracking, Eco-Advantage Mindset and the Triple Bottom Line along with the frequency of occurrence among all three-interview participants at each company. In addition, textual, verbatim examples from the interview participants were included for clarity of the essence to their experience related to the phenomenon of sustainability with their company. The thematic categories, as presented, generally follow the Eco-Sustainability Conceptual Framework; however, themes within these categories emerged from the data as well.

The qualitative software program *NVivo 9*® helped in managing the qualitative data by coding, classifying, sorting and arranging information, and noting the frequency and location of occurrences with the development of themes and patterns. The case study approach provided a detailed description of each company with themes identified in Chapters 4-8 (within-case analysis) and an analysis across all the different cases in Chapter 9. Finally, “lessons learned” from the multiple case studies is presented in Chapter 10.

Conclusions of the Individual Case Analyses

New England Wood Pellet Case Study Conclusion

New England Wood Pellet is a robust small to mid-sized enterprise, experiencing the challenges of managing accelerated growth in the young industry of biomass energy. After applying the Eco-Sustainability Conceptual Framework and Eco-Scorecard, analysis of the data revealed themes representing common responses of the interview participants confirming that New England Wood Pellet provides a product that offers a sustainable alternative to non-renewable fuels. Based on an increasing demand for wood

pellets, New England Wood Pellet is ready to respond with three manufacturing plants in key locations, along with supply and distribution networks in place. The Eco-Scorecard identified New England Wood Pellet's highest rated key performance indicators of CEO commitment to sustainability (E-15) and leadership making decisions with the long-term in mind for a tighter regulatory framework (E18). This contributed to the Eco-Advantage Mindset category, as a potential source of innovation as confirmed by New England Wood Pellet's manufacturing processes in reducing energy expenses, through recycling/reuse of materials and general energy reduction. Mr. Walker, as the Founder, President & CEO was described as a visionary leader having contributed to innovative initiatives at New England Wood Pellet through engineering and manufacturing, which accounted for the highest scores in the category of Eco-Advantage Mindset in (E-15).

Another theme emerged around New England Wood Pellet as a sustainable enterprise (A1 & A2), with the next highest rated key performance indicators of (A-1 & A-2). Yet the category of Eco-Redesign received the lowest percentage scores. Supply chain audits would have increased their Eco-Scorecard rating, which was addressed by Mr. Niebling:

We are becoming much more mindful of the impact on the market that our wood purchase have and the responsibility to make sure the wood and materials provided by our suppliers are produced in a sustainable fashion. Therefore, we exert influence on the people who supply us. We are now formalizing a corporate policy, to be in place within the next several months.

In his interview, Mr. Niebling identified the Eco-Redesign category as a source of potential innovation for New England Wood Pellet by saying, "This is continuous improvement and adaptive management, learning from our mistakes, not being afraid to change things and spend money if there is a better way to do it." Mr. Keeney confirmed

this sentiment when he discussed the biomass facility under construction adjacent to the manufacturing plant in Jaffrey, New Hampshire by saying, “We reached out to partner with a company to generate electricity, which is the biggest component of our manufacturing process. Generating electricity from forest by-products will provide a renewable source of electricity, as contrasted to getting energy from a utility generated from coal.” From our research study, this category as a source of innovation holds enormous potential for New England Wood Pellet in achieving these endeavors.

Applying the Eco-Sustainability Conceptual Framework and using the Eco-Scorecard as research tools served our study in useful ways including comparing case studies to one another (cross-case analysis). The Eco-Scorecard showed a diagnostic application in identifying strengths and weaknesses in the key performance indicators, which affect the eco-element categories as potential sources of innovation. In general, key performance indicator strengths helped New England Wood Pellet in distinguishing itself in manufacturing premium grade, wood pellets that offer a renewable bio-thermal heating alternative. In addition, its leadership is committed to environmental practices, stewardship, and optimizing efficiency in terms of energy consumption at their three manufacturing plants.

In conclusion, New England Wood Pellet is an alternative energy company, and therefore, by nature sustainable in terms of providing a product that makes a difference as an alternate fuel source. New England Wood Pellet seeks to reduce its own carbon footprint, but also that of their customers by providing a sustainable and renewable product. These highlighted themes, made possible with the use of the Eco-Sustainability Conceptual Framework, revealed an alignment of the company with this framework,

showing that New England Wood Pellet is a leader in the bio-fuel industry with capacity to spur innovation for ecological sustainability.

New Chapter Case Study Conclusion

New Chapter has the distinction of being the first herbal and vitamin supplement industry certified organic manufacturer to produce vitamins and minerals made with organic ingredients. New Chapter has been a pioneer in the whole foods vitamin and herbal supplement industry, which has a powerful alliance with Lifestyle of Health and Sustainability (LOHAS) consumers. This represents a demographic estimated as a \$290 billion U.S. marketplace for goods and services focused on health, the environment, social justice, personal development, and sustainable living. Approximately 41 million adults in the U.S. are LOHAS consumers, who embrace progressive social and economic change. This market sector has broad appeal with all of the researched case studies (www.lohas.com).

When visitors enter the New Chapter headquarters, they see the company guiding principles posted on the front wall, along with a large display of products and photos of their biodynamic farm in Costa Rica. The timing of the site visit to New Chapter could not have been better as two of the interview participants had just returned from a trip to India to meet with their suppliers (cooperative farmers), tour their organic farms, and verify raw material and seed sources. There was much to share as part of applying the Eco-Sustainability Conceptual Framework and Eco-Scorecard with the managers at New Chapter. We also met the first and only interview participant with a job title reflecting responsibility for sustainability.

Ms. Newmark's title is Sustainability Manager, and she manages New Chapter's environmental and social platforms, which encompass their impact on the Earth and how they give back through philanthropy, to product packaging and working to reduce their ecological footprint by tracking with the Global Reporting Initiative (GRI) standards. Ms. Newmark discussed the variety in her job responsibilities, including working on interdisciplinary teams for innovative projects like the sourcing of organically grown plant materials from Europe, India, and China.

The interview with Barb Schulick, Co-Founder truly brought forth the alignment of New Chapter with the Eco-Sustainability Conceptual Framework, with her storytelling of the company's history; reflecting many of the Eco-Sustainability Conceptual Framework features and Eco-Scorecard key performance indicators. Going from interviewing the longest tenured employee with Ms. Schulick to the shortest tenured employee, Mr. Miodonski, VP of Operations, offered an insightful comparison. He discussed his smooth transition from a multinational pharmaceutical corporation to New Chapter. This tied in with New Chapter's highest ratings in the Eco-Scorecard category of Eco-Advantage Mindset at 14.84 (92%). Of note, New Chapter scored the highest total percentage score of all five case study companies.

As observed, the power of intention is very strong at New Chapter, and was expressed by how the company began in 1982 with the intent of being innovative in its applications to the system of product formulation and by honoring nature in their production of mechanisms for wellness. Ms. Schulick said it best, "By using what nature is offering, we are getting the energetics of the Earth in the actual mechanism for healing."

The Eco-Sustainability Conceptual Framework and Eco-Scorecard identified the categories with the highest ratings as Eco-Culture and Eco-Advantage Mindset, followed by Eco-Redesign and Eco-Tracking. At New Chapter, multiple discussions revolved around the topic of nature and the company's commitment to ecological sustainability. Analysis of the interview data revealed a theme of leadership and Eco-Culture centered on the importance and value of nature. We learned how New Chapter utilized Life Cycle Assessments and the Global Reporting Initiative tracking with Scopes 1 and 2 in their Sustainability Report. Applying the Eco-Sustainability Conceptual Framework to New Chapter was a natural fit in terms of terminology, and identifying links between the framework's eco-elements, key performance indicators, and scientific principles utilized within the company.

One observation closely related to CEO commitment (E15) in the Eco-Advantage Mindset Category was the level of passion, enthusiasm, and dedication expressed by interview participants for sustainability endeavors. This personal connection indicated the motivation for sustainability was coming from another source besides profits, perhaps best described as intrinsic. This corresponded with the Esty and Winston (2006) Eco-Advantage strategy as having twin logic, where strategic gains run parallel with a strong values component, indicating companies can and should be a force for good, in leading the charge on caring for the environment, while protecting and restoring our shared natural resources. This was demonstrated by the researched case studies as inspired companies and industry leaders on the path toward ecological sustainability.

Hitchiner Manufacturing Case Study Conclusion

The Hitchiner Manufacturing Company produces metal castings in more than 160 different alloys for a broad spectrum of domestic and off shore markets that include a significant portion of the automotive, golf, military, and aerospace industries. Hitchiner Manufacturing brought insight to applying the Eco-Sustainability Conceptual Framework in that they differ from the other small to mid-sized enterprises in having a ‘process’ they offer to customers as opposed to a ‘product.’ According to Mr. Morison, Chairman of Hitchiner Manufacturing, “The process fortunately is one that in and of itself is capable of reclaiming the products of other people, particularly in terms of the metals we reprocess and reuse for most products.” In essence, their process (except for aerospace clients) is a sustainable manufacturing process that is aligned with their Living Values; specifically, “We Respect the Earth” (www.hitchner.com).

Hitchiner Manufacturing demonstrated their ability to link innovation to ecological sustainability with the recycling of metal, resulting in Hitchiner Manufacturing having less impact on the environment. Their capacity to use innovation for sustainability contributed to their improvements in material use and efficiency. According to Hitchiner Manufacturing, their innovative process linked to energy conservation methods gives the company a competitive advantage, which adds to their profitability as shown by a new, exclusive, innovative process called SLIC (several layer investment casting), introduced into production in 2010. SLIC is a hybrid of the original countergravity investment casting process and was an outgrowth of the Research & Development and Operations Departments working in collaboration with General Motors.

