APERTURA

Apertura
www.apertura.com

June, 2001
Reprinted with permission from Apertura

ESSAY

Natural Capitalism

The most innovative companies have already learned that saving energy and waste is not only an environmental action. It can also be good business.

Capitalism is the productive use of and reinvestment in capital; yet capital comprises not only money and goods, but also people and nature, which are even more valuable. Economies seek to economize on the scarcest resource. In the first industrial revolution, that meant people, and labor productivity has been the holy grail ever since. But now what's scarce is nature, not people. The same logic therefore yields new business models with striking competitive and environmental benefits.

DuPont has proposed,
in this decade, to increase its income
6 percent each year
without enlarging its use of energy.

Industrial capitalism is a temporary aberration, not because it is capitalist but because it defies its own logic by liquidating, without valuing, its largest source of capital. It deals only with money and goods, not also with people and nature. Indeed, what are called "labor and environmental problems" in the globalization debate simply reflect the utter absence of people and nature from the concept of "capital" used in the ideology of trade. Since money and goods are mobile, and can often be traded to advantage, while people and nature, being rooted respectively in a culture and a biome, are often damaged by mobility, it is no wonder that ignoring two of the four forms of capital, or treating them as if all four were alike, leads to trouble. Without "natural capital" there is no life and therefore no economic activity. Nature provides such free "ecosystem services" as nutrient cycling, climatic stability, atmospheric composition, and biological productivity. The substitutes that are known for only a few of the scores of ecosystem services are generally impractical—hand-pollinating a world without bees, for example, would be tedious. The $200-billion Biosphere II dome in the Arizona desert demonstrated the limits of human ability to replace natural ecosystem functions: it couldn't provide adequate and healthful air, water, and food for eight people. Biosphere I, our planet, does that and more for six billion people every day for free.

Accounting principles don't let firms liquidate unrecorded assets and book the proceeds as income. In the end, nature doesn't either. Conservative scientific estimates of the economic value of ecosystem services equal the Gross World Product. The correct value will doubtless be long debated by those who find internalization inconvenient. However, even if the correct values for natural capital aren't yet known and agreed upon, an economy that doesn't book the value of such a large and indispensable input will suffer. For example, harvesting a forest's monetized resource, wood fiber, can inadvertently liquidate its unmonetized but far more valuable ecosystem services, such as storing water, controlling atmosphere and climate, and providing habitat and biodiversity. Degrading such vital, valuable, and irreplaceable services triggered the Yangtze floods of 1998, which killed 3,700 people, displaced 223 million, inundated 25

million hectares of farmland, and cost $30 billion. China had to implement a logging moratorium and a $12-billion crash program of reforestation.

Obviously it's important to take unmonetized natural capital into account. However, we don't need to spend decades arguing about how much it's worth before we can use it *as if* it were very valuable. This practice follows the logic not of environmental economics—which treats nature as a minor external factor of production—but of ecological economics—which realizes that the environment (in economist Herman Daly's words) is "the envelope that contains, sustains, and provisions the economy." That is, the economy is a wholly-owned subsidiary of the environment, not the other way around.

The first Industrial Revolution made people more than 100 times more productive because in the mid-1700s, the relative scarcity of people was limiting progress in exploiting seemingly boundless nature. That logic is perennial, but today the pattern of scarcity has reversed: now we have abundant people but scarce nature. The new imperative is thus to use such resources as energy, water, fiber, minerals, and topsoil far more productively. This is not because oil and copper are becoming scarce—powerful extractive technologies keep bringing commodity prices to new lows—but because such huge gains in resource productivity are highly profitable. Resource productivity will also reduce the half-trillion-tonne-a-year global flow of resources from depletion to pollution. That extraction, transport, processing, use, and disposal are compromising the integrity of ecosystem services worldwide. But the resulting constraints, which a doubling of the human population would render acute, are a problem we don't need to have, and it's cheaper not to.

Our new book *Natural Capitalism* and its May–June 1999 *Harvard Business Review* précis (www.natcap.org) describe an alternative that yields astonishing benefits not only for future generations, but also for today's shareholders. Its operational principles enable businesses to behave *as if* they were properly valuing natural capital—and are highly profitable even today when it's valued at zero. Natural capitalism combines four richly interlaced and mutually reinforcing principles.

Its first step is to use resources 10 to 100 times more productively. Only 1% of today's resource flow actually ends up in durable products. Today's cars use only 1% of their fuel energy to move the driver. Ordinary light-bulbs turn only 3% of power-plant fuel into light. The U.S. economy wastes at least $300 billion worth of energy every year: despite past savings of about $200 billion a year, it's less than one-tenth as energy-efficient as the laws of physics permit, and so is even the most energy-efficient economy. Such gross shortfalls below what's now feasible are a business opportunity.

