SUSTAINABLE PRODUCTS PROJECT

LOWELL CENTER FOR SUSTAINABLE PRODUCTION

A NEW WAY OF THINKING:

The Lowell Center Framework for Sustainable Products

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University of Massachusetts Lowell

The Lowell Center for Sustainable Production at the University of Massachusetts Lowell helps to build healthy work environments, thriving communities, and viable businesses that support a more sustainable world.

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In 2009, the Lowell Center convened a work group to share insights about current projects, develop a vision for our efforts on sustainable products, and contribute to this document. University of Massachusetts Lowell participants included:

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Lowell Center for Sustainable Production
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The Lowell Center for Sustainable Production uses rigorous science, collaborative research, and innovative strategies to promote communities, workplaces, and products that are healthy, humane, and respectful of natural systems. The Center is composed of faculty, staff, and graduate students at the University of Massachusetts Lowell who work with citizen groups, workers, businesses, institutions, and government agencies to build healthy work environments, thriving communities, and viable businesses that support a more sustainable world.

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This document is available at *www.sustainableproduction.org*.

Table of Contents

Introduction

Designing a truly sustainable product is a huge challenge in modern society. Nevertheless, many companies are striving to continuously improve the sustainability of their products as consumer demand for safe, healthy, and green products is rising.

The Lowell Center Framework for Sustainable Products is a tool to help evaluate the environmental, social, and economic impacts of existing products and to design new products that minimize these impacts. Rather than focus only on the consumer, a sustainable product framework encompasses the entire product life cycle and considers impacts throughout this system. This analysis includes the people who make the product and those who handle it at its end of life, as well as the communities and ecosystems that are affected by the product through its production, consumption, and disposal.

The Lowell Center Framework for Sustainable Products is a tool to help evaluate the environmental, social, and economic impacts of existing products and to design new products that minimize these impacts.

How to use this framework

The Lowell Center Framework for Sustainable Products presented in this document defines the key elements of a sustainable product and offers a new way of thinking about products as embedded in systems of production and consumption. Companies can begin by addressing one or more elements of the Framework and use it as a continuum, with many opportunities for improvement over time. Some companies may focus on eliminating toxic inputs from production, whereas others will focus on improving working conditions and providing community benefits. Others may rethink their overall business strategy and redesign their products and production systems to ensure that their products meet all the elements of this Framework.

Projects of the Lowell Center for Sustainable Production and the Toxic Use Reduction Institute to encourage the development of sustainable products are described on pages 17–18. Some projects focus on identifying safer alternatives to a toxic chemical in a product, while other projects are designed to evaluate sustainable products more broadly, considering impacts on workers, consumers, and ecosystems. The Framework for Sustainable Products provides a guiding structure for all of these initiatives. This Framework builds on other key Lowell Center documents on sustainable production and alternatives assessment, including *Sustainable Production: A Proposed Strategy for the Work Environment* and *The Alternatives Assessment Framework of the Lowell Center for Sustainable Production*. These documents can be viewed at *www.sustainableproduction.org*.

Who will benefit from the Lowell Center Framework for Sustainable Products?

We offer the Framework as a resource for companies engaged in designing and manufacturing new products or improving existing products. Few truly sustainable products exist today, but many companies are working to lessen their environmental footprint and improve their social responsibility. By defining the key elements of a sustainable product, the Framework helps companies develop a broader vision of what a sustainable product encompasses, identify opportunities for improvement, and assess progress in meeting that vision. These efforts are undertaken in the context of current economic realities, which may dictate limits for full implementation of this ideal.

We hope that government policy makers, advocacy organizations, academic researchers, and individual consumers will also find the Framework useful for identifying changes needed to promote the development of sustainable products. We look forward to your comments about how to make this Framework more robust and useful to those who design, create, and use products.

Driving Forces for Sustainable Products

Consumers choose products based on a variety of factors, including function, price, quality, aesthetics, and, increasingly, environmental and social attributes. A recent survey found that rather than "green" being a narrow niche, over 50% of consumers are changing their buying habits because of their concerns about environmental impacts of products.[1] Another recent poll found that 80% of consumers believe it is important to purchase products from "green" companies and most say that they will pay the additional cost.[2]

A growing demand for healthy products is most evident in the food and agriculture sector. Organic foods are now big business and are available in large retail stores as well as in natural food markets. Products such as organic cotton clothing, eco-friendly school supplies, cosmetics, and "green" toys are being marketed to meet an increased demand for environmentally sound products. In addition to environmental attributes in products, consumers are also looking for products that have been ethically produced. Labels such as "fair trade" have been developed to respond to this demand. What are some of the forces driving this interest in sustainable products?

Is a Product Necessary?

In 2001, Steen Gade, the Director General of the Danish Environmental Protection Agency (EPA) asked, "I know that perfumed socks are now a possibility. The question is, are they a necessity?"

What European policy makers sometimes call "necessariness" is an often overlooked attribute of a product. While there is almost no limit to the number and diversity of products on the market available to those with discretionary income, it is valuable to consider how **necessary** a product is before considering its other attributes.

Unnecessary products require the use of significant resources to make, market, use, and dispose of them. An unnecessary product is not sustainable by definition, even if it may meet many of the criteria outlined in this framework.

However, since the "necessariness" of a product is a subjective evaluation, it can be difficult to determine. Although "necessariness" is not included as part of the framework presented here, we encourage you to consider this attribute when developing new products.

