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Sustainable Design
Final Assignment: Green Products
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A CRITICAL EVALUATION OF SUSTAINABLE DESIGN AT PRODUCT LEVEL: SEVENTH GENERATION'S FACIAL TISSUES

Seventh Generation is a retail distribution brand of non-toxic and environmentally safe household products. The company's brand-name products range from non chlorine bleached, 100% recycled facial tissue, diapers, napkins and paper plates to non-toxic, phosphate free, biodegradable cleaning, dish and laundry products (Seventh Generation). Since its inception, the company has established itself as a leader in social responsibility and environmental sustainability, and has received various awards for superior sustainability track record, exemplary corporate citizenship and rapid growth (The Non-Toxic Times, Jan 2005). Marketing itself as a sustainable business has enabled Seventh Generation to successfully capture a niche environmental-conscious market and to perform well financially (Figure 1). In 2003, it represented 34.5% of total household cleaning market in the natural product industry (Seventh Generation Corporate Responsibility Report, 2003). In 2005, Seventh Generation products began distributing in Target stores, further increasing its customer base (The Non Toxic Times, July 2005).

Figure 1. Seventh Generation's posters that marketed itself as a environmentally responsible company (James, 1999).

Seventh Generation was chosen as the subject for evaluation primarily because it possesses an excellent reputation for its green products and socially responsible business model (Non-Toxic Times, Jan 2005). This paper attempts to analyze critically and objectively, one of the company's much-acclaimed green products, to evaluate in reality how sustainable its design is. I chose to assess Seventh Generation's facial tissue, which is made from 100% recycled paper and whitened with a chlorine-free process, which confers it a "Process Chlorine Free" label (Figure 2).

Figure 2. Boxes of Seventh Generation's facial tissues. (Seventh Generation)

To evaluate product sustainability, I endeavor to analyze it qualitatively from the environmental, social and economic perspectives. For a product to be sustainable, it should fulfill all three facets of the sustainability paradigm. It should promote the integrity of the environment, champion social equity, as well as contribute to substantial financial returns for the company.

Environmental Sustainability: A Life Cycle Approach

A life cycle assessment (LCA) is an analytical tool that is used within businesses to understand quantifiable environmental impacts, and can be used to support decisions, manage risks and identify opportunities in the entire cradle–to-grave life cycle of products. A comprehensive life cycle inventory of meaningful environmental data can be utilized as a systems-based framework to evaluate the design and performance of Seventh Generation's facial tissues by identifying critical life cycle stages that pose significant threats to the environment. A generalized product life cycle is depicted in Figure 3. For a specific product, life cycle boundaries (cradle and grave of a product) and the "functional unit" (eg. a completed box of facial tissues) have to be well defined.

Figure 3. Diagram of Product Life Cycle.
(Seventh Generation Corporate Responsibility Report, 2003).

In the LCA, the "functional unit" of Seventh Generation's facial tissue encompasses the paper of the tissue, its plastic film packaging, and the cardboard used to ship it from its manufacturers to their customers (Seventh Generation Corporate Responsibility Report, 2003). Since the facial tissue is 100% recycled, the life cycle included collection and transportation of production waste scraps ("pre-consumer" paper) from paper factories, collection of used "post-consumer" paper to a recycling facility, transportation of recovered pulp from recycling facility to manufacturing site, manufacturing and processing of both papers using recovered fiber, and disposal via landfill or incineration (Seventh Generation Corporate Responsibility Report, 2003). Because Seventh Generation's facial tissues are entirely produced from recycled material, it inherently preserves forests by negating the need for virgin material extraction. At the same time, it also conserves energy and water required for extraction and processing of raw material. Every ton of 100% recycled paper saves as estimated 4100 KWH of energy, 7000 gallons of water and 60 pounds of air pollutants (Green Seal).