Hitchiner Manufacturing has realized savings and cost reduction related to their energy conservation investments, as outlined during the interview with Mr. Tuthill, Facilities Manager-USA. This is having a multiplier effect in reducing the use of natural resources such as water, and non-renewable resources like oil and natural gas. A 2009 Hitchiner Manufacturing Energy Study showed a reduced ecological footprint because of cost-savings of raw materials, which also carries secondary ecological benefits. From applying the Eco-Sustainability Conceptual Framework in the category of Eco-Culture, data showed how innovation is part of the organizational culture and growing around sustainability. Hitchiner Manufacturing's higher ratings were in the key performance indicators that involved eco-expense reduction to cut environmental costs by not wasting natural resources, energy reduction, and use of stretch goals as a driver for linking innovation and eco-sustainability (B3-B4).

Under the Eco-Redesign category, Hitchiner Manufacturing had high ratings for use of closed loop systems through recycling/reuse (C7-C8); indicating Eco-Redesign is a strength area for Hitchiner Manufacturing and hence, a potential source of innovation. The Eco-Tracking key performance indicators of using Life Cycle Assessments, tracking energy use, pollution, waste generation, compliance, and materials database (D11-D14) rated in third place. The highest rated category was Eco-Advantage Mindset with the strongest key performance indicator of CEO Leadership and commitment to sustainability. Hitchiner Manufacturing was the second oldest company at 66 years old and like Monadnock Paper Mills, they prefer being a private enterprise due to the benefits associated with long-range planning and decision making especially for sustainability. Mr. Morison confirmed this by saying:

If you are a privately owned company, where you can look at the long-term, along with having the right managers in place that can implement, that is the best. We are fortunate in having people who understand the manufacturing process, and having the technical advantages that we have, and we are willing to make the investments required.

Another commonality between Hitchiner Manufacturing and Monadnock Paper Mills are both companies are ISO 14001:2004 certified and are using their certifications to increase their marketability with global companies.

Eco-Culture received the lowest rating as a potential source of innovation.

Perhaps, if the key performance indicators of storytelling of Hitchiner Manufacturing eco-successes, lessons learned, Corporate Social Responsibility, Environmental Health & Safety Reports and environmental training had been discussed more frequently among the interview participants this may have increased their Eco-Scorecard scores in this category. This low rating may have under-estimated the power of Eco-Culture at Hitchiner Manufacturing, since it certainly has attracted and is retaining talent, in both Mr. Tuthill and Mr. Riguilme.

In conclusion, Hitchiner Manufacturing has distinguished itself as an industry leader in successfully balancing the economic, environmental, and social aspects. We may not use the same terminology, such as ecological sustainability instead of energy conservation, and cost reduction means recycling and finding energy solutions, according to Mr. Riguilme. He also added, "We are not using the term Triple Bottom Line, but we think our approach is close to it in concept; in applying a sustainability lens to our company - it is a balancing activity."

Monadnock Paper Mills Case Study Conclusion

Monadnock Paper Mills is honoring its mission and fulfilling its core value of environmental stewardship through a corporate commitment to product development that meets individual customer needs. Monadnock Paper Mills demonstrated a strong link between ecological sustainability and innovation performance through the application of Eco-Sustainability Conceptual Framework and Eco-Scorecard. The company's environmental and social strategies enabled the acquisition of capabilities (Laszlo & Zhexembayeva, 2011), referred to as the "building block" skills, which include pollution prevention, full cost analysis, cradle-to-cradle design, social auditing, community outreach, and stakeholder collaboration (Marcus, 2005). Monadnock Paper Mills showed how these capabilities have combined over time to create new capabilities, such as process innovation as evident by their sustainability product portfolio, continuous improvement, and Strive Process cross-functional management teams that manage and evaluate innovation projects. Monadnock Paper Mills has a proven record of managing environmental innovations and social performance leading to higher order learning, continuous innovation, and stakeholder integration that has resulted in improved corporate financial performance (Sharma & Aragon-Correa, 2005).

Environmental (and social) capabilities are complex and convey a disruptive change, such as producing zero waste, or creating sustainable products as observed at Monadnock Paper Mills. These capabilities represent a change in performance to meet customer needs with a reduced use of natural resources, low or no carbon emissions, products made with 100% renewable electricity, process chlorine free and post-consumer recycled content. The Eco-Sustainability Conceptual Framework confirmed ecological

sustainability capabilities have scientific, technological, organizational, and social dimensions, which Monadnock Paper Mills demonstrated with their eco-expense and cost reductions.

Not only is Monadnock Paper Mills on a path toward ecological sustainability as an industry leader, they are bringing their larger company customers along the way. For example, the Monadnock Paper Mills *Field Guide*, now in its third edition, provides information in support of sustainable design and print practices that give graphic professionals the opportunity to learn and think about design differently. *Field Guide* topics include paper selection, productions, inks, printing, finishing, packaging, a project checklist, eco-ethics, references, and bibliography, which proved Monadnock Paper Mills' Environmental Commitment.

Analysis of the interview data showed how Monadnock Paper Mills uses sustainable practices in the production of its specialty papers in reducing the environmental impact of the company as well as its clients. From the interview participants, we gathered a sense of personal as well as corporate commitment to the local community and for the environment from the leadership team to the plant floor workers.

Casella Waste Systems Case Study Conclusion

Casella Waste Systems started as a private, family owned company, and went public after 22 years. It was the only publically traded company among the five researched case studies, and the largest in terms of number of employees at 2,393. Applying the Eco-Sustainability Conceptual Framework and using the Eco-Scorecard confirmed the applications with a much larger and public company. The highest rated

categories were Eco-Advantage Mindset, Eco-Culture, and Eco-Tracking, followed by Eco-Redesign. From the data analysis, themes included mainstreaming Eco-Culture through innovation for customer ease (B-4), use of materials database to analyze their processes and waste (D-13), and CEO commitment to sustainability and environmental strategy (E-15).

In 2009, Casella issued their first Sustainability Report using the Global Reporting Initiative presented in a “Sustainability Scorecard,” format that included specific metrics and targets in the areas of environmental, social, and economic goals. Casella utilized SAP® Carbon Impact software to monitor GHG and to generate reports (see Appendix J). Casella understands the market force of declining natural resources, radical transparency, and the increasing expectations reshaping a new strategic path for companies (Laszlo & Zhexembayeva, 2011), and is facing these forces by providing innovative resource management and expertise in the areas of solid waste collection, transfer disposal, and recycling services. Their long-term goal of transforming traditional solid waste into renewable resources has definitely spurred innovation. Casella’s Research & Development effort, when realized in the “engineered feedstock” (a proprietary term), in taking waste material and making it into hydrocarbon substitutes to generate energy will be a “disruptive innovation” and will establish new markets by offering a unique value proposition through radical technologies (Dyer, Gregersen & Christensen, 2011).

The interview with Dr. Bai, Senior Process Engineer reinforced the link between the scientific principles and key performance indicators within the Eco-Sustainability Conceptual Framework as applied to Casella’s multiple research pursuits.

Dr. Bai described his research area of giving waste a second or third life to maximize the material on a molecular level. “We are doing a good job contributing to this development process and environmental protection and energy security. It really has motivated me to work for this company.” Another area of innovation demonstrated by Casella was shown in their intellectual property and patent portfolio supervised by Ms. Calabrese, Director of Strategy & Intellectual Property. This confirmed Casella’s ability to innovate for ecological sustainability as a competitive advantage, particularly in an industry that does not traditionally have patent portfolios.

During the interview with Mr. McDonnell, Director of Sales & Marketing, we discussed Casella as a change agent in the traditional trash and pick-up service model. Even their use of terms like “resource optimization model,” which aims to drive diversion of recyclables and “engineered feedstock” (a proprietary term), do not fit the traditional industry language. In addition, the company has instituted changes in operations, such as capping old landfills, gas collection systems at landfills, and conversion of trucks to use compressed natural gas. Presently Casella is working with a company with a dual fuel technology for heavy duty trucks that run on diesel fuel and compressed natural gas - all geared towards reducing emissions for their truck fleet and their carbon footprint. After applying, the Eco-Sustainability Conceptual Framework to Casella its compatibility was best captured and expressed by Ms. Calabrese:

I think your Eco-Sustainability Conceptual Framework is very interesting and insightful. When I sat back and really looked at it, I thought Shelley really cut across all kinds of dimensions within our business, and how we design our strategy and execute against it. It is hard to do that with a service-type offering as opposed to a company that manufactures a product.

Conclusions of the Cross-Case Analyses

A. Sustainable Enterprise

This category provided questions to frame interview participants' responses, which included striving to be sustainable, seeing sustainability as a continuous process, and having a long-term commitment to that process. The use of innovation to spur sustainability through the effective use of natural resources, and that sustainability is ingrained in the culture/mission of the organization (4 of 5 case studies) was shown by New Chapter with the highest total percentage score. In addition, Co-Founder, Barbi Schulick captured this by saying, "The name New Chapter came from a commitment to not only keep wholeness and purity in the product; but to be truly innovative. If it was worthy of the name New Chapter, it had to be an innovation in its category, it had to be whole, and it had to respect nature's wisdom."

During the discussions of questions A-1 and A-2, it was apparent that small to mid-sized enterprises have what David Lunati, Director of Marketing at Monadnock Paper Mills called a "glocal view," referring to starting local and going global, because of their abilities to apply sustainable practices that are extended into the supply chain of larger companies and multinational corporations. He described it as grass root efforts with significant, meaningful impact to large global companies due to working with environmentally aligned supply chains. Of the five case studies, three companies that competitively operate in global markets are Monadnock Paper Mills, Hitchiner Manufacturing, and New Chapter, which are all industry leaders who execute sustainability strategies.