Consumer awareness of unsafe products and increased demand for information

On-going media reports about tainted medicine, pet food, toys, toothpaste, and seafood have raised the awareness and concern of consumers about product safety issues and the problem of toxic chemicals in the global supply chain. Advocacy groups are speaking directly to consumers via blogs, web sites, and newsletters on toxic chemicals in a range of products, including cosmetics and personal care products, furniture, and toys. Consumers are carefully looking at product labels to try to determine product ingredients and where items have been made, and are avoiding some products.[3]

However, consumers are not routinely provided with detailed information about products, such as chemical and material ingredients, energy use, conditions under which a product is made, or hazards during use or disposal. Labeling programs, especially those that are third-party certified, help consumers make informed decisions about the products they buy. These programs focus on specific attributes such as energy efficiency, carbon footprint, and forest management. However, most labeling programs address only one aspect of sustainability and are not comprehensive. Therefore, purchasers must make decisions with incomplete information.

Citizens are demanding more information about products and increased accountability from corporations. In the 2009 proxy season, shareholders filed sixteen resolutions seeking disclosure on a variety of chemicals in products including mercury, pesticides, and nanomaterials, as well as asking for overall sustainability reporting. Some companies, such as Seventh Generation, Inc. have proactively responded by voluntarily disclosing the ingredients in all of their cleaning products. Their program, called "Show the World What's Inside" also includes information to help consumers interpret what the labels mean, at the point of purchase (the guide can be downloaded to a cell phone).

In addition to individual consumer demand, some large retailers are beginning to require that their suppliers provide information about product ingredients, especially for products that may contain toxic chemicals, and are specifying a preference for products that are more sustainable. These retailers act as large-scale "consumers" and so can have a powerful influence on the marketplace.

Surge in state regulations and new federal requirements

State legislatures have taken action to restrict toxic chemicals in products, in the absence of federal leadership. For example, in the last three years, state governments have introduced 90 bills to restrict bisphenol A, an endocrine-disrupting chemical. To date, two states, one county, and two cities have enacted policies that restrict the use of this chemical.[4] In addition to restrictions or bans on specific chemicals in products such as lead, phthalates (used to soften plastics), and brominated flame retardants, states are also introducing comprehensive legislation to reform chemicals management policies.

The federal government has also begun to take action, by strengthening the US Consumer Product Safety Commission (CPSC), the agency charged with assuring product safety. The CPSC, responsible for ensuring the safety of over 15,000 products, has a relatively small staff and budget and limited powers of enforcement. The CPSC does not have the authority or resources to test products for safety prior to introduction to the market. This is the responsibility of manufacturers, who are required to comply with government safety regulations. The agency works cooperatively with industry in developing voluntary standards and relies on companies to test their own products.[5] So, while most consumers assume that any product on the market has been tested for safety, this is not necessarily true. As many recent product recalls have made abundantly clear, current regulations and government institutions are insufficient to protect consumers.

The Consumer Product Safety Improvement Act of 2008 addressed some of the shortcomings that have existed for years in the federal consumer products safety regulations, particularly regarding children's products. It provides increased authority, staffing and funding to the CPSC, makes the voluntary toy standard mandatory, requires third-party testing of children's products, sets lower limits for lead, and bans six phthalates in children's products. Although these actions are encouraging, they are imperfect solutions, because of the thousands of chemicals in products that have still not been adequately tested for toxicity. The Kids Safe Chemicals Act, introduced in May 2008, would require chemical companies to provide basic data on industrial chemicals.

The Global Impacts of Unsustainable Products

Consumers compare prices as they make purchasing decisions and determine whether the quality of the product is adequate based on previous experience with the product, branding, referral from others, or specific product research. However, the prices of most products do not reflect the social and environmental costs of production. Manufacturing is often outsourced to developing countries eager to participate in the global economy.[6] The low prices consumers pay for toys, clothing, and other products are possible because of minimal wages paid to workers and lax enforcement of occupational and environmental regulations in these countries.

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China, a major source of US imports of consumer products, is known to have a weak structure for enforcing health, safety, and environmental regulations. The lead paint recently found on the surface of children's toys imported from China provides one example. During 2007, the CPSC recalled over 17 million toys because of excessive lead levels.[7] Lead paint, used widely in China for industrial applications, is up to one third cheaper than non-lead paint.[8] With tremendous pressure on factory managers to cut costs, and lack of a robust system for ensuring the integrity of the supply chain, it is not surprising that this toxic material found its way into toy factories.

The people and ecosystems of China are suffering the effects of unsustainable production. Pollution is taking an immense human toll as the economy rapidly industrializes without adequate environmental management or protection of public health.[9] The World Bank estimates 350,000 to 400,000 premature deaths from outdoor air pollution in China each year.[10] In 2008, more than 80 % of China's coastal waters

were polluted from agricultural runoff and raw sewage.[11] Groundwater aquifers in 90 % of China's cities are contaminated.[12]

This pollution has far ranging impacts on human and environmental health. China is the largest contributor to global anthropogenic releases of mercury (a potent neurotoxin) from coal-fired power plants.[13] These plants supply power to thousands of Chinese factories that are producing a wide range of consumer products for the global market. It is estimated that as much as 75% of the particulate pollution over Los Angeles, California originates in China.[14] Toxic chemicals are also taken up in the food chain. Polar bears and other arctic animals carry body burdens of persistent organic pollutants that originated far from the regions where they live.[15]

Fortunately, in recent years, the Chinese government has begun to take action to address widespread pollution and has set targets for improving energy efficiency and using renewable energy.[16] These initiatives include shutting down inefficient factories and increasing use of solar energy and light-emitting diode (LED) lighting in factories and homes.[17] These programs are significant but will take time to fully implement.