New design practices can often make very large resource savings cost less than small or no savings. For example, a Dutch engineer's redesign of a standard and supposedly optimized industrial pumping loop recently cut its pumping energy by 92% while reducing its capital cost and improving its performance. This required no new technologies—only substituting fat, short, straight pipes for skinny, long, crooked pipes. Similarly, our own house is comfortable with no conventional heating system, even when outdoor temperatures drop below –40°. It cost less to build because the heat-trapping measures cost less than the furnace and related equipment that they eliminated. The house's 99% savings in space and water heating and 90% in household electricity repaid their cost in ten months using 1983 technology; today's is much better. Space heating and cooling equipment have similarly been eliminated in equally comfortable, cheaper-to-build houses up to +46°C and in large buildings in a wide range of climates. Such buildings yield better health and labor productivity as a byproduct of their superior comfort.

Improving typical existing motor and lighting systems could save half the world's electricity with aftertax returns over 100% per year. Similar returns are often found in other major industrial energy savings. The Franco-Italian chipmaker STMicroelectronics, the eighth biggest in the world, has targeted improvements including 76% energy savings in new microchip fabrication plants (with lower capital cost and construction time and better performance) as a profitable way to cut CO_2 per chip by at least 92%; 98–99% carbon reductions per chip will be profitable soon (www.rmi.org/sitepages/pid171.asp). Similarly, DuPont plans in this decade to increase its revenue 6% a year without increasing its energy use (by raising its energy productivity at least 6% a year); to get a tenth of its energy and a fourth of its raw materials from renewable sources; and to cut its greenhouse gas emissions to 65% below the 1990 level—all in the name of shareholder value. Implementing advanced resource productivity faces many barriers, but systematic "barrier-busting" (www.rmi.org/images/other/C-ClimateMSMM.pdf) can turn each obstacle into a business opportunity. And in general, integrative design that optimizes whole systems for multiple benefits, not isolated components for single benefits, can make very large resource savings cost less than small or no savings: that is, it can make invest-

BY AMORY LOVINS

Amory Lovins, physicist and MacArthur Fellow, and Hunter Lovins, lawyer and social scientist, are co-CEOs of Rocky Mountain Institute (www.rmi.org), an independent, market-oriented applied research center working chiefly with the private sector. Their work has been recognized by the "Alternative Nobel", Onassis, Nissan, and Mitchell Prizes, the Happold Medal, and the Heinz, World Technology, Lindbergh, and "Heroes for the Planet" Awards. Their 27th book, with entrepreneur Paul Hawken (*Natural Capitalism: Creating the Next Industrial Revolution*), was published in 1999 by Earthscan (London) and Little Brown (New York). It is posted, with a Harvard Business Review article summarizing its business logic, at www.natcap.org. The book is available in four languages includ-ing Portuguese and is being translated into seven others, regrettably not yet including Spanish.

ment in resource efficiency yield not diminishing returns but expanding returns.

To illustrate the impressive savings now achievable in many resources, often simultaneously: ultralight, ultralow-drag, hybrid-electric Hypercars[SM] can provide uncompromised customer attributes and decisive manufacturing advantages while saving 82% of their fuel—as much oil as OPEC now sells. A midsized five-passenger sport-utility concept car

One of the keys is to redesign production on biological lines, with closed loops, **no waste, and no toxicity.**

of this type, developed by a young second-stage company in Colorado (www.hypercar.com), combines the capacity to haul a half-tonne up a 44% grade, sporty handling and acceleration, exceptional safety, 2.38 L/100 km, zero emissions, and competitive production cost. Such vehicles, in all shapes and sizes, could also accelerate a fuel-cell-and-hydrogen transition (www.rmi.org/images/other/HC-StrategyHCTrans.pdf) that can put coal and nuclear power plants out of business (by plugging in the cars' fuel cells as generators when they're parked), decouple road transport from climate and air quality, and cut automotive materials flows by about tenfold. Competition is rapidly bringing such innovations to the marketplace (www.rmi.org/sitepages/pid414.asp), in what may become the biggest shift of industrial structure since microchips.

Natural capitalism can also help to defeat the shortage **jobs and hope, security and satisfaction.**

The second key principle of natural capitalism is to redesign production on biological lines (www.biomimicry.net), with closed loops, no waste, and no toxicity. This reduces pressure on natural systems, turns wasted materials into inputs for composting or profitable remanufacturing, and often yields superior products at lower costs. When Steelcase asked architect William McDonough and green chemist Dr. Michael Braungart to redesign a textile, they reported that eliminating the toxic 99.5% of cloth-treating chemicals yielded a more attractive and durable product, but cut its cost, because the process could no longer poison the workers or the neighbors. McDonough says the rethinking "took the filters out of the pipes and put them where they belong, in the designers' heads"—eliminating the pipes and the entire concept of waste. Any disused textile can be composted in your vegetable garden, and, adds McDonough, "If you've got a fiber deficiency, you can eat it."