According to Mr. Morison and Mr. Riquelme at Hitchiner Manufacturing, and Mr. Verney at Monadnock Paper Mills, large global corporations, especially in Europe, are looking to work with sustainable small to mid-sized enterprise suppliers who are International Organization for Standardization (ISO) 14001 certified. Hitchiner Manufacturing hired Marc Riquelme as their VP of Sales and Marketing based on his experience working in foundries in Europe and Asia. During our interview, he said:

It is common that more and more customers in Europe ask about your ISO certification. I have never had a question from the U.S. In Europe, some people decide not to work for a particular company if they are not ISO 14001 certified, they simply do not conduct business with you. People buying your product want to know you are energy efficient and are reducing your carbon footprint.

One of the ways Monadnock Paper Mills carved their specialty paper niche with European companies was to secure ISO 9001 certification. In achieving ISO 9001:2001 certification, they satisfied a vast majority of their customer needs by meeting 90% of the requirements of 15 other individual certification programs they were previously pursuing. They went on to attain ISO 14001:2004 and as a result, Monadnock Paper Mills has an environmental management system with specific goals and objectives they measure themselves against on a continuous basis.

To date, Monadnock is the only paper mill making the types of products they manufacture in the United States that is ISO 14001:2004 certified, in addition to their paper being Forest Stewardship Council (FSC) certified. Yet another example of how Monadnock Paper Mills has differentiated their products was to become carbon neutral in their manufacturing operations. However, Mr. Verney stated, "Being a good steward of the environment is no longer a differentiator; it is expected."

Many of the interview participants tied question on sustainable enterprise (A-1) to the Triple Bottom Line in balancing the economic, social, and environmental aspects in producing profits, while protecting and restoring the environment, and improving the lives of their stakeholders. This ties in with the stakeholder approach that allows management to infuse traditional strategic analysis with the values and direction that are unique to the organization, including seeing the environment as a stakeholder and embedding sustainability (Harrison & St John, 1994). In Table 10-1, the total percentage scores across all five small to mid-sized enterprises for Sustainable Enterprise are aligned with the Triple Bottom Line total percentage scores. Hence, the Eco-Sustainability Conceptual Framework helped to identify a link between these two thematic categories in working together as a source of innovation addressed in research question #2.

B. Eco-Culture

A company's history, traditions, rituals, and leadership shape its culture and internal work-environment. From analyzing the Eco-Culture, we found it contributes to innovation as an overarching theme. Each of the research case studies demonstrated its own distinct culture experienced by its employees. The Eco-Scorecard key performance indicators for Eco-Culture included: eco-expense reduction, the art of storytelling, stretch goals, use of a sustainability lens, CEO and senior management commitment for sustainable practices, environmental and social stewardship, an environmental sustainability statement, and knowledge-sharing.

The highest consistency across all five small to mid-sized enterprises was eco-expense reduction as a source of innovation. Expense reduction can become a source of innovation as demonstrated by New England Wood Pellet pursuing a partnership in

building a biomass-power plant next to its Jaffrey, New Hampshire manufacturing facility. In addition, Monadnock Paper Mills is pursuing energy alternatives including hydropower. Mr. Verney acknowledged Monadnock Paper Mills' unique location on the Contoocook River with forested lands on the outskirts of the mill when he discussed the current process they are going through with a 50-year relicensing of their four dams. Presently, they have a permit from the Federal Energy Regulatory Commission to operate their hydropower plant and in a year, with the right amount of rain, Monadnock Paper Mills can generate 50% of their own electric needs. In addition, companies described continuous improvements in sustainable practices for recycling, energy efficiency and reductions in consumption/fuel costs, with each enterprise applying an eco-sustainability lens to business activities.

In terms of innovation, interview participants described innovation as inspired by stretch goals, particularly in the realm of energy reduction and reuse. Innovation was part of the overall company culture resulting in new sustainability practices in all five cases. The work of Jennings and Zandbergen (1995) in Institutional Theory support our research findings on how sustainability is institutionalized, and the role of Eco-Culture as a possible source of innovation. Interview participants described organizational culture as a source of innovation, demonstrated by New Chapter with their herbal supplement formulations such as Zyflamend. Another aspect of Eco-Culture was knowledge sharing, which was highest for Environmental, Health and Safety reporting. The percentage score across all five companies for Eco-Culture was the second highest total score followed by Eco-Advantage Mindset.

It was interesting to observe how the “process” of sustainability unfolds by using the Eco-Sustainability Conceptual Framework, beginning with Eco-Culture there is an awareness and gradual recognition, by interview participants, even excitement shared in the storytelling of their company’s sustainability journey. With incremental steps through each of the Eco-Sustainability Conceptual Framework categories, interview participants describe their company’s transition on the path toward ecological sustainability. A company’s path as a genesis or organic process in the Eco-Advantage Mindset category was recognized along with the identification of key staff as “keepers of the culture.” Within each small to mid-sized enterprise, the “keepers” were founders, CEOs, second-generation family members, or some combination of all three, who contributed to the sustainability leadership referred to by interview participants. Consistently, interview participants noted the significant commitment and foresight of the CEO and senior leadership in supporting sustainable practices (13 out of 15 participants).

Along the sustainability path is steep terrain, which is analogous with fast growth periods experienced by a company. These growth periods push boundaries in responding to sustainability challenges, especially in balancing economic, environmental, and social aspects, whether framed as the Triple Bottom Line, Corporate Social Responsibility or Environmental, Health & Safety. Any of these approaches can serve to take action for creating an Eco-Advantage Strategy, with each company finding its own language, terminology and organizational structures that work within their culture (Esty & Winston, 2006). Use of the Eco-Sustainability Conceptual Framework showed how integrating sustainable practices into everyone’s job moves innovation in the direction of increasing

resource performance, delivering a reduced carbon footprint to customer and creating product alternatives for customers by using fewer resources.

C. Eco-Redesign

The Eco-Redesign key performance indicators included the use of Design for the Environment (DfE), closed loop systems, LEED/Green Building technologies, and supply chain audits. Eco-Redesign addressed designing products, processes, and services with fewer resources, especially with virgin resources as demonstrated by Hitchiner Manufacturing's latest fuel-efficient, countergravity casting process called several layer investment casting (SLIC). SLIC reduces shell material usage by about 70%, floor space requirements by up to 70%, and mold-heating energy by 88%, while eliminating the need for large burnout furnaces.

Commonality occurred across all the small to mid-sized enterprises in their use of closed loop systems for recycling and reuse of materials. Although, in terms of ratings, this category had the lowest percentage score with ratings highest for New Chapter to the lowest ratings for New England Wood Pellet. The low percentage scores may be due to a narrow focus on key performance indicators within this category. Perhaps another way to examine Eco-Redesign would be to broaden key performance indicators tied to sustainable manufacturing processes or services as part of a company's overall sustainability strategy. A new International Organization for Standardization (ISO) 14006:2011 that provides guidelines for incorporating eco-design was not available when our research interviews were conducted (www.iso.com). In the future, this may provide a stronger link between innovation and sustainability. As acknowledged in the researched case studies, incorporating innovative Eco-Redesign contributes to sustainable practices

and in creating new products, processes, and services as demonstrated by Hitchiner Manufacturing and Monadnock Paper Mills in their Eco-Redesign of past manufacturing processes and products with improved sustainable versions of them.

D. Eco-Tracking

The Eco-Tracking category measures and tracks the environmental impact of the business with key performance indicators of Life Cycle Assessments, material databases, environmental management systems, and monitoring the use of energy, generation of pollution, waste and compliance. Analyzing the data across all five small to mid-sized enterprises revealed highest total ratings for reporting the use of materials databases followed by Life Cycle Assessments and monitoring energy usage, pollution, waste, and compliance. Eco-Tracking provides the management tools and methods by which companies measure their progress toward sustainability. Formalized management programs utilized by the case studies for tracking, training, management and evaluation included; ISO 14001:2004, Global Reporting Initiative, EPA's Climate Leaders Program, LEED, and Certified Organic programs.

Hitchiner Manufacturing (Mexico) and Monadnock Paper Mills are both certified ISO 14001:2004 for environmental management systems with guidelines they met on principles, systems, training and support techniques. Whereas the Global Reporting Initiative utilized by New Chapter and Casella Waste Systems provides the leading framework for corporate sustainability reporting, and has become required for small to mid-sized enterprise suppliers. The Eco-Tracking percentage score across all enterprises was on par with Eco-Culture.

E. Eco-Advantage Mindset

Eco-Advantage Mindset is the fifth category in the Eco-Sustainability Conceptual Framework and describes a 'generic' or 'organic' path to ecological sustainability. An Eco-Advantage Mindset creates environmental thinking and behavior that promote problem solving, and enthusiasm as a potential source of innovation. As quoted by Dyer et al. (2011) "One's ability to generate innovative ideas is not merely a function of the mind, but also a function of behaviors." Just as mindset is an influential part of the company culture, the same follows for Eco-Advantage Mindset being an influential part of Eco-Culture.

Collectively and individually, all five case study companies demonstrated how powerful the Eco-Advantage Mindset category is as a potential source of innovation linked to ecological sustainability, by giving it the highest percentage score of all the categories and within each company (see Table 10-1). The shared commitment to stewardship in each researched enterprise motivated managers and senior management alike on a personal level. To be successful in integrating the environment into a sustainability strategy, companies need to cultivate an Eco-Advantage Mindset that is part of their Eco-Culture, and contributes to the other eco-elements of Eco-Tracking and Eco-Redesign as well.

The Eco-Advantage Mindset category included the following key performance indicators: CEO commitment to sustainability, leadership decisions for the long-term, using a sustainability lens to reveal and push for sustainable options, and creating solutions to successfully optimize resources and reduce the environmental impact of the organization. Consistent across all five enterprises was the significant commitment and foresight of the

CEO and senior leadership in supporting sustainable practices (13 of 15 interview participants). This positively affected the Eco-Advantage Mindset within the organization from the top down.