The Challenges

A sustainable product is not well defined.

The demand for safe and healthy products is growing, but the term "sustainable product" has not been clearly defined. There is a need for an unambiguous definition to ensure that this concept is meaningful. The Lowell Center Framework for Sustainable Products provides this definition and criteria that can help companies to evaluate and improve their products.

Drop-in "greener" substitutes have limitations.

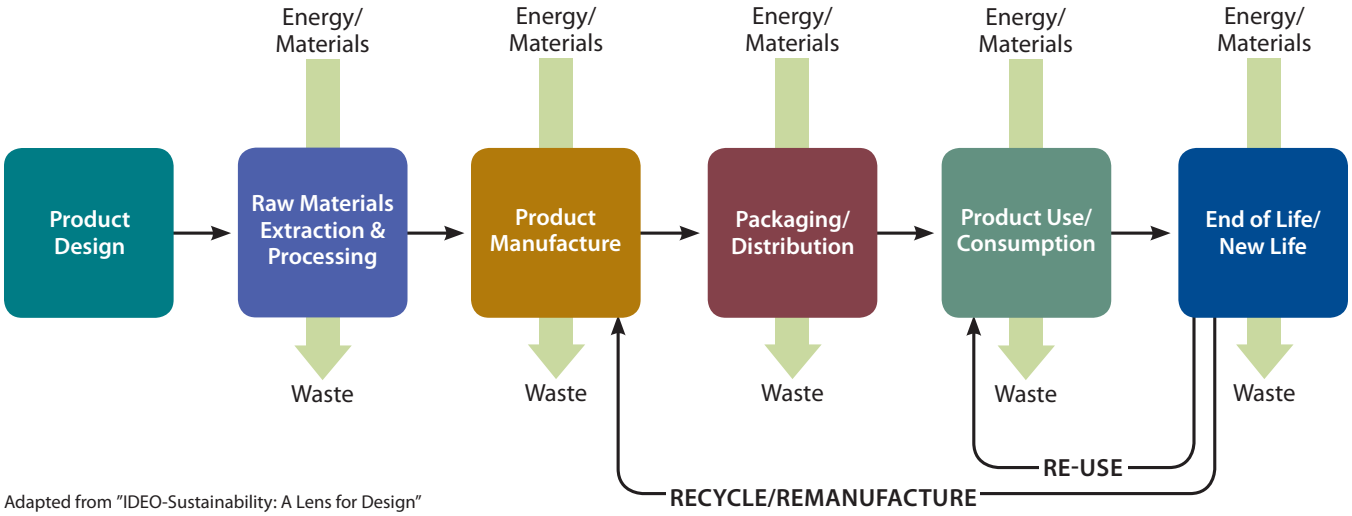
Many "improved" products are usually designed as "drop-in" substitutes for conventional products— for example, a product with a new formulation of chemical ingredients that can simply replace the conventional product. This method typically fails to take into account the "three safeties" described by the Global Health and Safety Initiative—consumer, worker, and environmental safety—and may adequately address only one aspect.[18] A focus on "drop-in" solutions may limit the innovative thinking that is needed to find more effective answers. That is, designing sustainable products is not just about transitioning to more benign materials and products. It is also about broadly examining the purpose of our activities and systematically considering alternative, and sometimes very different, strategies for minimizing unintended consequences while achieving the desired outcome.[19]

Data are lacking on chemical toxicity and the effectiveness of alternatives.

Although product designers may wish to find safer alternatives to commonly used hazardous chemicals and materials, this can be a challenging proposition, as many chemicals have not been thoroughly tested and impacts from low dose or multiple exposures are not well understood. Green chemistry, which is focused on designing environmentally friendly processes and chemicals, is a promising new approach. In addition, biobased and other emerging materials are rapidly being developed as possibly preferable alternatives. However, few of these materials are ready for commercialization, infrastructure for composting/recycling them is not yet in place, and there are sustainability concerns as these materials are produced on an industrial scale. Another problem is that manufacturers of safer alternative products and materials have not been willing to share their "greener" innovations to allow widespread implementation.

Understanding the Product Life Cycle

FIGURE 1 **Typical Product Life Cycle (linear)**



Adapted from "IDEO-Sustainability: A Lens for Design"

A first step in developing a framework for sustainable products is an understanding of the product lifecycle, because environmental and social impacts occur during production and disposal as well as use. The typical product life cycle looks something like the above.

It has been estimated that 70% of the life cycle cost of products is determined at the design stage.

The life cycle for most products is primarily linear, beginning with the design process and including the stages of raw materials extraction, manufacturing, packaging/distribution, consumption/use, and ending with disposal in a landfill or incinerator. Re-use, recycling, and re-manufacturing are generally quite limited. At each stage there are material, energy, and labor inputs, and waste outputs. This "waste" can be in the form of energy or materials but may also appear as occupational injuries or negative social and economic impacts on the local community, which are difficult to quantify. The environmental and social impacts of a product throughout its life cycle are made up of these various forms of waste.

Decisions made at the design stage and throughout the product development and production process have ramifications for a product's life cycle impacts. Extracting and processing raw materials may be hazardous to workers, degrade the environment, and harm local communities. The manufacturing stage poses additional occupational hazards, creates hazardous and solid waste, and causes air, water, and soil pollution. Packaging, distribution, and consumption/use of products often require significant amounts of energy and materials. At the end of a product's useful life, its disposal or incineration may result in health and environmental impacts.

