The “Intelligent Product” System

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To reduce waste and conserve our planet’s resources, manufacturers and consumers should lease instead of buy.

Many companies are constrained by linear approaches, i.e., the common view of industry as a continual stream of inputs and outputs. But firms using intelligent product systems will see a circle, continually linking manufacturers with consumers. Through cyclic intelligent product systems, visionary companies can reduce waste and conserve resources by designing products for use, return, remanufacturing, and redistribution, with the ultimate goal being industrial sustainability.

With the current regulatory culture moving away from the command-and-control approach toward a more flexible, proactive method, holistic thinking is needed to successfully move firms beyond compliance into a more sustainable future. With this move toward sustainability, companies will also need to become more competitive by achieving cleaner, cheaper, and smarter environmental performance. To achieve this performance, the economic, environmental, and social aspects of business must be considered in concert with the concept of industrial ecology. The main tenet of industrial ecology is the realization that waste equals food, i.e., all products and wastes should be cyclically recycled to provide a new feedstock.

The goals of this new approach are to (1) increase a firm’s eco-efficiency, (2) enhance industry competitiveness, and (3) promote innovative environmental management approaches.

One way this eco-efficiency can be achieved is through intelligent product systems. Intelligent product systems are based on the premise that products provide a service for consumers; then, products are returned to the manufacturer for transformation into another product. The product, viewed as a waste under the current environmental paradigm, would become a valuable source of “food” for the industry in this new system. This plan encourages the most forward-thinking industries to design their products for reuse or reclamation, and to view their products as finite, temporal services provided to the consumer.

The benefits of intelligent product systems include minimal environmental impact, optimization of natural resource use, increased customer loy-

“Intelligent product systems are based on the premise that products provide a service for consumers; then, products are returned to the manufacturer for transformation into another product.”
ally, an enhanced public image, and an economic advantage over other competitors who do not employ proactive approaches. By employing the intelligent product system, a firm can remain a step ahead of the competition environmentally, socially, and economically.

The System

Dr. Micheal Braungart and Justus Englefried of the Environmental Protection Encouragement Agency (EPEA) in Hamburg, Germany, first coined the term “Intelligent product system.” They advocated that firms move beyond the concepts of pollution prevention and industrial ecology to a system where waste is virtually eliminated. To distinguish different types of products, Braungart and Englefried divided products into three distinct categories: (1) consumables, (2) unsalables, and (3) products of service. These distinct categories are intended eventually to cover all products manufactured by industry.

Consumables

Products used by consumers only once and then biograded are generally categorized as consumables. Consumables, under this definition, are transformed from products into food that can be reused or converted into another benign product. Examples of consumables include clothes, food, and even cars, provided the design is environmentally benign. For example, pesticides in food and bleach used to manufacture cotton clothing disqualify the design from this new concept. To fit the definition of consumables under the intelligent product system, toxic and environmentally persistent chemicals would have to be eliminated from the manufacturing process as much as possible.

Unsalables

Unsalables are classified by Braungart and Englefried as products that are not salable, i.e., products that cannot become food for another process (such as toxic and environmentally persistent chemicals including polychlorinated biphenyls (PCBs), heavy metals like chromium and cadmium, and radioactive waste). According to Braungart and Englefried, the design of consumables should eliminate the use or manufacture of these unsalables.

Products of Service

Braungart and Englefried define products of service as, essentially, durable goods. Durable goods include such items as refrigerators, televisions, automobiles, videocassette recorders, personal computers, carpeting, and grills. Under the intelligent product system, these commodities should provide a service and be temporarily “licensed” to the consumer for use over the product’s useful life cycle. When the life cycle ends or the product is exhausted, it would be returned to the manufacturer for reuse, reclamation, or remanufacturing. Consumers would drop off the product at a resource recovery (or take-back) center, and the product would become a food for the manufacturer’s process.

There are three keys to the success of intelligent product systems with respect to products of service: (1) environmental, (2) economic, and (3) social. Environmentally, the design of the product should be in concert with the concepts of industrial ecology. It should also be designed for disassembly and recycling. Further, intelligent product systems should consider the economics of product take-back, including reclamation of natural resources and recovery of a valued product. The economic feasibility, i.e., a cost-benefit analysis, of remanufacturing the product should also be considered. Socially, the intelligent product system should have an ease of use, i.e., it should facilitate the reuse or remanufacture of the product with the consumer in mind.

The Progression

The most logical and efficient progression from recycling to take-back under the intelligent product system should involve the manufacturer. Who knows better the content and recycling technologies associated with their particular product?