Linking this category to innovation, interview participants noted the use of a sustainability lens in inspiring activities such as optimizing resources and closed loop systems. This category was one in which interview participants used adjectives like “commitment,” “dedication,” and “leadership” that were expressed with voices of excitement, passion, and smiles shown by the interview participants as they responded to questions (E15-E18). For example, in the New England Wood Pellet case study, a resulting theme conveyed how the company leadership demonstrates a commitment to environmental practices while instilling a company-wide focus on optimization of efficiency. This represented a company culture of understanding the environmental significance of their product, and a concomitant focus on public awareness and education.

F. Triple Bottom Line

The Triple Bottom Line is the sixth and final Eco-Sustainability Conceptual Framework category, which encompasses sustainability at the intersection of economic, social, and environmental performance, and Corporate Social Responsibility as a concept whereby organizations take action for their impact on society and the environment. Although, four of the five enterprises reported the use of Triple Bottom Line, the analysis showed that, in practice, all five companies, including New England Wood Pellet, utilized a Triple Bottom Line approach. In addition, all five companies implement Corporate Social Responsibility through philanthropic goals, educational outreach, and involvement in local community events. Of importance is the distinction made by

companies in how they described their work in terms of placing sustainability at the core of their business strategy, which has created an effective platform for Corporate Social Responsibility. In Table 10-1, the total percentage score across all five enterprises for Triple Bottom Line are aligned with the Sustainable Enterprise total percentage score. Hence, the Eco-Sustainability Conceptual Framework helped to identify a link between the thematic categories.

Key Overall Conclusions of the Research Study

The following key overall conclusions resulted from this research study. First, the research approach met the need for a broader understanding through an integration of the social and natural sciences represented in the Eco-Sustainability Conceptual Framework and Eco-Scorecard. Second, this research study offers empirical evidence on how small to mid-sized enterprises spur innovation in linking key performance indicators with scientific principles. Third, research findings suggest that small to mid-sized enterprises do create sources of innovation for ecological sustainability in categories including Eco-Culture, Eco-Redesign, Eco-Tracking, and an Eco-Advantage Mindset as demonstrated by applying the Eco-Sustainability Conceptual Framework and Eco-Scorecard.

As a point of clarification, terminology did vary within the case study companies in their use of different terms for 'ecological sustainability.' For example, Hitchiner Manufacturing uses the term energy conservation, while Monadnock Paper Mills uses the term environmental sustainability. Fourth, and perhaps the most rewarding conclusion, revealed the extent to which small to mid-sized enterprises are generating innovation for ecological sustainability. In addition to their influence on supply chains of larger companies and multinational corporations, the researched enterprises confirmed a major

role in providing sustained value through their manufacturing processes, products, and services to stakeholders. Based on this, a fifth conclusion is that small to mid-sized enterprises are providing successful sustainability performance, which can be highly desirable and sought after as acquisitions by larger companies and multinational corporations.

In fact, Procter and Gamble confirmed this on March 15, 2012 with the acquisition of New Chapter. As Paul Schulick, Co-Founder of New Chapter told the *Reformer*, he wasn't looking to sell the company when he began searching for additional funding to help fuel New Chapter's growth. Yet, once Procter and Gamble made its undisclosed offer to buy New Chapter, Mr. Schulick said he knew the time was right to sell because doing so would enable New Chapter to accelerate its global expansion plans, add more "marketing muscle" and more confidently navigate the increasingly murky landscape of supplement regulation. "Procter and Gamble shares our commitment and fascination with innovation and has the resources to dramatically boost our research and development of new products," Mr. Schulick said, "We will even enrich our philanthropic and sustainability platforms by joining with a force deeply committed to humanitarian efforts."

According to Elizabeth Bankowski, chair of the board of New Chapter, Procter and Gamble was not the only company to bid for New Chapter, but it won out because of the ownership model built into the bid. "It's a model we really hoped to have," Ms. Bankowski told newhope360. "It's very much the Stonyfield Model [in that New Chapter will remain] a stand-alone, wholly-owned subsidiary. The only company change is Procter and Gamble is sending in a CEO. We're still employees of New Chapter." Prior

to the Procter and Gamble acquisition, there were 125 shareholders, none of whom owned a controlling interest in the privately held the company. Ms. Bankowski said, “Procter and Gamble bought all of the shares, so we have a single shareholder now” (<http://newhope360.com>).

A sixth conclusion shared by both Mr. Morison at Hitchiner Manufacturing and Mr. Verney at Monadnock Paper Mills is that being a private company affords their business an advantage in longer term planning horizons for innovation and sustainability. Mr. Verney said, “If I have learned anything in my time here, it is that it always takes longer than we think to develop a new product. There lay the risks associated with innovation that need to be managed.” From his experience, being a private company provides a longer time horizon not afforded to public company focused on quarterly earnings. Mr. Verney acknowledged the dedicated resources and priority placed on environmental accomplishments and how they have made Monadnock Paper Mills more ecologically sustainable. Along the same lines, Mr. Morison at Hitchiner Manufacturing confirmed there is an advantage if you are a privately owned company where you can look at the long-term, along with having the right managers in place that can implement. Mr. Morison said, “We are really fortunate now because we have people who understand the manufacturing process and the technical advantages that we have and are willing to make the investments required.”

A seventh and critical conclusion is that the Eco-Sustainability Conceptual Framework and Eco-Scorecard, as applied specifically for this study, has future application. With minor modifications, the Eco-Sustainability Conceptual Framework and Eco-Scorecard are compatible for future applications with additional small to mid-

sized enterprises and larger enterprises. Ms. Calabrese's statement during her interview was confirmation when she stated:

I think your Eco-Sustainability Conceptual Framework is very interesting and insightful. When I sat back and really looked at it, I thought Shelley really cut across all kinds of dimensions within our business, and how we design our strategy and execute against it. It is hard to do that with a service-type offering as opposed to a company that manufactures a product.

Limitations of the Research Study

Unlike quantitative research, qualitative research does not seek generalizability from its results. Instead, the data collection and analysis techniques utilized seek to identify categories and themes that arise while providing an in-depth, rich context to the research (Creswell, 2003). For this reason, case studies have high internal validity, but limited external validity, making them difficult to generalize to a larger population. In an effort to address this concern, five case studies were part of this research study as opposed to a smaller selection.

Time and funding were limiting factors in terms of number of interview participants per individual case study, sample size (n=3), although in the cross-case analysis, the sample size was larger (n=15). In addition, case studies can over simplify a situation, as they reflect a partial view; however, the cross-case analysis and conclusions covered in Chapters 9 and 10 helped in broadening the picture. Case studies can be affected by the sensitivity and experience of the investigator, and a novice researcher may unintentionally introduce bias, that is why all interviews in this study were conducted according to a strict, semi-structured interview protocol. Another limitation may have been the small geographic representation of small to mid-sized enterprises located in the northern New England region of the United States. This may have contributed to

regional analogies manifested in cultural, environmental, social, and economic similarities.

As with all research methodologies, there are built-in advantages and disadvantages and many of the same disadvantages already covered for case studies have similarities associated with phenomenology. For instance, the researcher's verbal comments and non-verbal cues can cause bias and have an influence upon respondents' answers (David & Sutton, 2004, p. 161), thus it is difficult to detect or to prevent researcher induced bias as was previously addressed concerning case studies. Other limitations are that phenomenology does not produce generalizable data and the subjectivity of the data sometimes can lead to difficulties in reliability and validity of approaches and information as with case studies. A final limitation deals with difficulties associated with perceptual research, leading to interference in the interpretation of the data. According to Merriam (1998), by ensuring "epoche" or "bracketing" the researcher identifies and puts aside any prejudices, views, preconceived beliefs or opinions they have about the phenomenon under study.

Finally, using the qualitative software program *NVivo 9*® helped in data management, coding, and constructing queries for data analysis in drawing research conclusions. An advantage in using *NVivo 9*® is in its organizational features, and with five case studies, it proved highly efficient. One limitation did occur when it became quite cumbersome to use *NVivo 9*® on the cross-case analysis, which required using typed hard copies to organize the data.

Future Research

An extension of this research study would be to build upon the Eco-Sustainability Conceptual Framework and Eco-Scorecard findings and conclusions in examining the phenomenon of sustainability using theoretical insights from another seminal work or theory, such as the Knowledge-based View, to determine what factors link innovation performance and ecological sustainability in small to mid-sized enterprises. The Knowledge-based View may provide a deeper explanation of the firm's tacit capability for developing new capabilities as part of applying an Eco-Sustainability Conceptual Framework as opposed using the "Resource-based View, Institutional Theory, and Stakeholder Theory Trio." After utilizing a multidisciplinary research agenda, drawing insights from a singular theory in building the theoretical framework would offer an appealing approach. In addition, the current qualitative research on how small to mid-sized enterprises spur innovation for ecological sustainability would inform future research using a different type of qualitative research variation or strategy of inquiry (Denzin & Lincoln, 1994), such as a Grounded Theory or a Basic/Generic approach.

A logical progression of this research study would be to move in a theoretical direction based on this empirical investigation. A researcher could examine the phenomenon of sustainability in companies using theoretical insights from the Resource-based View or another theory, in determining how a firm uses innovation for ecological sustainability. This would entail developing a set of propositions from the research questions used in this study to quantifying results. In fact, our case studies could help pave the way for more theoretical scholarly pursuits based on their rich descriptive nature.

In planning for long-term research opportunities, using the companies that took part in this research could extend into a longitudinal study as they continue on their paths toward ecological sustainability. A possibility might be to focus on manufacturing companies in building upon a longitudinal study of sustainability and innovation in a particular industry. However, this future research would require substantial planning and funding if pursued.

