Designing for Sustainability: Applying Management Theory to the Pursuit of Sustainable Design

Jeanne Enders and Pamela Tierney

Portland State University

and

Albrecht Enders

A-dec, Inc.

For the

Second Annual International Conference on Business and Sustainability

Portland, Oregon

October 17, 2008

We measure the quality of product in terms of the total loss to society due to functional variation and harmful side effects.

- Genichi Taguchi c.f. Phadke's Quality Engineering Using Robust Design

Introduction

The drive to create new business models, practices, products or services that focus on protecting the planet and people has generated a great deal of enthusiasm in recent years (Unruh, 2008; Wirtenberg, Russell & Lipsky, 2009). The desire to meet both strategic business needs and the needs of society is increasingly becoming the norm for business organizations (Esty & Winston, 2006; Porter & Kramer, 2006). While the goals for socially responsible business become more salient, the paths to achieving sustainable design are not necessarily clear. The "how" remains as challenging as ever and, if we expect businesses to be profitable but still address many pressing societal issues, it is imperative that we work together to sharpen the tools in the toolbox for the best chances of sustainable success.

In this paper we propose that designing for sustainability is much like designing well for any other business success and that existing theory and practice in the areas of innovation and leadership

are readily applicable to the task of sustainable design. This paper presents a model wherein sustainability goals may be approached through social and technical paths and describes some useful theory for both practitioners and academics pursuing a better understanding of what it might take to innovate with sustainability as a central driver.

Sustainability and Sustainable Design Defined

What is sustainability? Since perhaps the earliest modern definition of sustainability from the United Nation's Brundtland Commission (World Commission on Environment and Development [WCED], 1987), many variations on the definition have emerged. The Brundtland Commission offered the frequently-quoted definition: sustainable development is resource use, the direction of investments, technological orientation and institutional change that are "made consistent with future as well as present needs.." (WCED, 1987, p. 25). To successfully attend to future generations while conducting business activity, actors must develop strategies for forecasting impacts of their actions. Interestingly, one model for sustainable business activity, The Natural Step, offers a concept called "backcasting" to assist decision-makers in identifying an image of success, or "principles of success" and work backward to better understand the externalities of business activity (Robert, 2003). Robert argues these "principles of success" are easier to agree upon than detailed descriptions of final outcomes. The Natural Step therefore defines four "system conditions" which represent principles for success. The system conditions include the following: [1] In a sustainable society, nature should not be subject to increasing substances which extract from the earth's crust, [2] nature should not be subject to increasing substances produced by society, [3] nature should not be subject to degradation of physical means and finally, [4] the ability of humans to meet their needs is not systematically undermined (Robert, p. 67). A sustainable company then, is one that makes decisions which "simultaneously improve the economy, the community and the environment" (Hitchcock & Willard, 2006) by attending to such principles of success.

Are there alternative definitions for a sustainable business? Indeed, one may think about sustainability from a variety of alternative perspectives. In fact, one might argue that a sustainable business is one that successfully profits over a reasonable period of time. Sustainability could also define a state during which a business has successfully provided employment in a community over a long period of time. Sustainability in business could also be the consequence of successful strategies for innovation such that the company provides customer value over a reasonable period of time. These definitions might culminate in a phrase such as a company that is sustainable is capable of "ongoing value creation" to a multitude of stakeholders. In this paper, we argue that a business that strives to be sustainable over time, along any of these dimensions, will need to be able to adapt, evolve, develop new products, services, business models and technologies and consistently satisfy internal and external stakeholders now and in the future.

Sustainability Innovation Design Model: Three Levels

As depicted in Figure 1, this organizational model focuses on three levels: theory, domain, and results. The theory we draw upon derives from the extant management literature addressing leadership and innovation. We rely on these two main areas of theory and research to inform our thinking about two domains of competency to which any company should carefully attend: the

social and the technical domains. We suggest that attention to these two domains will result in effective and enduring systems, and profitable results consistent with a sustainable enterprise.