Recycled Fibers

The fibers that constitute Seventh Generation's facial tissue are 80% pre-consumer and 20% post-consumer scrap waste paper. Pre-consumer waste includes paper recovered from the manufacturing process, such as paper mill scraps, trimmings and printing waste. Post-consumer waste, on the other hand, is paper that has been used by consumers and has been diverted from the waste stream for recycling (Green Seal). Generally, high post-consumer recycled content is considered environmentally preferable because it maximizes the useful life time of fibers and alleviates the pressure on scarce landfills (National Resources Defense Council). It is estimated that the use of post-consumer fibers reduces the impact on landfills by saving 3.3 cubic yards of space for every ton of paper that is re-channeled (Green Seal). Hence, even though Seventh Generation's facial tissue is 100% manufactured from recycled fibers, it has a relatively modest post-consumer content that underscores its reputation. Cascades Tissue Group, which produces the brand North River, and Marcal Paper Mills, which produces Fluff Out, both have higher post-consumer content (ConservaTree).

Deinking

Deinking of the recycled fiber is the process of removing coatings, fillers, pigments, inks and dyes, before it is used to make the facial tissue. Information about deinking for Seventh Generation's facial tissue products is not available, since it is outsourced to manufacturing partners. Disposal of sludge, which can contain toxic heavy metals such as cadmium, chromium, mercury and arsenic in inks and dyes used in printing, can have negative environmental impacts if improperly handled (Green Seal). For example, toxic sludge deposited in poorly designed landfills may leach and contaminate groundwater. Incineration of the sludge may result in release of toxic emissions that degrades our air quality. A lack of information about the deinking and sludge disposal process for Seventh Generation’s products impedes any credible conclusion on its environmental impact in this criterion.

Process Chlorine Free bleaching (PCF)

Chlorine bleaching to remove lignin from raw pulp and to whiten paper produces chlorine and its derivatives. Chlorinated compounds such as dioxins and furans are known toxics, carcinogens and mutagens that can bioaccumulate in animals and humans (Green Seal). Much of organochlorine pollution occurs in both mills and in the trace contamination of finished paper products, threatening human health (Seventh Generation). Green Seal, an independent, non-profit organization that develops and certifies environmental standards for products, recommends unbleached paper products, which will appear yellow (Green Seal). In the absence of unbleached paper, PCF (Process Chlorine Free), and then ECF (Elemental Chlorine Free) products are environmentally preferred. PCF manufacturing processes employ bleaching alternatives to chlorine and its derivatives. Seventh Generation utilizes hydrogen peroxide as a non-toxic substitute that breaks down into oxygen and water (Seventh generation). This is ideal, because it neither releases dangerous chemicals, nor compensates the quality and aesthetic appeal of the facial tissue as it still appears white.

Packaging

Packaging is part of the product and should also keep to stringent environmental standards. For example, it should not contain toxic metals such as lead, cadmium, mercury and hexavalent chromium (Green Seal). Seventh Generation does not provide information about the packaging toxic content for their facial tissues, making it difficult to assess its environmental safety. However, it does specify that no dyes and fragrances are used, minimizing VOC content (Seventh Generation).

Data Inventory

Life cycle data collected for Seventh Generation’s paper products is illustrated in a bar chart (Figure 4).

Figure 4. Life cycle inventory of Seventh Generation's paper products. Note that data is not specifically for its facial tissue products and is gathered from published sources for Europe and the U.S., rather than from the actual product manufacturing facilities Seventh Generation Corporate Responsibility Report, 2003).

From its life cycle inventory published by Seventh Generation, it is evident that the greatest environmental impacts, by far, occur in the product manufacturing steps, in which the most greenhouse gases, oxides of nitrogen and sulfur, VOCs are generated. This is related to the energy usage of processing the paper products (Seventh Generation). Transportation of the facial tissues appeared not to be significant, save for a moderate production of NOx. Seventh Generation products are usually transported from their factories to distribution centers, to distributors, and to stores. They are also shipped directly from factories to stores. The facial tissue is transported via trucks and trains and occasionally ships. Direct shipping reduces total distance traveled by the products, subsequently reducing energy used and pollutants emitted that stems from transportation. Rail transportation is more environmentally benign than truck freight, which has notoriously high emission rates and low fuel efficiency. Increase of direct shipments and rail transport from 2002-2003 resulted in improvements in Seventh Generation's overall environmental performance (Figure 5).