Another research option would be to use a mixed methods approach including a quantitative application, possibly with a mega study in extending the geographic reach and representation of small to mid-sized enterprises. This could utilize the Eco-Sustainability Conceptual Framework and Eco-Scorecard as a survey with a Likert Scale instrument used with a small to mid-sized enterprise database including global companies. In addition, research collaborations could extend the multidisciplinary lens to sustainability leadership, organization behavior, entrepreneurship or the niche of private, second-generation family business. Perhaps a researcher would be intrigued in studying small to mid-sized enterprises like New Chapter (and others) that have been acquisitions by multinational corporations. Could acquisitions serve as a business model or a sustainability strategy for small to mid-sized enterprises in duplicating the “Stonyfield Model,” in which the enterprise, in this case New Chapter, remains a stand-alone, wholly owned subsidiary of Procter and Gamble. This certainly poses an interesting research scenario.

Finally, a sub-conclusion resulting from this research study dealt with sustainability being best approached in a multidisciplinary manner and as a long-term process. This could be enhanced by a multi-generational approach as observed in four of

the seven small to mid-sized enterprises represented in Table 10-2. A researcher could design a study to explore how such variables might contribute to a long-term sustainability focus for a company. The research approach could accommodate a qualitative or quantitative methodology or a mixed methods approach. If broad geographic representation were arranged with the proper funding and other research collaborators, it would be interesting to see where grouping of these multi-generational companies occur and what industries are represented. Tying in the local sustainability aspects found in this study could provide reference material for a future research project.

Table 10-2

Small to Mid-sized Enterprise Case Study Attributes

Company	B-Corp	Public	Private	Family-Owned	2nd Generation	Rural
W.S. Badger Company	√		√	√	√	√
Epoch Homes			√			
New England Wood Pellet			√			√
New Chapter			√			
Hitchiner Manufacturing			√	√	√	
Monadnock Paper Mills			√	√	√	√
Casella Waste Systems		√		√	√	
Totals	1	1	6	4	4	3
% Totals	14%	14%	86%	57%	57%	43%

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APPENDICES

Appendix A: Small to Mid-Sized Enterprises Sample List

Screening Categories	W.S. Badger Company <i>Pilot-Interview Site</i>	Epoch Homes <i>Pilot-Interview Site</i>	New Chapter	Monadnock Paper Mills	New England Wood Pellet	Hitchiner Manufacturing	Casella Waste Systems
Northern New England Location	Gilsum NH	Pembroke NH	Brattleboro VT	Bennington NH	Jaffrey NH	Milford & Littleton NH (Mexico & France)	Rutland VT (Incorporated in Delaware)
Triple Bottom Line Approach	No	Yes	Yes	Yes	No	Yes	Yes
CSR/CER	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Publicly Traded vs. Private	Private	Private	Private	Private	Private	Private	Public since 1997 (on NASDAQ-CWST)
Tenure	Since 1995-17 years	Since 1983-29 years (Purchased by John Ela in 2006)	Since 1982 - 30 years	Since 1819 - 193 years	Since 1992-20 years	Since 1946 - 66 years	Since 1975-37 years
Environmental Sustainability Statement	Yes	Yes	Yes	Yes	No	Yes	Yes
Mission/Vision/Value	Yes	Yes	Yes	Yes	Yes	Yes (Living Values)	Yes
Environmental Product or Process	Healing Balms and Body Care Products	Manufacturer of high quality, energy efficient modular homes	Manufacturer of Organic Vitamins and Supplements	Paper/ Printing and Packaging	Premium wood pellet bio-fuels in NE	-Manufacturer of counter-gravity investment casting process -Green Design -Recycling Program	Solid waste management services in 15 states. Markets recyclables generates and sells electricity under contract at waste-to-energy facility. Does R & D
Environmental Certification	Certified Organic, Natural Product & Leaping Bunny Certified	Certified LEED, Green Building Standard & Energy Star	Certified Organic & Global Reporting Initiative (GRI)	ISO 14001:2004/ ISO 9001:2000 Quality Management	Not Yet	ISO 14001:2004 in Mexico	Global Reporting Initiative (GRI)
LEED	Selective on some aspects	Yes	No (they rent their facility)	No (but, have used LEED standards in lighting upgrades)	No	No	No
Member of Networks	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Financial Performance FY 2008/FY 2010	\$4.7 Million	\$7.5 Million	\$50-\$100 Million	\$50-\$100 Million	\$5-\$10 Million	\$150 -\$175 Million	\$139.8 Million

							revenue as of July 31, 2010
Family Owned	Yes	No	No	Yes	No	Yes	Originally yes, went public in 1997
Number of Employees	30	40	215	180	80	-Milford (577), Littleton (200) -Worldwide (1,300)	2,393
Environmental Awards	Yes	Yes	Yes	Yes	Yes	NH BIA under Waste Cap Award	John Casella named 2008 Industry Partner of the Year by EPA
Other	B-Corporation	-Leader in Green Building -Private Equity Backed		ISO 14001:2004 ISO 9001:2000 Numerous Certificates & Awards	Renew-able Energy Industry	-World's leading high-volume producer of ferrous investment castings -Owns a 100+ year old, 70a farm in Milford, NH preserved by an easement for agricultural purposes	Zero-Sort® Recycling, Landfill to energy First solid waste & recycling company to join EPA's Climate Leaders Program in 2003

Appendix B: Institutional Research Board Approval Page

University of New Hampshire

Research Integrity Services, Office of Sponsored Research
Service Building, 51 College Road, Durham, NH 03824-3585
Fax: 603-862-3564

19-Mar-2010

Mitchell, Shelley F.
WSBE, McConnell Hall
Nat'l Resources & Earth Systems Science Program
5 Denbow Road
Durham, NH 03824

IRB #: 4843

Study: An Empirical Investigation: How Small to Medium-sized Enterprises Use Innovation on the Path toward Ecological Sustainability

Approval Date: 19-Mar-2010

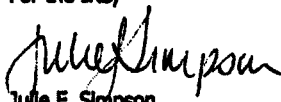
The Institutional Review Board for the Protection of Human Subjects in Research (IRB) has reviewed and approved the protocol for your study as Exempt as described in Title 45, Code of Federal Regulations (CFR), Part 46, Subsection 101(b). Approval is granted to conduct your study as described in your protocol.

Researchers who conduct studies involving human subjects have responsibilities as outlined in the attached document, *Responsibilities of Directors of Research Studies Involving Human Subjects*. (This document is also available at <http://www.unh.edu/osr/compliance/irb.html>.) Please read this document carefully before commencing your work involving human subjects.

Upon completion of your study, please complete the enclosed Exempt Study Final Report form and return it to this office along with a report of your findings.

If you have questions or concerns about your study or this approval, please feel free to contact me at 603-862-2003 or jule.simpson@unh.edu. Please refer to the IRB # above in all correspondence related to this study. The IRB wishes you success with your research.

For the IRB,


Julie F. Simpson
Manager

cc: File
Merenda, Michael

Appendix C: Dissertation Project Timeline

Phase 1

1. **Objectives:** Literature Review to gather secondary data sources related to scientific principles, business strategy and frameworks, and research methods. Identify primary document sources and potential Small to Mid-Sized Enterprises (SME) for case studies. Develop key performance indicators, set case study screening criteria, and select the tentative case studies.
2. **Tasks:** Meet with a Reference Librarian to learn about RefWorks for conducting research.
3. **Means:** Literature Review, and determine selection criteria and make a preliminary selection of the case studies.
4. **Product/ Outcomes:** Eco-Sustainability Conceptual Framework, Eco-Scorecard and selection of multiple-case studies. Write the first draft of dissertation chapter on scientific principles and business strategy and frameworks.

Phase 2

1. **Objectives:** Design Interview Script and Protocol Guide to be used in the field.
2. **Tasks:** Develop the interview script and Protocol Guide based on Phase I products/outcomes.
3. **Means:** Review the International Organization for Standardization (ISO) ISO 14001 & 9001, B Corporation Rating System, Campbell Environmental Health & Safety Award and Global Reporting Initiative-Sustainability Reporting Guidelines for interviews. Submit application to the Institutional Review Board for approval.
4. **Product/ Outcomes:** Interview script and Protocol guide to be used with a few potential respondents. This will be a two-stage process. The first stage will refine the conceptual model and interview protocol of the interviews with a couple potential respondents to identify problems such as poorly worded questions, items that may be easily misunderstood, or gaps in the content of the questions. Potential respondents (Small to Mid-Sized Enterprise - Managers) will not be included in the data gathering or final case studies. The Pilot Study results will greatly contribute to future interviews.

Phase 3

1. **Objectives:** Conduct case study interviews, Data Gathering, Content Analysis and Synthesis of Data focused on the Eco-Sustainability Conceptual Framework, Eco-Scorecard and semi-structured interviews.
2. **Tasks:** Submit transcripts of interviews to interviewees for approval, conduct follow-up interviews/ questions and answers sessions as needed. Finalize coding scheme, submit coding scheme to advisors for comments on reliability and validity. The researcher will conduct semi-structured interviews with the CEO/President if possible, key executives and managers. Interviews will include meeting with 3-5 employees in order to triangulate data within each company. Validity and reliability for the research will be addressed through two methods: triangulation and member checking. The validation method utilizes separate sources to identify the accuracy of data. The second method includes providing participants with the final categories and themes identified to ensure accuracy of the data provided by each participant.
3. **Means:** All interviews to be transcribed within 48 hours. If permissible, the interviews will be tape recorded or videotaped. Coding Software may be utilized such as *NVivo*® and training will be required.
4. **Product/ Outcomes:** Completion of case study interviews, Data Gathering and Content Analysis. 100% transcribed interviews, 100% coding completed.