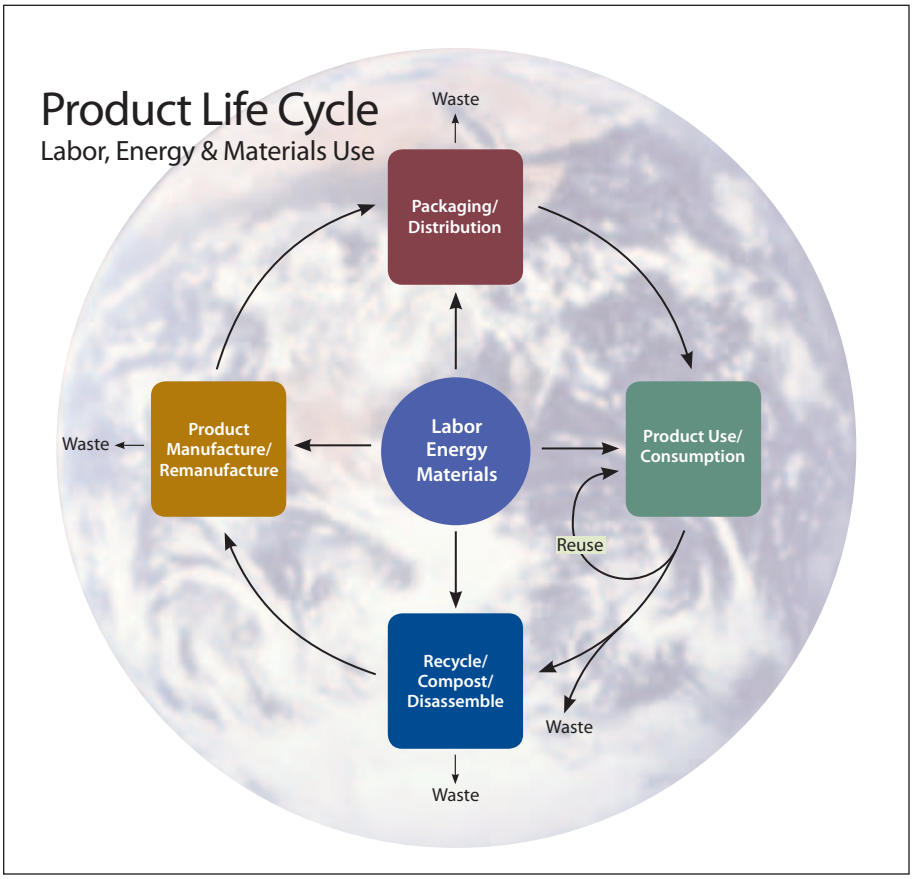
A more ideal product life cycle is illustrated in Figure 2. Ideally, resources and waste are managed in closed-loop cycles, with products being reused, recycled and re-manufactured.

Because products have such wide-ranging impacts throughout their life cycle, it is critical that the design process aim to minimize these effects. It has been estimated that 70% of the life cycle cost of products is determined at the design stage.[20] Manufacturers are becoming increasingly responsible for life cycle impacts of the products they produce, both because of legislation that entails extended producer responsibility[a] and adverse publicity that is generated from news such as sweatshop conditions or illegal dumping of waste. An analysis of the product life cycle can help make visible potential environmental and social impacts so that they can be designed out to avoid these hazards.

Sustainable products minimize environmental and social costs throughout the product life-cycle and aim to maximize environmental and social benefits to communities, while remaining economically viable.

Sustainable products minimize environmental and social costs throughout the product lifecycle and aim to maximize environmental and social benefits to communities, while remaining economically viable. Sustainable product design considers who makes the product, going beyond the basic health and safety considerations that are encompassed in eco design criteria, such as reducing the use of toxic materials.

FIGURE 2 **Product Life Cycle (cyclical)**



Workers often pay the price for economic pressures on manufacturers to cut corners in order to meet demand for low cost products. Even if toxic inputs are eliminated from a product design, workers may be subjected to unhealthy working conditions, such as poor air quality, poor ergonomic design of work stations, involuntary overtime, and excessive pace. A product that is safe for consumers but presents significant hazards for those involved in its production is not a fully sustainable product. Similarly, a product that is polluting in its production and therefore harms the local community is not a fully sustainable product, even if this impact occurs far from where the product is consumed/ used.

a For example, the Waste Electrical and Electronic Equipment (WEEE) Directive, enacted by the European Union in 2003, requires electronic equipment producers to take back their products at the end of life. This directive is intended to encourage design for disassembly and remanufacture and also to support designs that can be repaired, reused and recycled.

A New Way of Thinking:
The Lowell Center Framework for Sustainable Products

In the wake of product recalls and safety scares, many consumers are learning to ask questions and read labels to determine whether a product is safe for them and their family. However, this is often where the questioning ends. The Lowell Center Framework for Sustainable Products challenges us to ask additional questions, such as:

- What are the conditions under which this product was made?
- Is the production process safe for workers?
- What resources were used in making the product and what is the environmental impact of this product in production, use, and disposal?