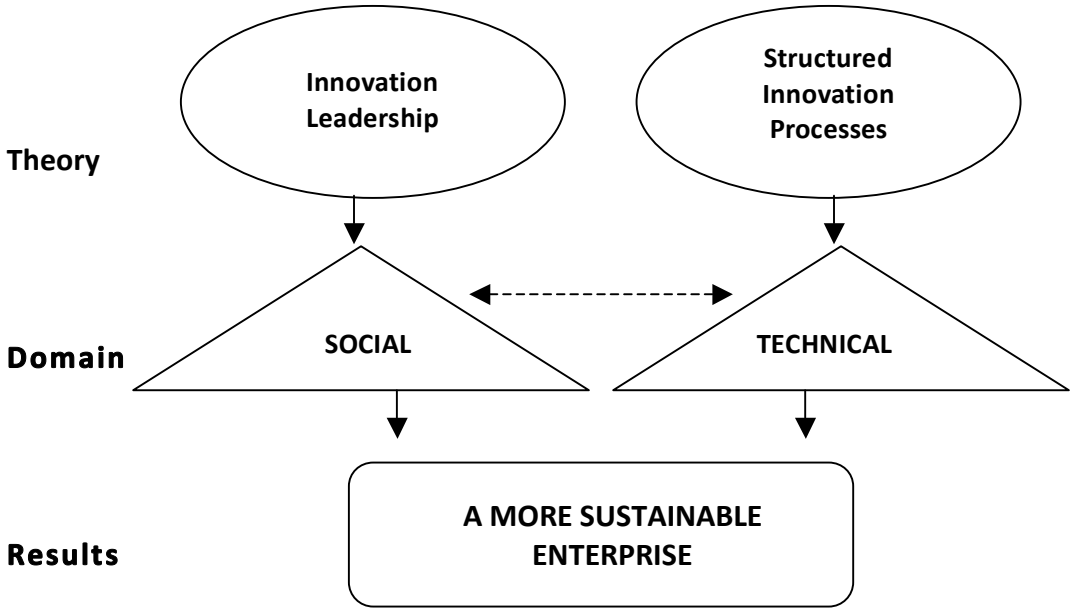

Figure 1. An Organizational Model of Innovation and the Sustainable Enterprise

The Domains of Sustainable Design

Together, the two presiding, general domains depicted in our model shape numerous aspects determining whether the organization and its members will successfully engage in successful sustainability-conducive innovation. The two domain types are specified in relation to numerous phenomena in organizational theory in recognition that action within work contexts is largely a function of people and technical factors. Borrowing from group process literature, in this paper, *technical* is synonymous with "task process" whereas *social* refers to the "socio-emotional" aspects of organizational life (McGrath, 1984).

The Technical Domain. The technical domain in an organization refers to the aspects of organizational life wherein tools are rigorously applied to achieve results that benefit the organization. Examples of technical tools for task process in innovation include the use of surveys, focus groups, rigorous observation in the field, customer needs identification through job mapping, interactive prioritization of customer needs (in this paper we call this a "customer session") and the use of a concept matrix as a decision-making tool. Attention to the technical domain, or to structured processes for innovation around customer need, offers the best chance of hitting the *innovation sweet spot* required for profitability and long-term success in product, service and business model design (Drucker, 2002; Ulwick, 2008). In the excitement and rush to do "good work" and meet the important goals of protecting people and the planet, focus on foundational requirements such as creating new value to customers at the lowest cost possible

(increasing the cost to value ratio of product/service platforms) remains a critical driver for long-term success. Generating products and services that are environmentally sound and telling customers they *should* wish to change behaviors for the good of the planet, for example, will not likely result in sustainable business success. Rather, these products and services must capture that *innovation sweet spot* where customers get excited about having their needs met and value is high. The tools of the "technical domain", as discussed in this paper, can be helpful in the pursuit of these goals for sustainable design.

