FROM "DESIGN FOR ENVIRONMENT" TO "DESIGNING SUSTAINABLE SOLUTIONS"

Walter R. Stahel
Product-life Institute, Geneva, Switzerland

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Summary

This article brings forward a new approach to fulfilling material (product) needs, based on the triple compatibility (in social, ecologic and economic terms) of sustainable

development. In addition to the design principles of DfE for the manufacturing of durable goods, it takes into account aspects of:

- consumption goods, such as energy, agrochemicals, paint;
- a "cradle back to cradle" approach which includes the utilization optimization of goods;
- the use of technology to increase competitiveness;
- the opportunities hidden in the shift from a manufacturing to a service economy;
- the job creation potential hidden in a regionalization of the economy for certain types of goods.

"Design for Sustainable Solutions" focuses on the performance of goods during utilization, rather than their manufacturing. It includes the sale of performance instead of goods and the resulting extended performance responsibility of economic actors. It encompasses technologic and commercial strategies in making the most efficient use of existing stock, i.e. the fleet of goods, components and materials (asset management).

The article sketches out these new opportunities for a sustainable responsible design. It also shows the impact that a design for sustainable solutions will have on jobs and qualifications, on the environment and on resource consumption. It shows the necessary changes in the economy—for reasons of staying competitive—and how new boundary conditions could speed up this change.

1. Introduction: Design for Performance

Design has always existed as part of a craftsman's function to create products. Specific designs were then selected by the buyers (demand) because they offered the best performance. Stradivarius and his violins, for instance, became famous because of the music quality the violins were capable of producing in the hands of a master violinist.

The slogan of "form follows function" by the American architect Louis Sullivan was another step to focus design (of buildings) on the functions that they had to perform.

"Industrial design" is a child of the great depression in the 1920s, when it became crucial for the economy to give people an incentive to buy new goods, and more goods, in order to re-boost the economy. Industrial design was no longer product specific, design became a profession, sometimes an art, in itself. German industry even went a step further and created two separate professions, "Konstrukteur" (in charge of engineering) and "Gestalter" (in charge of aesthetics).

In this text, the terms "design" and "designer" are used in the more holistic view of the Anglo-saxon industrial design.

In the mid 1980s, the terms "Design for Environment (DfE)" and "Eco-Design" started to be used in Europe, the USA and Japan for a design that focuses on eco-efficiency, the simultaneous optimization with regard to economic and environmental efficiency. The aim was first to reduce the environmental impairment of the production of goods, later to achieve a higher resource productivity in manufacturing durable goods and buildings with less resource input per units of service during their expected design life.

As "the environment" is a culturally defined issue, a large variety of definitions have developed for DfE and Eco-Design. What they have in common is the vision that the environment needs to be protected against the shortcomings of industrial activity.

2. The Two Main Issues at Stake: Eco-efficiency and Regional Job Creation

Designing and manufacturing goods with the idea of "protecting the environment" in mind is an idea that pops up periodically. From the Shaker community in the USA to the Bauhaus schools in Germany, "caring for nature" and good husbandry in resource use are regularly recurring themes. The motivation behind it is normally one based on ethics or scarcity. Its impact was therefore often limited to a group of followers.

The development of "Design for Environment" has taken on a new meaning in the 1980s, when slogans such as "pollution prevention pays" introduced a monetary link between economy and ecology. Again, this development had strong cultural regional roots. In Europe, it evolved under the name of "Eco-Design," in the USA it was called "DfE" for "Design for Environment," and in Japan similar ideas were pushed under the titles of "eco-factory," "inverse manufacturing" and "zero waste."

The term "Design for Sustainable Solutions" was coined in the context of the Austrian Design Prize Competition in the early 1990s. It was an attempt by the jury—of which the author was a member—to make the transition from the theme of "protecting the environment" to the wider concept of "sustainability," which combines economic, ecologic and social considerations on equal terms. There were two flaws in "Eco-Design" that we tried to overcome with this name change:

- The lack of "social compatibility" in design, the introduction of which needed a mind shift from "eco-design" to "designing sustainable solutions."
- The lack of the notion of "sufficiency," as a complement to the notion of technical eco-efficiency. This meant the inclusion of innovative marketing strategies, such as shared and multiple utilization and zero-options, into eco-design concepts (these terms are explained in Table 2).