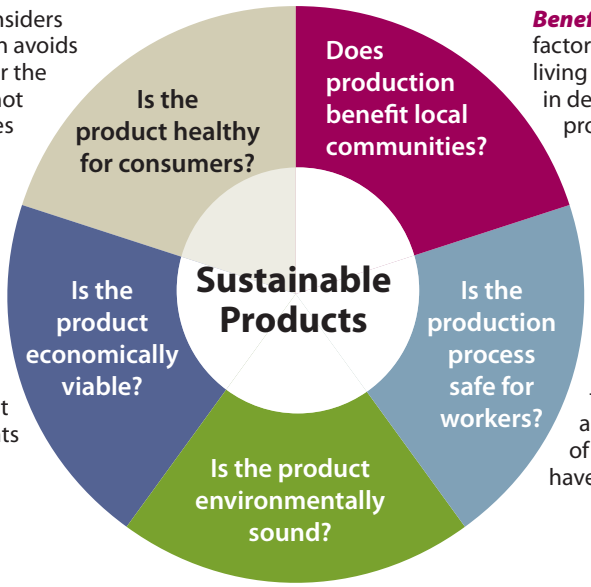
This Framework also considers who benefits from production. While existing economic structures aim to ensure that shareholders accrue financial benefits, this framework also addresses whether benefits accrue to the local community. For example:

- Do workers receive a living wage?[b]
- Do profits support local community development?

In addition, the Framework assesses economic viability beyond the assurance of short-term profits to shareholders, by considering whether a company is profitable without externalizing social and environmental costs.

FIGURE 3 **Lowell Center Framework for Sustainable Products**

Healthy for consumers considers whether the product design avoids toxic chemicals and whether the product is safe in use (e.g., not flammable or explosive; does not cause injury).



Beneficial to local communities considers factors such as whether workers receive a living wage, community members have a voice in decision making, and whether some of the profits accrue to the local community.

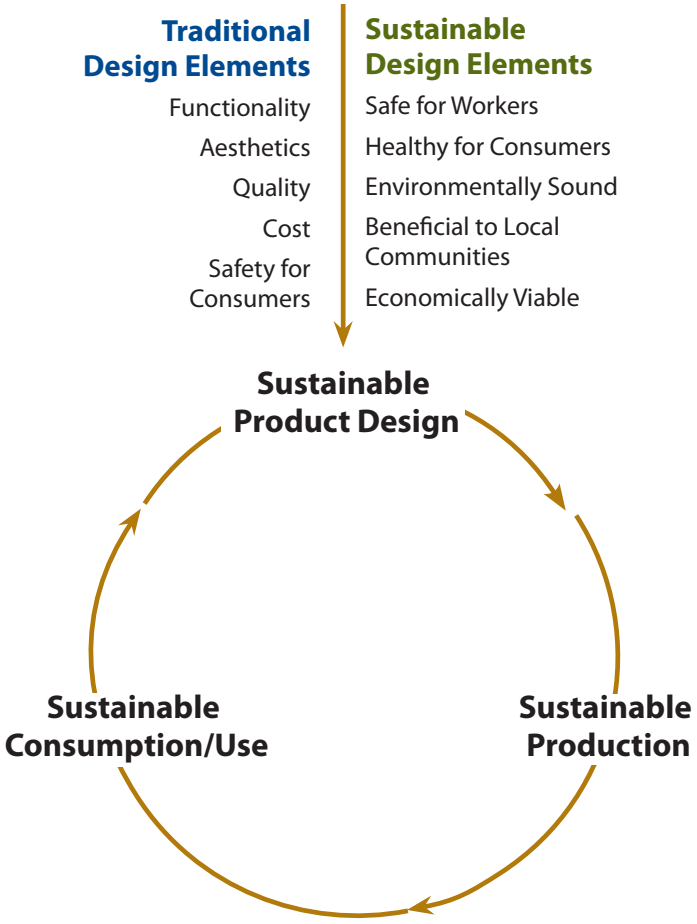
Economically viable considers factors such as whether the product is responsive to market requirements and whether the product is priced to internalize social and environmental costs.

Safe for workers includes the following types of considerations: working hours and pace; whether the workplace is safe, ergonomically appropriate, well ventilated and free of toxic exposures; and whether workers have freedom of association.

Environmentally sound considers factors such as: avoidance of toxic chemicals; energy, water and materials efficiency; durability; biodegradability; recyclability; and use of renewable resources.

b Living wage is defined as the level of income sufficient to allow workers to meet basic needs and support their families without public assistance.

FIGURE 4 **Linking sustainable product design to sustainable production and consumption**



The Lowell Center Framework for Sustainable Products presents many opportunities for innovation in product design. Sustainable product design parameters expand the concept of quality as traditionally conceived as they go beyond technical performance, costs, aesthetics, and basic safety considerations to include environmental and social attributes.[21] This new intention in design encourages the use of safer chemicals and materials, designs that are efficient in use of energy and materials, and products that can be repaired, recycled, or remanufactured. In addition, because so many products and their associated packaging become waste within days or months, sustainable product designers are reconsidering their design choices for products created for short-term use and are selecting materials that are recycled, recyclable, and/or biodegradable.

Figure 4 illustrates the necessary linkages between sustainable product design, production and consumption. To be effective, the sustainable product design process must be linked into systems that support sustainable production and consumption. These systems include strong legal structures

Sustainable product design parameters expand the concept of quality as traditionally conceived as they go beyond technical performance, costs, aesthetics, and basic safety considerations to include environmental and social attributes.

for protecting environmental and occupational health and safety, elimination of subsidies for unsustainable materials, and market and government incentives for sustainable product innovation.

One promising innovation is the concept of a "product-service" system. In this model, manufacturers or service providers maintain ownership and responsibility and so have an incentive to produce durable, environmentally sound, and easily repairable products. Product-service systems shift the business focus from designing and selling products that meet market demand to creating a combination of products and services that also meet demand but in a more sustainable manner. This new way of interacting with customers can enhance the life of the product, increase durability, and ultimately reduce resource use. Examples of product-service systems include solvent leasing services, car sharing services, and carpet leasing systems.