The Social Domain. A presiding notion in the management literature is that innovation is very much a social phenomenon, and that the emergence of innovative ideas cannot be understood without consideration of the social context and dynamics in which it is embedded (cf. Amabile, 1988; Woodman, Sawyer & Griffin, 1992). The social domain is comprised of every member of the organization and the multiple, complex actions, norms, values, perceptions, and behavioral exchanges that take place among them. The social domain of innovation resides at multiple levels of the organization from the most macro such as the company culture and climate, the meso level consisting of interpersonal dynamics between and within teams and work units, to the most micro level which captures issues such as employee values, attitudes, and knowledge related to sustainable innovation. The social domain is particularly critical because it is a strong determinant of whether employees are both motivated and enabled to generate innovative ideas. Although numerous factors can shape the social domain for innovation, research over the last decade points increasingly to the myriad ways in which leadership influences whether an organization and its members tend to innovate around core issues (Tierney, 2007) such as sustainability. As such, much of the research on innovative leadership has focused on how leaders motivate and enable employees to create designs or ideas for products and processes that are both unique and meet the goals of the organization.

Influence of Innovation Tools on the Technical Domain

There are many tools available to influence the technical aspects of innovation in product, service or business model design. In this paper, we will discuss three basic process tools: customer job mapping, customer sessions and concept matrices. The first two offer a means for data collection. The latter is where requirements for sustainability can be implemented in the design process.

Customer Job Mapping. Customer job mapping involves looking at customer needs from the perspective of what job a customer needs to get done (Ulwick, 2008). The first step is to create a "job map" from the perspective of a customer and then generate outcome statements (customer needs) for each specific phase of the job. These outcome statements become the structure of the customer requirements used to identify unmet needs. Like a flow diagram, each step of the job is listed with accompanying outcome statements. The most important needs can then be identified through a prioritization process using tools such as structured surveys. Based upon structured survey results, an innovation map can be generated that defines the innovation sweet spot in the form of a scatter diagram, for example. Ulwick's job map and outcome-based methodology can also address emotional components of customer needs/jobs. Innovative companies are already very good at mapping or addressing the emotional impact of how products and services are used and how customers experience the product or service (Bettencourt & Ulwick, 2008).

Customer Sessions . The term "customer session" refers to a specific innovation tool for gathering data in a group setting (Desai, J. Personal communication, June 2005). A customer session provides an opportunity for an innovation team to bring together multiple and varied end users of products or services to discuss customer needs. The innovation team prepares a "universe of ideas" in advance using tools such as surveys, interviews, observational fieldwork, card sorts, or even just idea generation from the innovation team. In the customer session, customer participants and the teams collaborate to assure the list of customer needs and requirements is complete and robust. The goal in the customer session is to eventually surface the *innovation sweet spot* and *what customers value most* – find the vital few requirements or unmet needs – wherein the greatest value shift lies. These will be areas that are very important to the customer and also where current satisfaction is very low. Customers select from lists of requirements those they believe have the greatest value and then in groups discuss and rank the needs into categories of value. As customers discuss their individual priorities, "true" value emerges and customers are guided through a trade-off process ultimately resulting in identification of the 20% of the requirements that account for 80% of the value. This process should be repeated multiple times (six to twelve, for example) with different customer teams. The interactive process with the customer teams allows the innovation team to gain deep insights into what provides true customer value.