As a result, from 1995 onwards, both products and services have been accepted as entries for the Austrian Eco-Design Prize, and both have been awarded prizes. "Design" now has a much wider scope to contribute to the move towards a more sustainable future!

This redesign in thinking—from material products to solutions, both material and immaterial—is at the root of the challenge for designers in the twenty-first century. This challenge is the more demanding as it is two-fold:

- to minimize the consumption of nonrenewable natural resources (section 3); and
- to optimize the use of renewable resources including human labor (section 5).

3. Design for a Minimized Consumption of Nonrenewable Natural Resources (Eco-efficiency)

Two different paths are running parallel and largely independently of each other towards this objective. They have in common that they strive towards:

- increased economic competitiveness (section 3.1); and
- higher sustainability (section 3.2).

3.1 Competitiveness

The OECD defines economic competitiveness as follows:

> The degree to which a nation can, under free and fair market conditions, produce goods and services which meet the test of international markets, while simultaneously maintaining and expanding the real incomes of its people over the long term.

The term "sustainability" is over two hundred years old—but most experts outside forestry have only taken notice of it in the last ten years. Today, the term has taken on a life of its own, being shaped to fit the requirements of whoever needs a "vision." With regard to competitiveness, "sustainability" will become an important issue within national competitiveness, in the medium to long term. To understand its implications for the private business sector, it is crucial to see that one of the keys to a "higher competitiveness through sustainability" is a responsibility of economic actors far beyond the factory gate or shop window. A responsibility with a meaning of "performance responsibility" in a wide sense, encompassing economic and ecologic and social values during all phases of a product's life, with an emphasis on the utilization of goods, products and services—a major shift from the responsibility limited to the manufacturing quality of goods in the past.

3.2 Sustainability, Economy, and Society

The vision of sustainability can be compared to the problem of crossing a shallow river, in which stepping-stones are hidden. In the past, society has found the first three stepping-stones, leading us to the present vision of an eco-efficient economy. Now, we are standing in the middle of the river and need to find more stepping stones in order to reach the goal, the other river bank of sustainability (Table 1).

THE FIVE PILLARS OF SUSTAINABILITY

1. Nature conservation (precautionary principle);
2. Health and safety, non-toxicity (qualitative);

The first border line: from protecting the environment (doing things right)
to increased economic competitiveness (doing the right thing)

3. Increased resource productivity (reduced throughput, quantitative);

The second border line: from a sustainable economy
to a sustainable society

4. Social ecology (jobs and wants, sharing and caring);

5. Cultural ecology (the choice between sufficiency and efficiency).

Source: The Product-life Institute, Geneva

Table 1. The five pillars, or stepping stones, of sustainability, and the first and second borderline

3.2.1 Crossing the First Border Line to a Sustainable Economy

After the first two stepping stones (the pillars of nature conservation and of health and safety), society crossed a borderline before reaching the third stepping stone of a higher resource productivity. To recognize this border is important because the societal drivers towards sustainability differ from the "old" side of the border to the new one: protecting the environment in the past, innovation and competitiveness in the future.

Achieving a higher resource productivity also means a departure from the theories of the industrial economy. Yet the fundamental changes which this borderline implies have not yet been widely accepted, neither by policy makers nor by economic actors:

- the new goal is to de-couple corporate success as well as GDP from resource consumption, to create more wealth while consuming considerably less resources;
- the new drivers are money, technology and competitiveness (pillar 3 in Table 1), no longer the motivation to "save the environment" (pillars 1 and 2);
- the main framework condition is a product responsibility "from cradle back to cradle," through a series of loops and spirals—witness the single use camera;
- the key tool is "wild" innovation supported by free market safety nets, instead of a "command and control" approach dictated by laws and regulations;
- speed of action becomes as important as scientific correctness, as knowledge increasingly becomes private property;
- the reward is a first mover advantage leading to a higher competitiveness, rather than a "feeling of green and good" leading to eco-awards.