Phase 4

1. **Objectives:** Write multiple-case study. Submit completed dissertation to Graduate School.
2. **Tasks:** Complete synthesis of data, submit dissertation drafts to Advisory Committee for comments, and integrate comments into successive drafts.
3. **Means:** Committee Review of manuscript drafts. Do Dissertation Defense.
4. **Product/ Outcomes:** Completed Dissertation, presentation of findings at a professional conference; “Lessons Learned” and how they may be applied to northern New England and beyond.” Co-author and publish one or two papers in a peer-reviewed journal.

Appendix D: Comparison of Fuel Costs

According to the Pellet Fuels Institute website, wood pellets are a cost stable and price competitive fuel. The following chart shows a comparison of home heating fuels with values that are national averages for the 2011-12 heating season (www.pelletheat.org).

<p>Wood Pellets Cost per ton in dollars \$ <input style="width: 50px; text-align: center;" type="text" value="245"/> Appliance Efficiency <input style="width: 50px; text-align: center;" type="text" value="80"/> % Cost per million BTU=\$18.67</p>	
<p style="text-align: center;">Fuel Oil #2 Cost per gallon in dollars \$ <input style="width: 50px; text-align: center;" type="text" value="3.58"/> Appliance Efficiency <input style="width: 50px; text-align: center;" type="text" value="78"/> % Cost per million BTU=\$33.25</p>	<p style="text-align: center;">Electricity Cost per kWh in cents <input style="width: 50px; text-align: center;" type="text" value="12"/> ¢ Appliance Efficiency <input style="width: 50px; text-align: center;" type="text" value="100"/> % Cost per million BTU=\$35.16</p>
<p style="text-align: center;">Natural Gas Cost per therm in dollars \$ <input style="width: 50px; text-align: center;" type="text" value="1.39"/> Appliance Efficiency <input style="width: 50px; text-align: center;" type="text" value="78"/> % Cost per million BTU=\$17.38</p>	<p style="text-align: center;">LP Gas / Propane Cost per gallon in dollars \$ <input style="width: 50px; text-align: center;" type="text" value="2.83"/> Appliance Efficiency <input style="width: 50px; text-align: center;" type="text" value="78"/> % Cost per million BTU=\$39.72</p>
<p style="text-align: center;">Hardwood (air dried) Cost per cord in dollars \$ <input style="width: 50px; text-align: center;" type="text" value="200"/> Appliance Efficiency <input style="width: 50px; text-align: center;" type="text" value="60"/> % Cost per million BTU=\$16.66</p>	<p style="text-align: center;">Coal Cost per ton in dollars \$ <input style="width: 50px; text-align: center;" type="text" value="250"/> Appliance Efficiency <input style="width: 50px; text-align: center;" type="text" value="75"/> % Cost per million BTU=\$10.89</p>

Appendix E: Full Analysis Tables for New England Wood Pellet

Table 4A. *Key Performance Indicators for Sustainable Enterprise*

Invariant Constituent	# participants to offer this experience (n=3)
(A-1) NEWP as an energy company that is processing wood pellets for an essential need of fuel & heat	2
(A-1) Product makes a difference as an alternative; there is a public benefit to what we do (innovation for improvement)	2
(A-1) A focus on growth and getting more people to do the right thing (to see the costs vs. benefits)	1
(A-2) Striving to increase production with decreased consumption of energy and resources (balance)	1
(A-1) Customers drive the industry	1
(A-1) Completely renewable product	1
(A-1) Far ahead of the average in terms of sustainability	1
(A-1) Business is dependent on external circumstances (public opinion, oil prices, weather, etc.)	1
(A-2) Source of wood is recycled	1
(A-2) Dependent on productive capacity of the Earth	1
(A-2) Improvements needed in documentation as to where all wood comes from	1
(A-2) Negatives of use of plastics, as well as diesel to run trucks	1
(A-2) Sustainable forest practices	1
(A-1) Using and producing renewable energy	1

Table 4B. *Key Performance Indicators for an Eco-Culture*

Invariant Constituent	# participants to offer this experience (n=3)
(B-5) Leadership committed to environmental practices and stewardship	2
(B-3) Optimizing efficiency	2
(B-4) A culture of challenging conventional wisdom or knowledge for	2

sustainability	
(B5-6) Culture of employees understanding the company makes a difference and therefore on public awareness, potential benefits, and public interests	2
(B4-5) Leadership driving the creativity of the people and the company/ leadership involved with employees, seeking ideas & thoughts	2
(B-3) Sustainable forest practices (renewable)	1
(B-3) Using and producing renewable energy; focus on energy reduction and sustainable renewable energy	1
(B-3) Energy reductions/ culture of reducing	1
(B-3) Generating own electricity	1
(B-3) Looking to use rail service to new facility (decrease trucking)	1
(B-3) Recycle everything (waste costs money)	1
(B-3) Current overall U.S. social culture promoting low efficiency in trying to meet LEED and others: is a loss of sight of higher efficiency solutions	1
(B-3) Approach of doing more on less; continuous improvement in efficiency	1
(B-3) Company focused on reducing the carbon footprint	1
(B-6) Good safety record; cares about safety	1
(B-4) Limited use of stretch goals due to rapid growth, time constraints	1
(B-4) Stretch goals to achieve sustainability	1
(B-5) Passionate leader who thinks of the big picture, the long terms	
(B-4) Design/redesign for the environment is source of innovation	1
(B-5) Risk taking	1
(B-4) Team approach to finding new innovation	1
(B-6) Cultural shift in seeing company as an energy company, not a wood products company	1
(B-6) Focus on public awareness, potential benefits and public interest	1
(B-6) Training	1
(B-6) Use website to communicate directly	1
(B-6) Environmental health, safety reports	1

(B-6) Focus on knowledge network to facilitate communications, technology transfer, and best ideas	1
(B-6) No job titles reflective of sustainability or responsibility	1
(B-6) Getting word out to buy locally; saves costs and energy required to transport	1

Table 4C. Key Performance Indicators for Eco-Redesign

Invariant Constituent	# participants to offer this experience (n=3)
(C-7) Helping customers reduce ecological footprint	2
(C-7) Do not use EPA program design for environment	2
(C-8) Moving people off oil, using a renewable energy source; supporting local supply rather than global oilers	1
(C-8) Recycling and Reuse: recycle bag film, wood pellets, cardboard, metal, etc.; recapturing resources through recycling and reusing materials	1
(C-9) LEED systems: retrofitting existing buildings	1
(C-10) Supply chain audits not yet in place, but developing	1

Table 4D. Key Performance Indicators for Eco-Tracking

Invariant Constituent	# participants to offer this experience (n=3)
(D-11) Invested in responding to Occupational Safety and Health Administration (OSHA) issues through informal Environmental Management System (EMS)	2
(D-11) Developing life cycle assessments, but incomplete: Do not have documentation where all wood comes from yet.	1
(D-12) No formal program for tracking	1
(D-12) Inputs only wood and energy/ outputs include emissions and small amount of solid waste	1
(D-12) All represent costs and trying to make the best of it	1
(D-13) Maintain a materials database	1

Table 4E. Key Performance Indicators for Eco-Advantage Mindset

Invariant Constituent	# participants to offer this experience (n=3)
(E-15) CEO definitely committed to environmental practices and stewardship	3
(E-15) Pushing for sustainable options	1
(E-15) Some leadership deeply committed; others not as deeply committed	1
(E-15) CEO committed but frustrated with political processes	1
(E-18) Leadership ability to make long term decisions	1

Table 4F. Key Performance Indicators for the Triple Bottom Line (TBL)

Invariant Constituent	# participants to offer this experience (n=3)
(F-19) TBL contributes to economic sustainability	1
(F-19) Already make a product that is sustainable	1
(F-19) Seeking consumer opinion and understanding of their responses (communication with the local community)	1
(F-19) Reach out to everyone	1
(F-19) Company has a big impact on energy use in the area	1
(F-19) Brand loyalty	1
(F-20) Corporate social responsibility (CSR): is fundamental to what company is about	1
(F-20) CSR: is all about the mission, providing the alternative to fossil fuels, getting people to understand	1
(F-20) Educating the consumer	1

Appendix F: Full Analysis Tables for New Chapter

Table 5A. *Key Performance Indicators for Sustainable Enterprise*

Invariant Constituent	# participants to offer this experience (n=3)
(A-1) Commitment to sourcing that supports sustainability	2
(A-1) Company-wide respect for nature and natural processes	1
(A-1) Ever-conscious of impact on people and environment, while making business run	1
(A-1) Striving to be sustainable; some aspects not completely sustainable yet	1
(A-1) Innovative basis for sustainability	1
(A-1) Done a great job respecting environment in business; always consider the effect on the environment	1

Table 5B. *Key Performance Indicators for an Eco-Culture*

Invariant Constituent	# participants to offer this experience (n=3)
<i>Eco-expense reduction</i>	
(B-3) Compost system	1
(B-3) Recycling (cardboard, glass, soybean labeling)	1
(B-3) Concern about waste and production	1
(B-3) Not wasting natural resources	1
(B-3) Very good at doing the right thing (even office supplies like pens are eco-friendly)	1
<i>Applies Eco-sustainability lens</i>	
(B-4) Waits in order to develop truly sustainable product (continuous improvement in sustainability efficiency)	2
(B-4) Over the years, have had a vast improvement in using a sustainability lens	1
(B-4; B-6) Have a sustainability department	1
<i>Leadership contribution to culture of sustainability</i>	