Concept Matrix. The concept matrix (Pugh, 1981) allows for evaluation of different concepts and technologies against the vital few requirements some of which are established at the customer session described above. The concept matrix offers the most promising area for attending to sustainability requirements while generating break-through concepts. A concept matrix is a spreadsheet wherein the rows house the vital few requirements; these are key value drivers (unmet needs), key sustainability drivers and total business cost drivers. The columns in the spreadsheet represent a baseline concept and several alternate new concepts. The new concepts are then compared against the baseline on how much improvement they show on the vital few requirements relative to the baseline concept. For example, a baseline service concept in grocery retail might be home delivery service by order. An alternate concept might be subscription service where the customer automatically receives products delivered regularly without having to place an order. Comparing both concepts relative to a possible customer requirement such as "convenience", for example, might show that the new subscription concept is an improvement along that specific dimension. Baseline concepts are usually "best in class" products or services that the team is attempting to leap frog. The objective of the process is to create new breakthrough concepts that show conceptual improvements on as many vital few requirements as possible generating new value for the customer while reducing the overall business cost. Multiple iterations are used to further improve robustness of promising concepts and/or of the final concept. The ultimate goal of multiple iterations is to shift the baseline several times so that the final concept has significant improvement in terms of value to cost ratio. Anecdotal evidence (based upon using this method in an MBA classroom and an industry setting) suggests that initial, first iteration concepts generated by different teams produce similar outcomes and create no dramatic shift in value to cost ratio. It is only through multiple iterations of the structured innovation processes, wherein personal idea ownership is quickly impossible to maintain, that true value shifts are likely to be identified. It is tempting to shortcut through the iterations and may be helpful to remember that Thomas Edison apparently required thousands of attempts before he finally created the light bulb.

ITERATION ONE	**Baseline**	**Concept 1**	**Concept 2**	**Concept 3**
KEY CUSTOMER VALUE DRIVERS				
Enhanced customer experience*				
More efficient "job completion"*				
KEY SUSTAINABILITY DRIVERS				
Low-impact (sustainable) supply chain*				
KEY BUSINESS COST DRIVERS				
Manufacturing cost*				
Reliability considerations*				
Serviceability considerations*				

*many more levels in practice

Figure 2. Sample Concept Matrix

Sustainability in the Technical Domain. Sustainability requirements can show up in multiple areas in the innovation process. They can appear as part of the innovation sweet spot as unmet customer needs. For example, medical reports on the dangers of chlorine bleach to human health may suddenly create a customer need for non-toxic household cleaners. If sustainability issues are part of unsatisfied customer needs, customers will seek them and a sustainability requirement can therefore provide a value shift to customers for which they are willing to pay a premium. If the ultimate product or service solutions are mostly innovation team guesses, rather than products of a structured innovation process that clearly defines the innovation sweet spot and commits to rigorous concept generation and selection, they are less likely to succeed in the marketplace.

Sustainability concepts can also be introduced through a company's business model – how companies manufacture or deliver products or services. An example of a total business cost requirement that is driven by sustainability values might be the need to reduce post-production transportation costs and devise alternative supply or delivery chains to reduce fossil fuel consumption and the rising costs associated with such use of petroleum.

If sustainability requirements do not support a shift in customer value in combination with healthy business costs, a company's solution is likely to fail, similar to the way that a presumably exciting new technology that does not provide real benefit to the customer will fail. The key is that any successful innovation will ultimately support and improve the value to cost ratio of a product, service or business model. One classic example of this is how Cirque de Soleil transformed the

circus by creating a higher value proposition to expand the customer base for circuses and eliminate high-cost, low-value features such as animal acts (Kim & Mauborgne, 2005).

Indeed specific markets will differ on the value they place on sustainability requirements. One means to promote the value of sustainability is through educating markets and modeling social responsibility and good will, but, as a rule, the best path to successful innovation is not to tell the customer what they should want but to simultaneously locate that innovation sweet spot while incorporating sustainability requirements in the design. Ultimately, if there is a stronger connection, by whatever means, between the customer and the community, sustainability needs can be more naturally integrated into the product design because customers will select for solutions that provide community value.

Influence of Innovation Leadership on Social Domain

Although numerous aspects of leadership's influence on sustainable design through the social realm could be addressed, we will focus on three: core values, role modeling, and collaboration.