Both this biomimicry and advanced resource productivity are rewarded by natural capitalism's third element—a shift of business model from selling goods to leasing a continuous flow of service that meets customers' evolving value needs. For example, in Europe and Asia, Schindler leases vertical transportation services instead of selling elevators. Dow leases dissolving services instead of selling solvents, and Carrier is starting to lease comfort services instead of selling air-conditioners. This aligns the interests of providers and customers, *rewarding both for the same thing—doing more and better for longer with less*. (James Womack notes that it could also damp out the business cycle by removing the instability in capital-goods acquisition.)

Combining the first three principles of natural capitalism, Interface, a $1.5 billion global firm based in Atlanta, now gets 27% of its operating profit from eliminated waste—$165 million so far. Its new product, Solenium™, contains nothing toxic, is certified climate-neutral, doesn't stain or mildew, can be washed with a garden hose, and is five times more durable and 35% less materials-intensive than normal carpet (a sevenfold reduction in massflow per square meter carpeted per year). This innovation provides a superior floor covering with 80% less materials flow, lower production cost, and superior customer performance. Next, Interface is beginning to lease a floor-covering service rather than selling carpet, so only the worn one-fifth is replaced, not the whole area. This raises the materials saving to 97%—and soon to 99.9%, because Solenium is designed to be completely remanufacturable into identical product with no downcycling (loss of quality). Next will come conversion to renewable feedstocks, such as polylactic acid made from corn wastes. That step will sever the link to the oil well upstream and the landfill downstream, turning both into profits. Next, the corn can be organically grown in a way that sustains soil, poor rural communities, and climate (since the farmers can get paid for taking carbon out of the oil and putting it back into humus where it belongs). So far, all this is very good business: Interface is doing well by doing good. Just the first four years of its transition to natural capitalism doubled revenue, nearly doubled

employment, and tripled operating profit. And imagine how hard it will be to compete with such a firm, which uses 97–99.9% less raw material and 90% less capital to deliver a better service at higher margin and lower cost...and as a tax-deductible operating lease to the customer. This illustrates the kind of breakthrough competitive advantage that early adopters of natural capitalism are achieving.

Fourth, prudent capitalists will reinvest their profits in the most productive way—in restoring, sustaining, and expanding the scarcest form of capital, namely natural capital, so as to yield more durably abundant biotic resources and ecosystem services. Initial benefits are being captured by such industries as Collins Pine, which earns doubled margins on certified-sustainable lumber. Ranchers using biologically inspired grazing techniques increase their herds *and* the density and diversity of their range, even in areas with as little as 10 cm of rain a year. Farmers grow more food with higher profit and lower risk by imitating ecosystem behavior rather than treating soil like dirt. Major companies substitute native prairie for grass lawns and biological wastewater treatment for chemical engineering. As more firms model their production processes on and take their feedstocks from natural systems, more will benefit directly from such wise reinvestment in natural capital, and fewer will risk suffering the key business constraint of this new century—nature's falling behind on its deliveries of ecosystem services.

Natural capitalism can also help overcome scarcities of work and hope, security and satisfaction, by reversing the interlinked waste of resources, money, and people. Firms that downsize their unproductive tonnes, liters, and kilowatt-hours can then provide more and better work for more people. Countries that shift taxation from jobs and income to depletion and pollution will need less tax revenue to repair the damage to both families and nature. Indeed, by applying to a whole city the same integrated design principles and entrepreneurship that natural-capitalist firms apply to their production processes and equipment, the Brazilian city of Curitiba has prospered even as its population quadrupled and tides of poverty lapped around it. Treating its formidable economic, social, and ecological needs not as competing priorities to be traded off but as interlinked design elements with synergies to be captured has brought greater success than most North American cities have achieved through costly, single-purpose megaprojects. Rather, by integrating hydrology and physiography, transport and land-use, nutrient and waste flows, education and health, participation and dignity, Curitiba has built one of the world's great cities—not through wealth but by design, in a brilliant process led largely by architects and mainly by women.

Natural capitalism will subsume industrial capitalism into its new paradigm much as industrial capitalism subsumed agrarianism. It will reintegrate ecological with economic goals, rewarding choices and companies that achieve both. The winning firms will take their values from their customers, their designs from nature, and their discipline from the marketplace—everything genetically modified crops forgot to do, which is why they've failed in the marketplace. Traditional environmental regulation will start to become a quaint anachronism, because the firms that most need it will already be out of business, having spent too much money making things nobody wants—things that in the 20th Century we called "wastes and emissions," but now know to call "unsaleable production," because that term makes us focus on: "Why are we making this thing if we can't sell it? Let's not make it; let's design it out!"

Curitiba has become **one of the most most magnificent cities of the world** not because of its wealth, but as a result of its design.

This shift takes time, but it is already accelerating as early adopters gain stunning competitive advantage, boost short-term profitability, and empower their people, who quickly zoom out of sight of both managers and competitors when the contradiction they felt between their work and their family goals is suddenly removed.

As Edgar Woollard remarked when Chairman of DuPont, companies that take such opportunities seriously will do very well—while those who don't, he added, won't be a problem, because ultimately they won't be around.