(B-5) CEO and leadership committed to sustainable practices	3
(B-5) Culture comes from the top down	2
(B-5) Environmental sustainability defines company mission and culture	1
<i>Company Culture and Innovation</i>	
(B-5) Sense of community/family in which employees take ownership of sustainability efforts	2
(B-5) Awareness of sustainability and practices infused in culture	2
(B-5) Commitment to sustainability	1
(B-5) Company identification with connection with people and nature or oneness with nature; comes from leadership	1
(B-5) Leadership involved with employees/inspiring them	1
(B-5) Previously used environmental sustainability measures on key performance indicators (KPI), but now is woven into the fabric of who we are	1
(B-5) Innovation is part of the culture, not really a stretch goal; have our own goals	2
(B-5) Innovation for sustainability where current technology does not offer a solution/ innovation to solve problems with the sustainability focus (stretch goals for more sustainable practices)	1
(B-5) Innovative sourcing strategies to truly know where raw materials come from	1
<i>Storytelling/knowledge sharing</i>	
(B-6) Job titles, created sustainability department and science and innovation team	2
(B-6) All employees involved; trip to Costa Rican farm as part of learning process/ training for increased understanding	1
(B-6) Pamphlets and website to disperse information	1

Table 5C. Key Performance Indicators for Eco-Redesign

Invariant Constituent	# participants to offer this experience (n=3)
(C-7-8) Recycling efforts	2
(C-7-8) Retrofitting building to meet LEED	2

(C-7-8) Find the sources of raw materials to ensure pure organic	2
(C-10) Recent audit, 80-85% materials get compost or recycled	1
(C-7) Do not actually use EPA's Design for the Environment (DfE)	1
(C-7) Organic sustainable sources	1
(C-7) Employees trained in the use of recycling methods	1
(C-8) Try to use closed loop systems wherever possible	1

Table 5D. Key Performance Indicators for Eco-Tracking

Invariant Constituent	# participants to offer this experience (n=3)
<i>Life cycle Assessments</i>	
(D-11) Life cycle assessments: From the source to the product and waste created in the process	2
(D-11) Outsourcing: use of third party for Life Cycle Assessments (LCA)	1
(D-11) Tracking footprint through use of Global Reporting Initiative (GRI) with a focus on scope 1 and 2	1
(D-11) Stepping away from the global reporting initiative to doing it ourselves; customizing the process	1
(D-11) Supply chain adjustments depending on findings and current circumstances	1
<i>Tracking/Materials Database</i>	
(D-12) Do energy and waste audits: air pollution and waste generation is low	1
(D-12) Self-set energy allotment	1
(D-12) Required inputs want to be recycled	1
(D-12) Established requirements and procedures	1
(D-13) Yes, have materials database: inputs/outputs	1
(D-13) Materials database and tracking used to determine the sustainability practices of sources	1
<i>Environmental Management System (EMS)</i>	

(D-14) No formal EMS	1
(D-14) Seek to provide a healthy, great place to work	1
(D-14) Seek out ways of maximizing the use of the resources	1
(D-14) Not using International Organization for Standardization (ISO) ISO 14001	1
(D-14) Audits completed by retailers not as in depth, or not done	1

Table 5E. *Key Performance Indicators for Eco-Advantage Mindset*

Invariant Constituent	# participants to offer this experience (n=3)
(E-15) CEO commitment	3
(E-15) Culture comes from the top down	2
(E-15) Consistent CEO and leadership commitment to sustainable practices	2
(E-15) Times when forego profit to do the right thing	1
(E-16) In efforts to be as sustainable as possible, looking for finer details as we go (sustainable options)	1
(E-18) Bigger decisions are long-term decisions and are made with sustainability in mind	1
(E-18) Some tactical decisions need to be short term	1
(E-18) About switching to the sustainable source because is no longer a short run, is a good market so you go back to your sustainable methods	1

Table 5F. *Key Performance Indicators for the Triple Bottom Line (TBL)*

Invariant Constituent	# participants to offer this experience (n=3)
(F-19) Do not make decisions without considering the people, planet, and profit	2
(F-19) Working to make more and more of the business sustainable	1
(F-19) Do a great job with establishing dialog and engaging the local community (communication)	1
(F-19) Give back to local community	1

(F-19) Foes contribute to marketing competition	1
(F-19) Engage with friends as stakeholders	1
<i>Corporate Social Responsibility (CSR)</i>	
(F-20) Take responsibility for our impact on individuals, society, and environment	2
(F-20) Philanthropy: rain forest sustainability	2
(F-20) Assist in improvements in lives of the farmer suppliers etc.	2
(F-20) A primary focus of the company: doing as much as can to improve wherever possible	2
(F-20) Support youth programming	1
(F-20) Support prenatal clinics in Indonesia	1
(F-20) Led by company leadership	1
(F-20) Donating products back to the communities	1

Appendix G: Full Analysis Tables for Hitchiner Manufacturing

Table 6A. *Key Performance Indicators for Sustainable Enterprise*

Invariant Constituent	# participants to offer this experience (n=3)
(A-2) Recycling and reuse of raw materials/ shift focus on reuse	3
(A-2) Company striving to reduce carbon footprint	2
(A-1) Growth and development along with innovation and improvement	2
(A-1) Effective use of resources serves as a driver for innovation	1
(A-1) Provides a competitive advantage	1
(A-1) Balance taking care of employees and customers	1
(A-1) Need to get people to see cost for non-sustainability and benefit to sustainable practice/offer savings and efficiency	1
(A-2) Creating sustainability in the local environment	1
(A-2) No product produced, is a process	1
(A-1) Company goal to produce profits while protecting environment	1
(A-1) Projects for cost savings and energy reduction	1
(A-1) Shared personal values with the company	1

Table 6B. *Key Performance Indicators for an Eco-Culture*

Invariant Constituent	# participants to offer this experience (n=3)
Recycling rather than use of raw materials	2
(B-5) Leadership commitment to sustainable practices of recycling materials/ production waste & environmental and energy use reduction	2
(B-4, B-3) Cost reduction by innovative energy use, tracking, & recycling/ Targets for pollution and energy conservation/ focus on and innovation in energy reduction processes	2
(B-4) Stretch goals for innovation in sustainability and profitability	2
(B-3) Reclaiming products of others and reuse	1
(B-5) Company mindset and culture contribute to innovation/ success in driving	1

innovation lies in the people and organization	
(B-6) ISO 14001 in Mexico, attempting in U.S.	1
(B-3) Work on cost reductions and waste management to reduce costs	1
(B-4) People will buy product because know you are energy efficient (competitive advantage)	1
(B-6) Training staff to understand the importance of eco-sustainability	1
(B-6) Take back program	1
(B-5) Employee compensation for environmental performance	1
(B- 5) Economic reasons for environmental issues	1
(B-5) Leadership commitment to safety, quality, productivity, and utilization	1
(B-4) Research & Development Center	1

Table 6C. Key Performance Indicators for Eco-Redesign

Invariant Constituent	# participants to offer this experience (n=3)
(C-7) Fuel transfer for more economical vehicles and less fuel use	2
(C-8) Closed loop system reclaiming wax	2
(C-8) Closed loop system for air emissions/ air meds	2
(C-9) Replaced old lighting with more efficient	2
(C-8) Water cooling and heating for reuse elsewhere and plans for more heat recovery	2
(C-7) Efficiency in material and energy use: Designing product & helping customer to redesign theirs to see advantage in using our technology/ designing product to reduce material use of customer	1
(C-7) Rocker arm designs for smoother operating engines	1
(C-8) Recycling sand	1
(C-9) Installation of skylights for natural lighting (use of alternative sources)	1
(C-9) Motion sensor lighting	1
(C-8) Use of algae produced	1
(C-10) Supply chain audits of packaging to reduce and reuse	1

(C-10) Purchasing group in charge of audits of supply chains	1
(C-10) Audits for improvement with conservation	1

Table 6D. *Key Performance Indicators for Eco-Tracking*

Invariant Constituent	# participants to offer this experience (n=3)
(D-12) Track materials use, costs, and wastes, including energy use, water, air pollution, waste generation, and compliance	2
(D-13) Materials database	2
(D-13) Castings can be melted down and reverted to virgin material/ get rebirth, recycled material every time it is melted down	2
(D-14) Health, environmental and safety practices/ Environmental and risk management: Going beyond OSHA requirements; value employees and do not want to put them at risk	2
(D-12) Shut off when not in use	1
(D-12) Recycling of cardboard, plastic, aluminum to avoid disposable fees	1
(D-12) Progress on energy savings from fixing defunct equipment	1
(D-12) Heat recovery	1
(D-12) Quality control	1

Table 6E. *Key Performance Indicators for Eco-Advantage Mindset*

Invariant Constituent	# participants to offer this experience (n=3)
(D-15) Management team very committed to sustainability, which is a big part of the company	2
(E-18) Company values employee retention and customer loyalty	2
(E-16) Cost reduction means recycling & solutions	1
(E-16) Company is focused on innovation in energy reduction processes to reduce costs and be competitive with overseas markets	1
(E-18) Leadership views whole value chain	1
(E-18) Strategic plan for eco-sustainability	1

Table 6F. Key Performance Indicators for the Triple Bottom Line (TBL)

Invariant Constituent	# participants to offer this experience (n=3)
(F-20) Involvement with local community	2
(F-19) Approaching the Triple Bottom Line	1
(F-20) On-site training for community	1
(F-20) Communicating and conversing with the local community	1
(F-20) Committed to social responsibility	1
(F-20) Care about environment and where employees live	1
(F-19) Culture not just about profit, but investing in the future	1
(F-19) Management commitment to what is right for the environment and to create a better place to work	1
(F-19) Employee training and awareness	1
(F-20) Support wildlife journal	1
(F-20) Donations from foundation	1