Much of what leaders do, and the influence they have on employee action, stems from the personal values leaders espouse (Kouzes & Posner, 2007). The extent to which a company is successful in terms of sustainable design will in large part be determined by whether leaders at all levels value both innovative thinking and the notion of sustainability. When top leaders possess such values, they are more likely to formulate the corporate vision and operationalization of strategic goals to explicitly include sustainability-related innovation, create reward systems that recognize successful sustainable design efforts, and provide time and resources to be dedicated specifically to sustainable innovation activities. In this regard, leaders set the 'tone' around sustainability for the organization. Leaders at lower levels of the company, such as work unit supervisors, are on the front-line for innovation among their employees (Tierney, 2007) and the extent to which they value innovation and sustainability also shape employees' action in this regard in some fundamental ways. On a regular, and more immediate basis, supervisors are able to communicate to employees the importance of thinking and acting in sustainable ways, and how individual employee actions align with the organization's sustainability mission. When leaders hold innovation-sustainability values, they are more likely to notice and encourage individual employee efforts that are the necessary, first step toward the generation of sustainability design. They are also more likely to create a climate in their work unit where employees are comfortable taking risks in thinking of new and sustainable ways to approach their work processes, or products.

Leaders are also able to shape and motivate employees through the innovative behaviors they model (Mumford Scott, Gaddis, & Strange, 2002). When leaders engage in innovative activities such as approaching work issues in creative and sustainable ways, they demonstrate for employees how such engagement is possible and the manner in which it can be accomplished. Thus, modeling is a way in which leaders can develop employee skill and knowledge for sustainable design. Leaders are also able to motivate employees for sustainability innovation through their role modeling. Research (Tierney & Farmer, 2002, 2004) has shown that employees with leaders that model innovative work feel that innovation is a valued and expected part of their jobs and report having greater confidence that they personally can successfully generate creative ideas for products and processes. Role modeling is also one of the fundamental mechanisms by

which leaders shape a corporate culture. Engagement in sustainability design behaviors by leaders over time results in the development of a culture characterized by shared values around the importance of sustainability innovation, norms in which innovation around sustainability-related issues is expected behavior, and a sense of meaning in which employees sense that they are innovating for issues that have a significant impact.

In many regards, generating and developing innovative design is a collaborative endeavor (Amabile, 1988), and the extent to which sustainable design efforts will be advanced depends on the degree of teamwork that takes place among coworkers. Leaders are a prime mechanism for encouraging and facilitating the collaboration among employees that is necessary for innovation. Leaders are in a position in which they can create opportunities for dialogue among employees regarding the importance of sustainability. They also are able to initiate points of interaction among employees by which they can share their innovative ideas regarding sustainability and receive crucial feedback that aids them in further developing and refining sustainability design. Innovation around a certain issue often emerges when there is a sharing of diverse opinions, areas of expertise, and knowledge (Kanter, 1988). When leaders create a safe environment for idea sharing, and embrace the importance of individual differences, employees feel comfortable bringing their personal 'resources' to a problem and contributing to its solution through innovative means.

Reciprocal Domain Influence. It is important to note that although we tend to categorize factors in terms of the social or technical domain, these domains do not operate in isolation of one another. There are, in fact, relevant areas of influence between the two domains in which the social aspects shape the technical, and technical aspects alter the social. For example, commitment to a set of technical processes for discovery of ideas and concepts means innovation teams can avoid conflicts about how to proceed in their innovation work. Engagement in such processes could also have a spillover effect in terms of creating a norm around collaboration for innovation efforts within the broader organizational setting. The use of the concept matrix supports the separation of individual idea ownership from the concepts themselves and provides a structured means of evaluating value. Such activity encourages participants to step away from their preconceived notions and goals, and move towards the attainment of superordinate goals related to customer need fulfillment. These effects may be characterized as a way in which the technical domain shapes social phenomena. On the other hand, it is clear that structured processes are enhanced by strong motivational outcomes such as accelerated learning through collaboration. Customer sessions in particular offer an opportunity to surface "emergent data" on customer needs and preferences that are impossible to achieve without effective group process. Also, the utilization of the innovation tools discussed require corporate resources and employee time. The extent to which leaders allocate resources and authorize employee engagement for such activities will be determined, in large part, by whether leaders value sustainability and view it as a strategic imperative for their corporation.