Figure 5. The impact of product transportation on NOx, VOC and PM emissions. (Seventh Generation Corporate Responsibility Report, 2003)

There are some limitations to life cycle assessment as a tool to evaluate green design. First, it tends to measure negative environmental impacts, ie. the amount of energy and water used. It illuminates areas of mediocre environmental performance and in turn encourages remediation of processes to improve the situation. In contrast to this reactionary approach, William McDonough in *Cradle to Cradle* proposes a proactive designing process that endeavors to enhance and nourish ecosystems, rather than remediate, reduce and mitigate environmental damage. (McDonough, W. and Braungart, M, 2002). Hence, while LCA is useful as a method to track negative impacts of Seventh Generation's facial tissue, it cannot reveal how its design has left a positive legacy on the environment, which would be a superior measure of sustainability. Secondly, the challenge of setting life cycle boundaries and parameters is a key issue, especially in evaluating a green product. For example, is Seventh Generation's 100% recycled facial tissue considered green despite it ultimately coming from the felling of old-growth forests?[1] In addition, because the facial tissue is manufactured in facilities that are not owned or operated by Seventh Generation, environmental data for its manufacturing process (incidentally, the life cycle stage of greatest significance), is not accurate (Figure 4). Examining the LCA of the facial tissue, which is really a combined end-product of several companies, is operationally challenging because it requires transparency and collaboration across corporate barriers.

[1] Note: there was no mention about sustainable/unsustainable forestry practices of pre/post-consumer paper suppliers for Seventh Generation's facial tissue.

Social Sustainability

To be socially sustainable, equity should be promoted in the form of reasonable consumer transparency about product environmental impacts and content. This was achieved in the case of Seventh Generation's facial tissues. It is declared to be PCF and 100% recycled. Furthermore, information about its relative proportions of pre-consumer and post-consumer fiber content was forthcoming, both in the packaging labels and corporate websites. In addition, the company released their Corporate Social Responsibility audit reports, based on the CERES small business reporting framework, which disclosed internal information about their products (Seventh Generation Corporate Responsibility Report, 2003).

There are, however, some uncertainties about the social sustainability aspects of the facial tissues. A socially sustainable product should be produced largely from local materials and resources, which contributes to the local economy, treats its employees and the local community fairly. However, as in the case for environmental data gaps, information about material sources, supply chain and labor practices are not available for Seventh Generation's facial tissues. This is again in part due to the fact that the facial tissue is not manufactured by the company, but by its partners located elsewhere. Hence, there is a limited amount of control and knowledge over the raw material ingredients, environmental and social performance, and equity of business practices. In fact, Seventh Generation addressed this issue in its 2003 Corporate Responsibility report:

"…in many cases, our production volumes limit our ability to influence those facilities' operations. We are hopeful, however, that as we grow we will be able to wield increasing amounts of economic clout and will be able to convince our manufacturing partners to commit the capital investments needed to create additional positive environmental changes in their facilities…we accept the responsibility to do all we can to improve the environmental performance at all the facilities with which we contract."

(Corporate Report, 2003)

Notwithstanding the lack of sustainability information for the manufacturing processes of the product, the candor displayed in the above comment is encouraging, and Seventh Generation has indeed, within its scope of influence, made an effort to maintain its sustainability standards. For example, the company rejected partnering with Wal-Mart as a distributor despite its mass retail potential, because of its lack of transparency around its supply chain and the company's negative social impacts on local communities. Instead, Seventh Generation utilized socially responsible investment due diligence reports to research and select a corporation that has better social, economic and environmental practices: Target (The Non-Toxic Times, July 2005).