Appendix H: Full Analysis Tables for Monadnock Paper Mills

Table 7A. *Key Performance Indicators for Sustainable Enterprise*

Invariant Constituent	# participants to offer this experience (n=3)
(A-1) Characteristic of company/ingrained in the company/natural way of doing business for the company	2
(A-1) Commitment to local sustainability (employees and leadership dedicated to achieving sustainability)	2
(A-1) Educational function	2
(A-1) Provides a competitive advantage/ niche in the marketplace	2
(A-2) ISO 14001	2
(A-2) Balance of inputs and outputs to neutralize impact	2
(A-1) Continuous transformative process that the company is dedicated to	1
(A-1) Company is far ahead of competition in terms of ensuring the balance of economic, social, and environmental aspects	1
(A-2) Supply chain of access/ "glocal"	1

Table 7B. *Key Performance Indicators for an Eco-Culture*

Invariant Constituent	# participants to offer this experience (n=3)
(B-4) Reinventing the products	3
(B-5) Mindset/culture of reducing carbon footprint (core business value/team based approach)	3
(B-4) Need for new direction sparks innovation	2
(B-4) Incentive from having distinction through having environmental conscience/leading in the field	2
(B-4) Focus on new innovation, seeking out new certification to provide competitive advantage	2
(B-6) Leadership ability to make decisions for the long-term	1
(B-3) Do not want to pollute own backyard	1

(B-5) Energy & soon water are biggest environmental issues	1
(B-4) ISO 9001 & ISO 14001	1
(B-4) Stretch goals to promote innovation	1
(B-4) Constantly changing technologies to meet constantly changing market needs	1
(B-4) Innovation has several sources	1
(B-4) Innovation stemming from management and leadership committed to the Triple Bottom Line	1
(B-6) Influencers in the value chain	1

Table 7C. Key Performance Indicators for Eco-Redesign

Invariant Constituent	# participants to offer this experience (n=3)
(C-10) Frequent use of supply chain audits to account for costs and potential impact	1
(C-7) Design for environment with intense Research & Development (R&D) system	1
(C-8) Closed-loop systems inclusive of recycling paper, water, & raw materials	1
(C-9) Green building LEED could be improved	1
(C-9) Implementation of efficient lighting project	1
(C-9) Roadblocks to retrofitting in historical value of facility	1

Table 7D. Key Performance Indicators for Eco-Tracking

Invariant Constituent	# participants to offer this experience (n=3)
(D-11) Lifecycle assessments	1
(D-12) Indicators to track energy use, pollution, waste generation, and compliance	1
(D-13) Part of the operations includes a materials database that tracks everything: "A significant and intense database"	1

Table 7E. Key Performance Indicators for Eco-Advantage Mindset

Invariant Constituent	# participants to offer this experience (n=3)
(E-16) Company is focused on innovation to create new product directions that remain in line with sustainability practices	3
(E-15) Employees and owners/leadership dedicated achieving sustainability	2
(E-15, E-18) Company leadership viewing the entire value chain from raw materials	1
(E-18) Ability of leaders to make decisions for the long term	1
(E-15) Leadership support for sustainability from the top down	1
(E-18) Additional person hired for health/safety	1
(E-18) Educational reimbursement	1
(E-18) Focus on employee retention	1
(E-17) "significant" Local and State involvement	1

Table 7F. Key Performance Indicators for the Triple Bottom Line (TBL)

Invariant Constituent	# participants to offer this experience (n=3)
(F-19) Management/leadership that buys into the TBL approach, incorporating social, environmental, & financial effects	2
(F-20) Commitment to corporate social responsibility demonstrated by support for company foundation and wildlife support	2
(F-19) Successful transformation: Company is better off due to the adoption of the TBL approach	1
(F-19) Company is far ahead of competition in terms of the TBL, but there is always room for improvement	1

Appendix I: Full Analysis Tables for Casella Waste Systems

Table 8A. *Key Performance Indicators for Sustainable Enterprise*

Invariant Constituent	# participants to offer this experience (n=3)
(A-1) Innovation commitment to optimization and focus on diversion with recycling	2
(A-1) Purpose to reduce carbon footprint	2
(A-1) Service weighted toward recycling, processing material to return to manufacturing stream	2
(A-1) Enables returns for customer	1
(A-1) Mission/culture aligns with eco-sustainability goals	1
(A-1) Decommoditization of market	1
(A-1) Material recycling at the molecular level and infinite reuse	1
<i>Carrying Capacity of Earth</i>	
(A-2) Converted trucks, gas collection systems in landfills, closed and capped landfills,	1
(A-2) Reducing waste and customers waste	1

Table 8B. *Key Performance Indicators for an Eco-Culture*

Invariant Constituent	# participants to offer this experience (n=3)
(B-4) Mainstreaming eco-culture through innovation for customer ease	3
(B-3) Company focused on recycling/committed	2
(B-5) Very strong leadership commitment and vision	2
(B-3, B-6) Lead with recycling; customers moving more to environmental responsibility	2
(B-5, B-6) Investment in employees	2
(B-5) Company mission aligns with eco-sustainability goals	2
(B-3) Greenhouse gas reductions/gas collection systems	1
(B-3) Materials reuse/recycling at the molecular level	1

(B-3) Post-recycling material used for power	1
(B-3) Optimization	1
(B-3) Converted trucks	1
(B-5, B-6) Ensure that employees understand the roots of the company/training employees	1
(B-3) Climate leaders program	1
(B-5) Company focused on recycling, not waste	1
(B-4) Innovation for energy reduction and sustainability (patents)	1
(B-4) Culture of innovation	1
(B-6) Sustainability reporting	1
(B-6) Articulate mission well, is important to investors	2

Table 8C. *Key Performance Indicators for Eco-Redesign*

Invariant Constituent	# participants to offer this experience (n=3)
(C-7) Unsure about design for environment	2
(C-8) Recycling	2
(C-9) Trading out light bulbs	2
(C-9) LEED certification	2
(C-7) Not using design for environment	1
(C-8) Not a closed loop system	1
(C-9) Zoning	1
(C-8) Use of alternative power sources (wind, solar)	1
(C-7, C-10) Partner with U.S. Green Fiber	1
(C-10) Use, but not familiar with supply chain audits	1
(C-10) Not audited	1

Table 8D. *Key Performance Indicators for Eco-Tracking*

Invariant Constituent	# participants to offer this experience (n=3)
(D-11) Use a lot of Life Cycle Assessments (LCA)	2
(D-13) Materials database	3
(D-11) Look at each project from a life cycle perspective	1
(D-12) Try to reduce from the beginning	1
(D-12) Progress in internal communication	1
(D-13) Have become more consistent with the data and how recorded	1
(D-14) SAP® system	1
(D-14) Strong safety department	1
(D- 14) Compliance audit	1

Table 8E. *Key Performance Indicators for Eco-Advantage Mindset*

Invariant Constituent	# participants to offer this experience (n=3)
(E-15) CEO is committed and supportive	3
(E-16) Process aligned with idea of resource optimization model	1
(E-18) Yes, leadership decisions with long term, eco-effect in mind	3

Table 8F. *Key Performance Indicators for the Triple Bottom Line (TBL)*

Invariant Constituent	# participants to offer this experience (n=3)
(F-19) Company subscribes to the Triple Bottom Line	2
(F-20) Involvement with local community, Corporate Social Responsibility (CSR) especially at the local level	2
F-20) We are eager adopters/leaders	1
(F-20) Not done enough with CSR	1

Appendix J: SAP® Customer Profile and Key Ratios for Casella Waste Systems

Casella Waste Systems is committed to managing and reducing its greenhouse gas (GHG) emissions cost-effectively. It chose the SAP® Carbon Impact on-demand solution to streamline the GHG inventory management process, identify the optimal mix of emissions reduction projects, and facilitate reporting to multiple voluntary GHG registries.

With professional, experienced staff who understand greenhouse gas inventory and assessments, the SAP team supporting SAP Carbon Impact is in its own league when it comes to in-depth GHG reporting and analysis.” James W. Bohlig, Chief Development Officer, President, Casella Renewable Group

Company

- Name: Casella Waste Systems
- Location: Rutland, Vermont
- Industry: Utilities – resource management
- Products and services: Recycling
- Revenue: US\$554 million
- Employees: 2,393
- Web site: www.casella.com

Challenges and Opportunities

- Comply with impending greenhouse gas (GHG) regulations
- Partner with the EPA Climate Leaders Program
- Take advantage of opportunity to differentiate by offering low-emission services

GHG reporting

- Make GHG usage and cost information more accessible at the division level
- Drive investment in cost-effective energy efficiency projects
- Guide development of strategic emission reduction plan

Key Ratios for Casella Waste Systems
 As of 2/6/12 (<http://ir.casella.com>; www.sap.com/download.epd?context)

Recent Price \$	7.00
52 Week High \$	7.79
52 Week Low \$	4.50
Average Volume (Mil) (RTMA)	0.09
Beta	1.81
Market Data	
Market Cap. (Mil) \$	181.65
Shares Out (Mil)	26.94
Float (Mil)	24.45
Dividend Data	
Yield %	0.00
Annual Dividend	0.00
Payout Ratio (TTM) %	0.00
Financial Ratios	
Quick Ratio (MRQ)	0.70
Current Ratio (MRQ)	0.80
LT Debt/Equity (MRQ)	508.00
Total Debt/Equity (MRQ)	510.00
Valuation Ratios	
Price/Earnings (TTM)	-
Price/Sales (TTM)	0.51
Price/Book (MRQ)	2.06
Price/Cash Flow (TTM)	3.60
Operating Performance	
Earnings (TTM) \$	-0.39
Sales (TTM) \$	13.69
Book Value (MRQ) \$	3.39
Cash Flow (TTM) \$	1.94
Cash (MRQ) \$	0.16
Return Metrics	
Return on Equity (TTM)	-
Return on Assets (TTM)	-1.50
Return on Investment (TTM)	-1.80
Profitability Ratios	
Gross Margin (TTM) %	37.70
EBIT Margin (TTM) %	6.80
Profit Margin (TTM) %	-2.80