On the supply side, the key actors to achieve a higher resource productivity through a more sustainable production are technology managers and innovators. The strategic priority for managers is to "do the right thing." "Doing things right" (e.g. clean production, EMAS/ISO) is still important, but it will not open up new markets.

This first borderlines thus also implies changes in economic thinking. Economists have only just started to accept that "economy of scale" goes hand in hand with "diseconomy of risks." And industrial ecology may lead to a technology lock-in and stranded investments, and thus to a loss of competitiveness. One example of the latter was the economy of the GDR (the East German Democratic Republic), the demise of which was triggered by the disappearance of the Iron Curtain. Other examples include the potential collapse of centralized electricity production in those countries that have privatized their State monopolies.

The GDR was a perfect example for the combination of the concepts of an "industrial ecology" and an "economy in loops." The dominant resources used were brown coal as regionally available energy, and waste materials that were collected and recycled religiously as indigenous resources. The industry was almost all-electric, and the waste heat from the central electricity production was the only source to heat large buildings. Production was organized in clusters to minimize transport, and the distribution of goods had to be done through the (electric) railways. However, the brown coal was a major source of air and water pollution, and its exploitation in open pits destroyed large areas of agricultural landscapes including the villages. After reunification, brown coal was replaced by imported oil, and the railways by motorways. This not only destroyed the economic balance of the region, but also most of its industrial fabric and jobs.

3.2.2 Crossing the Second Border Line to a Sustainable Society

On the demand side, a higher resource productivity can be achieved through means of a more sustainable consumption, such as sufficiency. This means crossing a second borderline, from eco-efficiency (a sustainable economy) to a sustainable society. Behind this second border lies the next set of stepping-stones to reach the sustainable bank of the river: the stepping stones of "social ecology" and "cultural ecology."

Sufficiency solutions are, from a sustainability point of view, the most efficient strategies. Sufficiency means changing the "wants and wishes" of people, the behavior and attitudes of individuals, the values of society, through changes in the "social and cultural ecology":

- the new goal, once eco-efficiency has been achieved, is to create a sustainable society: ecologically, socially and economically desired, encompassing both consumption and production—the goals of a sustainable development;
- the driver must be people's desire for sustainability—a desire which seems to be utterly lacking so far; this desire can have many different cultural forms, but should be based on a common vision of sustainability;
- the framework conditions need to focus on performance and results, rather than on products and technologies; standards and legislation have to specify desired performances instead of "legal technology" (e.g. clean air instead of catalytic converters for vehicles);
- the key tools are cultural leverages—sustainability values that are appealing to people which will apply them in order to increase their own quality of life;
- the reward is happiness de-coupled from resource consumption (many philosophers, from Taoism to Seneca to today, have defined happiness as the "goods available divided by the needs and wishes of people").

The service economy is the junction where sustainable production and sustainable consumption meet. For sufficiency solutions are of interest only to economic actors in a service economy, where they enable an income without resource consumption. Example: reusing towels in a hotel bathroom is not only beneficial to the environment, it also reduces the operating costs of running the hotel.

In a service economy, social actors can compete with economic actors in the "production of results and performance." Anyone can hire a car for a day, or borrow it from a friend, or rent it from a car-sharing cooperative. Social innovation now competes with economic innovation—something that was difficult to achieve in manufacturing.

New solutions can also be fostered on a conceptual, policy level. Policy makers thus have a new leadership role, as the old safety barriers and framework conditions (legislation, regulation and technical standards) are of limited use or may even hinder innovation in a nonlinear development. The key to a more "sustainable mobility," for instance, lies in town planning and systems optimization, not in vehicle technology. Tony Garnier, a French architect and possibly the first modern town planner who worked in Lyon around 1900, integrated many of the ideas of a sustainable town already in his work. A telling example is the residential area called "Quartier Americain" in Lyons and its "American hospital."

By using innovative technology in combination with innovations in the field of logistics and marketing, economic and political actors can greatly contribute to a more sustainable and eco-efficient service economy. But examples for innovations in social and cultural ecology are still rare and hardly researched, even if their number is increasing, sometimes in unexpected cases. Most Europeans associate "green thinking" with northern European countries—but it was Italy that introduced "automobile-free" Sundays in Spring 2000! Little research has been done so far to detect the patterns of cultural ecology, which would enable policy makers to use cultural leverages in order to promote sustainable solutions.