Table 2 (page 13) provides criteria for each element of the Framework. Companies can use these criteria as goals to strive for in creating products that are more sustainable. This Framework can be utilized in a process of continuous improvement, as some changes may be easier to implement than others.

TABLE 2 **Lowell Center Framework for Sustainable Products**

Healthy for consumers A sustainable product is healthy for consumers. This means:	• It avoids chemicals that cause cancer or mutations, damage the reproductive, nervous, endocrine or immune systems, are acutely toxic or accumulate or persist in the environment. • It is safe in use—not flammable, explosive or corrosive, does not cause lacerations, choking or strangling, burns/shocks, damage hearing or injure eyes.
Safe for workers A sustainable product is safe for workers. This means:	• Workplace is safe: clean, well lit, ventilated, with good air quality, well designed ergonomically, free of exposure to toxins, equipped for fire safety and other emergencies. • Workers receive adequate health and safety training. • Working hours and pace are not excessive. • Workers have some job control and input into production process. • If workers are housed in dormitories, the living quarters are clean, and workers have sufficient food, access to potable water and sanitation. • Workers are treated fairly and with respect and dignity; there is no corporal punishment, verbal abuse, coercion, discrimination or harassment. • Child or forced labor is not permitted. • Workers have freedom of association and the right to collective bargaining. • Employees' skills are well utilized and their ideas and input are valued. • Communication is valued and encouraged among workers and management.
Environmentally sound A sustainable product is environmentally sound. This means:	• Chemical and material inputs/outputs are not hazardous (see Healthy for consumers above). • Product is energy, water, and materials efficient in production and use. • Waste is prevented and/or minimized throughout the product lifecycle. • Product and packaging are durable as appropriate, and are reused, repaired, recycled or composted. • Product is designed for disassembly—it can be taken apart and remanufactured. • Renewable resources and energy are utilized in production and use. • Scarce resources are conserved and ecosystems are not damaged in extracting resources for production. • Critical habitats are preserved during extraction, production, and use.
Beneficial to local communities A sustainable product benefits the communities in which it is made. This means:	• Workers receive a living wage and can support their families without additional government assistance. • The work design is supportive to family life—e.g., families are not separated, and good-quality child care is available for workers' children. • The work design promotes equity and fairness in the community—e.g., there is no age or gender discrimination. • Some of the firm's profits accrue to the local community to be used for public improvements (such as in education, health care). • The work design promotes community input and participation and the community is informed about production and labor practices.
Economically viable A sustainable product is economically viable for the firm/organization. This means:	• The product is responsive to market requirements. • Innovation is encouraged to anticipate market needs. • The firm is stable in terms of ownership and philosophy. • The company reinvests in the facility to improve its capacity for further production. • The product is priced for economic viability and also aims to internalize costs so that its production can be environmentally sound and socially just. • The firm is recognized for its corporate social responsibility: this includes programs that support and value employees as well as programs that benefit the community and environment.

Implementing the Framework

The following section considers each of the five framework elements to explore some of the key changes that are needed to encourage the development of sustainable products. Decision makers in government, industry, and communities are encouraged to use the Lowell Center Framework for Sustainable Products to identify the conditions needed to drive this transformation.

1. Healthy for consumers

How do we insure that products are as safe and healthy as possible for consumers? It starts with business intention and a strategy that prioritizes consumer health and safety. This value must be communicated to product designers so they are encouraged to select the safest and most sustainable materials and chemicals in the design process. It also requires that systems are in place to ensure the integrity of the design throughout the supply chain until it reaches consumers.

The 2008 Consumer Product Safety Improvement Act described earlier in this document is a step in the right direction in improving systems to ensure product safety. However, additional policy changes at the federal government level are urgently needed, including a new approach to managing chemicals and ensuring their safety prior to introducing them to the market.

Globally, there is increased pressure on manufacturers to increase transparency about what products are made of and how they are made, so that consumers can better understand their health, environmental, and social impacts. This drive towards increased sharing of information is being promoted by advocacy groups and government policy makers and is being responded to by retailers. It is critical that companies make data on product sustainability easily accessible and relevant to their customers. As more information becomes available, institutional and individual consumers will have a greater ability to influence the marketplace through their purchasing decisions. Requirements for greater transparency are likely to influence manufacturers toward the use of safer and healthier input materials.

2. Safe for workers

How to ensure that working conditions are as safe as possible and humane? Multinational corporations have been working for many years to design codes of conduct and set up systems for auditing factories where production has been outsourced. Yet serious problems continue to occur with the systems that are in place. For example, in October 2007, children as young as ten years of age were found working in a sweatshop in India embroidering clothes for the GAP, Inc. This is not an isolated situation, as the Indian government estimates that thirteen million children are working, many in hazardous industries.[22] It is widely recognized that there are problems with these auditing systems. Factories often keep two sets of books and provide scripted answers for employees. Recognizing these problems, the electronics industry has formed an industry alliance to address them.[23]

A key demand of many advocacy organizations campaigning for improved working conditions in overseas factories is to increase the transparency of the process and involve workers in the implementation and monitoring of codes of conduct, as they have found that most workers are unaware of these standards. Some corporations have begun to make these changes. For example, Levi Strauss and Company, after ten years of finding that inspection information was inaccurate, is now involving workers in regular meetings to follow up on implementation of codes of conduct. This provides an opportunity for workers to exert some influence toward improving conditions.[24]

3. Environmentally sound

The eco design parameters described earlier in this document provide many innovation opportunities. Yet this innovation is unlikely to occur on a large scale without government support for market and regulatory drivers that encourage the development of "green" products through their life cycles. Governments can support this advancement through incentives for the development of safer materials and renewable energy; bans/phase outs of toxic chemicals; elimination of fossil fuel and mining subsidies; and labeling programs and purchasing policies that prefer these products. In addition, governments play an important role in supporting infrastructure development for reuse, recycling, and composting products at end of life.