For the automobile as well as other durable goods (e.g., computers, washing machines and dryers, televisions, carpeting, etc.), the form of take-back most plausible is a leasing rather than ownership agreement. Leasing is currently performed with automobiles, but the manufacturer does not have responsibility for the product in the United States once the product is sold. In the new take-back paradigm, the manufacturer would lease the car, collect the car, extend the life of the car, and even recycle and reuse the car. As a result, companies would begin to view themselves as service companies rather than manufacturers that make a product.

The key is a paradigm shift from conventional wisdom, i.e., recycling a durable good, to the “emergent alternative wisdom,” i.e., return of the product to the manufacturer for reuse and remanufacturing. Through enhanced product responsibility on the part of the manufacturer (now the “service provider”), natural resources would be conserved and recycled. This is essential to attaining industrial sustainability.

Figure 1 presents the current (and past) status of durable goods recycling. In most cases, the product is disposed at some point in the progression from raw material to user. Disposal prior to the user could be the result of waste materials generated during the manufacture of the product or as a result of quality rejects. In this paradigm, since the user disposes of the durable good in a landfill, the ground symbol is used in the
disposal branches. It should also be noted in Figure 1 that the process is entirely linear; cyclic processes, a central tenet of sustainability and industrial ecology, have not yet been introduced. (It is important to note that in Figures 1 through 3, the primary producer, manufacturer, and service provider may or may not be the same entity.)

Figure 2 represents the changing product paradigm where the product moves from primary producer to manufacturer to user with cyclic reuse and take-back loops in the process. In this paradigm, the product may be reused by the user, returned to the manufacturer for remanufacturing, or returned to the primary producer for recycling, i.e., take-back in terms of the intelligent product system. While cyclic processes are included in this figure, there is still a disposal “ground” from the user to the earth as progression from raw material to primary producer to manufacturer. In addition, products are made sustainably (in the economic and environmental sense) from indigenous materials in a socially responsible manner.

In Figure 3, two new entities are
introduced: the service distributor who provides the service of the durable good, and the take-back broker who handles the take-back of the product. Instead of selling the product (e.g., carpeting), the service provider sells the service of the product (e.g., the use of the carpeting). This service distributor tracks the transmittel of the product through the process so the take-back broker facilitates take-back of the product. At this point, the take-back broker can facilitate take-back to the primary producer, the manufacturer, or the service distributor.

In Figure 3, one major cyclic process is included: the take-back broker feed-back loop. Ground paths to the environment are also provided with the tree symbol representing environmentally friendly disposal (simulating earth’s natural systems where waste equals food). This ground path does not provide for disposal of unsalables. Instead, natural biodegradation is encouraged. If there are unsalables involved in the process, they should be reused or recycled as much as possible or included in a product that is continually remanufactured or recycled in order to reclaim these unsalables, thereby preventing their discharge to the environment.

**The Economic Considerations**

Economic feasibility is critical to the success of the intelligent product system. In general, this system will be economically feasible on a large scale only when it becomes economically prohibitive to continue to generate products without responsibility for product stewardship.

For macroeconomic feasibility of the intelligent product system to be achieved, national laws will need to address the following issues in a different manner: resource extraction, use of resources in manufacturing effective analysts of various external environments; (3) are astute observers of their own organizations; and (4) are effective managers of change, able to achieve the multiple internal consistencies between structural and processual elements necessary to bring their organizations into sufficient fit with their external contingencies on a sustainability-oriented basis.

**Some Examples**

BMW and Interface, Inc. are growing their businesses by applying concepts of the intelligent product system. The American headquarters of BMW is located in Greer, South Carolina, and Interface, Inc. is based in Atlanta. *These organizations believe product stewardship on their part will drive them ahead of the competition in the years to come.*

**BMW**

BMW has, in many cases, set the standard for recycling and take-back. Instead of relying on consumers and scrapyards to act responsibly in their reuse of automotive products, BMW has initiated an aggressive take-back program in Germany. Not only is this strategy environmentally sound, but more importantly for BMW, they believe the program will result in sub-
stantial profit savings. These savings will come in large part from the reuse of major parts. BMW currently reconditions major mechanical devices on vehicles including starters, alternators, and engines that results in energy savings in excess of 30 percent. Along with several other European vehicle manufacturers, BMW has devised a plan for each manufacturer to take control of all automobile recycling in its home market. Currently, 75 percent of the car scrap produced in Europe is being reused in some fashion. The goal of the consortium is to increase reuse to 85 percent by 2002 and 95 percent by 2015.