3.3 Changes Driven by Science and Research: The Art of Marrying Technology, Competitiveness, and Sustainability

Technology driven by scientific discovery has always done things its own way. From the invention of the railways to dynamite to nuclear energy to the exploration of space, utopians have promised us heaven, and pessimists have predicted the apocalypse.

A sustainable economy will have to be frugal with regard to material consumption. This means managing existing assets by squeezing maximum performance out of stocks while minimizing resource consumption. Science and technology, especially material sciences such as nanotechnology, and life sciences such as biotechnology, can provide a major contribution to this aim by, for instance, transforming consumption goods (water, energy, agrochemicals, wastes) into durable (re-usable) goods.

The role of the designer on the science driven path has been, and will remain, to design applications of the new technologies that enhance people's life and take advantage of technologic progress. Alternative energies are a point in case: wind turbines are a challenge as stand-alone objects, whereas for solar panels and fuel cells, it is their integration into existing structures which presents the main challenge to designers, architects and engineers.

3.4 Changes Driven by Corporate Strategy and Policy: Three Key Actors

Even if economic changes also come from innovation into new corporate strategies and national policies, they are often hampered by structural inertias. Framework conditions including legislation pose obstacles that are considerably more difficult and time-consuming to overcome than many of the obstacles that scientific innovators in research and technology have to face.

In the market economy, the challenge therefore is to find methods in which corporate managers, legislators, and designers can work in cooperation, each having to solve a specific task.

Policy makers have to remove obstacles and safety barriers that were designed for a bygone era; managers have to come up with creative and innovative new strategies to bring more sustainable solutions rapidly to the market; and designers will have to shape the new solutions in a compelling way.

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Biographical Sketch

Walter R. Stahel is an alumni of ETH, the Swiss Federal Institute of Technology, Zürich, where he received his diploma in architecture in 1971. He has been one of the founder-directors of the Product-life Institute since 1983. Before that, Stahel worked as an architect in London and as a project-manager at the Center for Applied Economics, Battelle Geneva Research Centers, Geneva, in the fields of business strategy and feasibility studies. He left Battelle in 1980 to become personal assistant to the CEO of a holding company with worldwide activities in railway maintenance, shipping, and real estate. Since 1984, Stahel has worked as a business consultant in most European countries, the U.S., and Far Eastern countries in the fields of: the development of strategies and tools to foster sustainable development (sustainable production and consumption issues); research into utilization-related technologies such as the re-use, repair, reconditioning, and technological upgrading of components, goods and systems, from points of view of technical and commercial strategies as well as industrial design; risk management and the insurability of risks, and their relevance for an industrial and a service economy; regional economic development and job creation. In 1982, with a paper "The Product-life Factor," Stahel was one of the laureates of the Mitchell-Prize Competition on sustainable societies in Houston, Texas, USA. In 1978, together with Peter Perutz, he was awarded a first prize in a competition of the German Future's Society on job creation. Stahel has been a member of the first Environmental Council of the German Railways, Berlin since 1996, and of the Umweltrat of the UmweltBank, Nürnberg, since its foundation in 1997. He was member of the Jury of the SHE (Safety, Health, and Environment) Excellence Awards 1996, 1998, and 1999 of Du Pont de Nemours, Wilmington, Delaware. He is a member of the Eco-Dream-Team of Interface Inc, Atlanta GA, and of the work group on "Basic Needs" for the world exhibition EXPO 2000, Hanover. Additionally, Stahel acts as a consultant on strategies of a sustainable development to the European Commission in Brussels; he participated at its "Futures 2010" project and is an associate member of ESTO, the European Science and Technology Observatory. He also works as a consultant for a number of large industrial companies as well as SMEs. Stahel regularly lectures at universities in Europe, Japan, and the U.S. on subjects ranging from eco-design to sustainable development. Stahel is the author of books and numerous articles on policies, strategies and tools to foster an economic development aimed at a higher resource productivity, and for a more sustainable society.