A significant change is occurring as policies to promote extended producer responsibility (EPR) and product stewardship (PS) are put in place. Both EPR and PS move the responsibility for end of life management of products from local government and waste haulers to product manufacturers. Product stewardship programs include a role for government, retailers, and others whereas EPR focuses on producer responsibility. EPR and PS can be implemented using a variety of policy tools including disposal bans, take-back programs, refund deposit programs, and legislative mandates.[25]

In the absence of federal government leadership, some states such as California and Michigan are taking the lead in supporting green chemistry approaches that develop substances that are "benign by design." In addition, industry groups such as the Green Chemistry and Commerce Council are taking the lead to promote research and practice in green chemistry and engineering across industry sectors.[c]

Examples of programs that increase transparency about products

GoodGuide.com is a new site that provides information on the health, environmental, and social performance of products and companies. As of April 2009, the site included information on 70,000 foods, toys, personal care, and household products. Consumers can focus on a particular attribute of concern or use the integrated score to choose preferred products. ***www.goodguide.com***

The Fair Trade Certified label certifies that farmers receive fair prices for their products and that working conditions are humane. In addition, sustainable agriculture and community development are supported, as fair trade revenues are invested in local projects. ***www.transfairusa.org***

The **Forest Stewardship Council** is focused on responsible management of forests around the world. The organization has developed 10 principles and 57 criteria that address legal issues, indigenous rights, labor rights, multiple benefits, and environmental impacts surrounding forest management. ***www.fscus.org***

EcoLogo provides third-party certification of environmentally preferred products in over 120 product and service categories. ***www.ecologo.org***

Green Seal promotes environmentally sound products by providing third-party certification for a range of products, including cleaning products, windows, paper, and paints. ***www.greenseal.org***

Climate Counts is a nonprofit organization with a mission to raise public awareness about climate change. It has developed a scorecard that ranks companies on their efforts to fight global warming. ***www.climatecounts.org***

Healthytoys.org has tested over 1500 toys and children's products for cadmium, lead, bromine, arsenic, chlorine, and mercury. The site provides a ranking of toys, information about toxic chemicals that may be in children's products, and ideas for taking action to ensure that children's products are safer and healthier. ***www.healthytoys.org***

c The mission of the Green Chemistry and Commerce Council is to promote and support green chemistry and the design for environment approach to research and practices nationally and internationally among companies and other governmental and non-governmental entities. See *http://greenchemistryandcommerce.org/greenchemistry.php.*

4. Beneficial to local communities

Many companies, especially those that operate internationally, understand that as their markets expand in developing countries, it is vital that they contribute positively to the social and economic development of the communities where production occurs. An important aspect of corporate citizenship is community engagement that addresses local social challenges and goes beyond providing jobs and paying taxes.[26] Many companies are beginning to make these community investments. Examples are extremely varied, such as teaching rural women in India to start micro enterprises or offering free community medical care.[27] Innovest Strategic Partners, a socially responsible investment firm, has identified the 100 most sustainable firms in the world by evaluating companies' performance on social, environmental and strategic governance in relation to other companies.[28] Although the methodology is imperfect, it demonstrates how investors increasingly understand that social and environmental performance is relevant to financial performance and are looking for evidence of these commitments.

5. Economically viable

Products must be responsive to market requirements and must be profitable to the firm. However, sustainability requires that economic viability be measured beyond short-term profits. Often, the implementation of pollution prevention practices and eco design results in increased production efficiency in the long-term, which can reduce costs and increase profits. Also, eliminating toxic chemicals from the production process avoids waste management costs and liabilities. Good corporate citizenship practices can also help in improving the economic viability of the company by creating trust with community members and other key stakeholders. All of these efforts can contribute to the long-term stability and viability of a firm. However, leading in the sustainability realm can be challenging and costly, if peer companies are not following suit. Government incentives and consumer demand can help make the business case for investing in communities and protecting the environment, workers and consumers.

Moving towards sustainable products

One of the greatest challenges for corporations engaged in a journey toward corporate social responsibility is to determine how to design integrated solutions. Humans are skilled at identifying problems, designing solutions, and then dividing up these strategies into manageable pieces. Unfortunately, this approach often results in compartmentalized solutions that do not get at root causes. Both incremental steps and systemic change are needed to make progress on the path toward creating sustainable products and ultimately designing a more sustainable world. While implementing these smaller steps it is important to continue to work toward a larger vision of transformational change.

There are many opportunities for design and production innovations to improve the sustainability of our products. From small steps, such as improving packaging by using recycled materials that are recyclable, to larger changes such as substituting safer chemicals and materials and implementing product-service systems, products can be made with reduced environmental and social impacts. All of these changes are vital in moving toward a society where sustainable products are expected by consumers and are routinely provided by manufacturers and retailers.

Lowell Center Projects to Promote Sustainable Products

Lead-free Electronics

Although lead is a well-established human and environmental hazard, it is still used in many products such as printed circuit boards in electronics products. Lead has remained the preferred material on printed circuit boards for the past 60 years because of its proven reliability. To help the electronics industry find alternatives to lead, the Toxics Use Reduction Institute (TURI) and the University of Massachusetts Lowell convened the New England Lead-Free Electronics Consortium. The Consortium is a collaborative effort of industry, government, and academia.