Financial Sustainability

A critical, and often neglected, criterion for sustainable design is its financial performance. Ultimately, a product can be designed to be environmentally friendly and socially responsible, but not fulfill its function properly, or end up being too costly or unmarketable. A well-designed green product should, and *must* sell to contribute to the profitability of a company; else, it will not survive on the market for long. Since Seventh Generation is a private company, it does not disclose its financial data. However, based on the longevity of the facial tissue product line in the market, and the growth of the company, it is reasonable to assume that this product is financially sustainable. The facial tissue itself is sold in three sizes, 85, 100 and 175 count cubes (2 ply sheets) and priced competitively with comparative quality.

Concluding Evaluation

At the product level, Seventh Generation's facial tissue appears to be a relatively green product deserving of its reputation. This is justified because it is 100% recycled and process chlorine free (PCF). It is recommended in several green product lists, such as in a wallet guide issued by Natural Resources Defense Council to guide shoppers to purchase environmentally friendly tissue products (Figure 6). Other less obvious, but equally important sustainable features includes responsible, transparent labeling, socially sustainable corporate partnerships and competitive pricing combined with good product quality and functionality.

Figure 6. Wallet guide for environmentally friendly facial tissue brands (National Resources Defense Council).

I have outlined two main areas of improvements that arise from my analysis to improve the sustainability of this product:

1. **Collaboration with manufacturing partners to bridge data gaps**

As acknowledged by Seventh Generation, there is a need to obtain specific information about supply chain environmental and social practices from their manufacturing and supply partners. Although the company does not have control over external partners, it can be argued that they have responsibility to ensure that products marketed under their brand names as "green" have standards that mirror their own. This is especially critical since the life cycle inventory of paper products reveals that the manufacturing, not distribution steps, create the most significant environmental impacts. In particular, information about toxic sludge produced in the deinking process should be collected in the life cycle inventory. Heavy metal and chlorine concentrations[2] in the finished facial tissue products/packaging should be openly disclosed to the public.

2. **Design mindset shift**

Seventh Generation's facial tissue is greener than most facial tissue products in the market, which can be credited to the company's product design team that aims to minimize negative environmental impacts. Yet, such a design mindset that is based on the premise that products will inevitably harm the environment will never be able to produce a very green product. Its design will be less "brown", but never really "green". Rather, I recommend that Seventh Generation begins rethinking its product design to seek areas in which the facial tissue can provide services for the environment, enriching and nourishing ecosystems instead of trying hard to poison them a little less. For example, facial tissue can be designed to be highly biodegradable such that it does not release undesirable chemical in the environment as it decomposes. Wood-fiber based paper is rich in nutrients (cellulose), providing the opportunity, in theory, to be a valuable composting material.

As I developed my analysis, I became acutely aware of a flaw in the design mindset for green products, which I have articulated several times in this paper. Sustainable design simply cannot be confined at the product level; it has to be ultimately assessed from process, industry and market perspectives. Seventh Generation's struggle to account for the environmental performance of its external partners is a strong example of the logistical challenge one faces in assessing a green product that

[2] Chlorine is present in the finished product despite a PCF bleaching process because recycled fibers may contain chlorine. To be entirely free of chlorine, virgin pulp has to be used.

is designed, manufactured, transported, distributed and recycled by different industries. Social sustainability, in particular, does not seem to be directly related to product design. Yet, would you consider a pair of recyclable, non-toxic, inexpensive shoes produced by cheap child labor in India a "green product"? I think not. Hence, I make the concluding argument that a sustainable design mindset has to go beyond merely minimizing impact at a product level; it should endeavor to leave a net positive legacy on the environment in its cradle to grave life cycle, *and*, it has to be widened to incorporate larger scale sustainability issues. These are no doubt challenging and rather unconventional demands, but frame an exciting shift in mindset for green design. This has implications for the expertise that should be included in a design team, opening a Pandora's Box of creative and lucrative opportunities for this field.

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