Interface, Inc. Interface, Inc. was founded by President and Chief Operating Officer Ray Anderson in 1973, and had sales of over $1 billion in 1996. Interface is a manufacturer of flooring systems such as commercial carpet tile. Under Anderson's management, Interface has pledged to become the first truly sustainable organization in the world. To craft Interface's strategy, Anderson assembled the Interface Eco Dream Team of leaders in the environmental movement. These members are listed in the table following.

Interface has begun the progression toward sustainability through the steps outlined below.
1. Eliminate the concept of waste.
2. Eliminate unsalables.
3. Substitute renewable energy sources for nonrenewable ones.
4. Apply industrial ecology to transform linear manufacturing processes to cyclical ones.
5. Reduce transportation of people and products using plant location, logistics, E-mail, video conferencing, telecommuting, etc.
6. Create a community within and around Interface that understands the concepts of natural systems.
7. Redefine commerce to focus on delivery of the service instead of

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<tr>
<th>Team Member</th>
<th>Summary of Accomplishments</th>
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<tr>
<td>David Brower</td>
<td>Leader North American environmental movement. Founder of League of Conservation Voters,</td>
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<td>Friends of the Earth, and the John Muir Institute for Environmental Studies.</td>
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<td>Bill Browning</td>
<td>Leading authority in Green Architecture. Director of Rocky Mountain Institute's</td>
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<td>Green Development Series.</td>
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<td>Bernadette Cozert</td>
<td>Prominent community and social activist working in the areas of hunger, institutional</td>
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<td>racism, violence, employment, and the environment.</td>
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<td></td>
<td>Chairman of The Natural Step, U.S. and co-chair of The Natural Step, International.</td>
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<tr>
<td>Amory Lovins</td>
<td>Physicist, MacArthur Fellow, and founder of the Rocky Mountain Institute in Snowmass,</td>
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<td>Colorado. The Wall Street Journal's Centennial issue named him among 28 people in the</td>
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<td>world most likely to change business in the 1990s.</td>
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<td>Bill McDonough</td>
<td>Leading designer of sustainable industrial systems in the United States.</td>
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<td>Principal of William McDonough + Partners and Dean of Architecture at the University of</td>
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<td></td>
<td>Virginia. His firm designed the corporate campaign for The Gap, a production facility for</td>
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<td>Herman Miller, and an environmental prototype store for Wal-Mart.</td>
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<td>John Picard</td>
<td>Environmental consultant whose clients have included Sony Pictures, Dreamworks, The Gap,</td>
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<td></td>
<td>and Compaq Computers. He works through E² Environmental Enterprises building the capacity</td>
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<td>within corporations to move toward sustainability.</td>
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<tr>
<td>Jonathon Porritt</td>
<td>Prominent spokesperson for the environment in the United Kingdom. He cochaired the Ecology</td>
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<td></td>
<td>Party in 1980 (later called the Green Party).</td>
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<tr>
<td>Daniel Quinn</td>
<td>Author, educator, cultural anthropologist, and philosopher. He wrote many books, including</td>
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<td>Ishmael which won the Turner Tomorrow Fellowship, a half-million dollar award established</td>
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<td>by Ted Turner to encourage authors to seek creative and positive solutions to environmental</td>
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the good through the Evergreen Lease. Also engage external organizations to create policies and market incentives to encourage sustainable practices.

Interface is applying these concepts of take-back and intelligent product system through the Evergreen Lease. The objective of the Evergreen Lease is to transform a durable good (carpet) into a service. This arrangement allows building owners to lease the service of clean and new commercial carpet tile rather than own the carpet. When the tiles wear out and are replaced, the old tiles are broken down and remanufactured as part of the lease fee. This cycle begins to emulate nature where each waste becomes food for another process. 19

BMW and Interface are examples of companies taking the first step toward sustainability by applying take-back. But progress is needed on a much bigger scale. With the largest economy in the world, the United States will need to address environmental, economic, and social impacts of products in our society. Eventually, economic and environmental impacts will necessitate a paradigm shift from consumption and disposal toward an intelligent product system that embraces the service and utility of the product instead of consumer ownership.

Use and disposal of durable goods imposes a significant burden on the environment. With the ever increasing rates of consumption in the United States (and the rest of the world), the ownership of durable goods must shift away from consumer ownership to product stewardship on the part of the manufacturer.

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18 Ibid.
17 Ibid.
7 Ibid.