Conclusion

The goal of this paper was to consider some pre-existing management literature and innovation practices by conceptually dividing them into two domains: the social and the technical, and describing their importance in the pursuit of sustainable design. The design of sustainable

products, services and business models requires commitment, a motivated workforce, a culture of creativity and risk-taking, collaboration and innovation, and technical tools to determine where the most value for the customer and for the business lie. A company that is economically sustainable (offers employment or makes profits for a reasonably long period of time) and produces sustainable products or services (friendly to the environment and society) will benefit from an emphasis on both the social and technical domain knowledge available in traditional management literature.

References

Amabile, T.M. (1988). A model of creativity and innovation in organizations. In B.M. Staw & L.L. Cummings (Eds.), *Research in Organizational Behavior,* 10: 123-167. Greenwich, CT: JAI Press.

Bettencourt, L. & Ulwick, A. (2008). The customer-centered innovation map. *Harvard Business Review*, May 2008, 109-114.

Drucker, P. (2002). The discipline of innovation. *The Innovative Enterprise*, August, 95-103.

Esty, D. & Winston, A. (2006). Eco-advantage strategy. In *Green to gold: How smart companies use environmental strategy to innovate, create value, and build competitive advantage.* New Haven: Yale University Press.

Hitchcock, D. & Willard, M. (2006). Introduction & Sustainability as a strategic issue. In *The business guide to sustainability: Practical strategies and tools for organizations.* London: Earthscan.

Kanter, R.M. (1988). When a thousand flowers bloom. In B.M. Staw & L.L. Cummings (Eds.), *Research in Organizational Behavior,* 10: 169-212. Greenwich, CT: JAI Press.

Kim, W. C. & Mauborgne, R. (2005) *Blue ocean strategy: How to create uncontested market space and make the competition irrelevant.* Boston, MA. Harvard University Press.

Kouzes, J.M. & Posner, B.Z. (2007). The Leadership Challenge. 4th edition. San Francisco, CA: Jossey-Bass

McGrath, J.E. (1984). *Groups: Interaction and performance*. Englewood Cliffs, N.Y. Prentice-Hall.

Mumford, M.D., Scott, G.M., Gaddis, B., & Strange, J.M. (2002). Leading creative people: Orchestrating expertise and relationships. *Leadership Quarterly*, 13: 705-750.

Porter, M. E. & Kramer, M.R. (2006). Strategy & society: The link between competitive advantage and corporate social responsibility. *Harvard Business Review,* 84: 78-92.

Pugh, S. (1981). *Concept Selection-A Method that Works.* International Conference on Engineering Design,. Rome, Italy.

Robert, K. (2003). Integrating sustainability into business strategy and operations. In S. Waage (Ed.), *Ants, Galileo, & Gandhi: Designing the future of business through nature, genius,and compassion.* UK: Greenleaf Publishing.

Tierney, P. (2008). Leadership and employee creativity. In J. Zhou & C.E. Shalley (Eds.), *Handbook of Organizational Creativity*: 125-147. Lawrence Erlbaum Associates: New York.

Tierney, P., & Farmer, S.M. (2002). Creative self-efficacy: Potential antecedents and relationship to creative performance. *Academy of Management Journal*, 45: 1137-1148.

Tierney, P., & Farmer, S.M., (2004). The Pygmalion process and employee creativity. *Journal of Management*, 30: 413-432.

Ulwick, A. (2005). Formulating the Innovative strategy. In *What customers want: Using outcome-driven innovation to create breakthrough products and services.* New York: McGraw-Hill.

Ulwick, A. & Bettencourt, L. (2008). Giving customers a fair hearing. *MIT Sloan Management Review*, 49(3), 62-68.

Unruh, G. (2008). The biosphere rules. *Harvard Business Review*, February.

Wirtenberg, J., Russell, W.G. & Lipsky, D. (2009). *The sustainable enterprise fieldbook: When it all comes together.* New York, NY: Greenleaf Publishing.

Woodman, R.W., Sawyer, J.E., & Griffin, R.W. (1993). Toward a theory of organizational creativity. *Academy of Management Review*, 18: 293-321.

World Commission on Environment and Development (WCED) (1987) *Our common future*. Oxford, UK: Okford University Press.