The Framework for Sustainable Products helps guide this effort. The goal of the project is to eliminate lead in consumer electronics products, which will make these products *healthier for consumers*. By removing lead from manufacturing, the production process will be *safer for workers*. By eliminating lead in electronics that is a problem if improperly disposed of at end of product life, the product will be more *environmentally sound*. The Consortium evaluates alternatives for performance and also for *economic viability.*

For more information, contact *Gregory_Morose@uml.edu* (*www.turi.org/industry/electronics).*

Sustainable Biomaterials Collaborative

The Lowell Center participates in the Sustainable Biomaterials Collaborative (SBC) to spur the adoption of biomaterials that are sustainable from cradle to cradle. The SBC advances the development and diffusion of sustainable biomaterials by creating sustainability guidelines, engaging markets, and promoting policy initiatives. Other members of the SBC include the Institute for Agriculture and Trade Policy, the Institute for Local Self-Reliance, and Clean Production Action.

The SBC aims to set a high standard for the production of biomaterials as described in "Guidelines for the Development of Sustainable Bioplastics." The Guidelines propose goals and a roadmap for improving the sustainability of bioplastics. The term "sustainability" in this document encompasses issues of environment, health, and social and economic justice. These guidelines align with the Framework for Sustainable Products and address the following elements: healthy for consumers, safe for workers, environmentally sound, and beneficial to local communities. The SBC seeks to increase market demand to address the issue of economic viability. Recent purchasing specifications are intended to drive the market for products that meet strong criteria.

For more information, contact *Cathy_Crumbley@uml.edu* (*www.sustainablebiomaterials.org*).

Sustainable Hospitals Program

The underlying premise of the Sustainable Hospitals Program (SHP) is that integrating pollution prevention with occupa-tional safety and health results in more sound and appropriate solutions. This approach dovetails with the Framework for Sustainable Products as it integrates solutions that are healthy for consumers, safe for workers, environmentally sound, and economically viable.

A recent SHP white paper reviewed cleaning products and practices in health care facilities and identified existing knowledge gaps for future research. The transition from conventional, often hazardous cleaning products to safer alternatives in the healthcare sector is complex. While some green cleaning products may have fewer health effects and be more environmentally sound, the purchase of green cleaning products does not assure the overall reduction of risk. The SHP encourages green cleaning programs to move upstream in the cleaning process towards non-chemical or less toxic alternatives by identifying new technologies, building materials, and work practices as a means of strengthening infection prevention and control goals.

For more information, contact *shp@uml.edu* (*www.sustainableproduction.org/proj.shos.abou.shtml*).

Sustainable Children's Products Initiative

The Lowell Center formed the Sustainable Children's Products Initiative to promote the sustainable design and development of children's products.[d] The goal of the first phase of this project was to engage the toy industry supply chain and its stakeholders in a dialogue about how to improve the design and development of children's products to make them more sustainable. To begin this discussion, the Lowell Center convened a work group that included toy manufacturers, retailers, trade association representatives, toy designers, children's environmental health advocates, and government.

The Framework for Sustainable Products informs this initiative in its vision of making toys and other children's products that are healthy for consumers, safe for workers, environmentally sound, beneficial to local communities, and economically viable. The Lowell Center is currently serving as an advisor to EcoLogo, a leading environmental standard setting and certification organization that has launched a process to develop an environmental leadership standard for toys and children's products. In addition, the Lowell Center is evaluating alternatives to toxic chemicals found in children's products and is documenting the practices of companies showing leadership in developing sustainable children's products.

For more information, contact *Sally_Edwards@uml.edu* (*www.sustainableproduction.org/proj.toys.abou.shtml*).

Green Chemistry and Commerce Council—Retailers Project

The Lowell Center for Sustainable Production facilitates an industry group called the Green Chemistry and Commerce Council (GC3) that supports the use of green chemistry and design for environment practices in the development of sustainable products. The GC3 is working with retailers to encourage a focus on improved product chemicals management with the goal of ensuring that products sold to consumers are safe. Although this project is focused primarily on one element of the Framework for Sustainable Products—healthy for consumers—widespread implementation of product chemicals evaluation and management systems by retailers is likely to lead to a preference for products that are safer for workers, more environmentally sound, and economically viable.

To respond to growing consumer and media awareness and concern about toxic chemicals in products, a GC3 working group prepared a report that documents case examples of innovative retailers who have or are developing product chemicals management systems. The case examples look at the drivers of product chemicals management systems, the structures of these systems, obstacles encountered, benefits recognized, information flow with consumers, and lessons learned. By identifying best practices in product chemicals management in the retail industry, the GC3 hopes to encourage other retailers to include product chemicals management as a key element of their sustainability business practices.

For more information, contact *Yve_Torrie@uml.edu* (*www.greenchemistryandcommerce.org*).

d The Lowell Center convened this group in partnership with GreenBlue, a non-profit institute based in Charlottesville, Virginia (*www.greenblue.org*).

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The Sustainable Products Project

The Sustainable Products Project of the Lowell Center promotes the sustainable design and development of safer, healthier, and greener products through engaging stakeholders, conducting research and providing information that can spark innovative, environmentally sound solutions. The Lowell Center Framework for Sustainable Products is a tool to help evaluate the environmental, social, and economic impacts of existing products and to design new products that minimize these impacts. By defining the key elements of a sustainable product, the Framework helps companies develop a broader vision of what a sustainable product encompasses, identify opportunities for improvement, and assess progress in meeting that vision.

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