

# The Blue Economy

*“100 innovations inspired by nature that can generate 100 million jobs over a decade and redefine the model of competitiveness by stimulating entrepreneurs to change the business model”*

By Gunter PAULI



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*Let us not demand more of the Earth.  
Let us do more with what the Earth already provides.*

The world is in need of a new economic model. Who would doubt this? We need to find a way to meet the basic needs of the planet and all its inhabitants with what the earth produces. Many grand steps have been taken in the sustainability and green movement. The question we need to raise: Have we done enough? The answer: We have barely started and the debate should not focus on what is good and what is bad. The dialogue we have to engage in concentrates on “what is better.”

While the debate on climate change escalates – along with the earth’s temperatures – and the facts on unemployment and poverty remain very alarming, we have to search for solutions that will allow us to make a quantum leap forward. While the world has set forth clear objectives to achieve the Millennium Development Goals, we all know that setting targets is not enough. We have to know *how* to achieve each one of them. The economic models of the past collapsed. The planned economy was never able to efficiently allocate resources. While it did provide the basic needs of many, it could not sustain itself, and it imploded without any war or revolution.

The market economy evolved in parallel to a system whereby companies pursue economies of scale, increasing production to ever higher levels, in the hope that the marginal cost of each additional unit would be lower than the previous one. As companies were limited in their organic growth, the drive to achieve ever higher economies of scale unleashed a wave of mergers and acquisitions whereby companies leveraged their assets in order to control competitors. When debt became untenable, and junk bonds were not the rage anymore, the financial wizards invented sophisticated financial instruments that created assets based on next to nothing. Then that scheme collapsed. Even the largest companies and financial powerhouses had to admit

defeat, and even some of the biggest companies ever needed a bailout from the government. From this harsh reality emerged a renewed dialogue on how to design our economies. The only serious response to the capitalist and communist development models has been the green economy.

## Green Economy

Starting with the organic movements of the 1960s, a new focus started to emerge. Farmers and consumers protested against the toxins

inundating the food chain. Concepts evolved towards fair trade and mobilized the conscious consumers to pay a reasonable yet higher price to the farmers, especially for products supplied by the Third World. This alternative economic model shaped up, outlining what it did not want to be asking – all actors on the market to pay more in an effort to offer social and environmental justice.

The promoters of this new model questioned the parameters of success of the market economy and argued for a set of objectives society wishes to achieve beyond economic empowerment as summarized in the Millennium Development Goals like eradicating extreme hunger and poverty, achieving universal primary education, and promoting gender equality and female empowerment. The concept of social and economic development emerged as a model.

Unfortunately, the green economy has not taken off. While it has made an impact on specific products in niche markets, it has yet to shape our entire economic system. While the world market for green products reached an estimated \$635 billion industry by 2010, it represents less than 1% of world annual output. The main challenge is that this green approach requires companies to invest more and consumers to pay more. This is a valid and justified strategy when the world economy is expanding and unemployment is decreasing, or when the main actors on the market are flush with financial resources.

However, this strategy that costs more and relies on governments to subsidize it, which in the end requires taxpayers to cough up the bill, is a tough act to follow when demand drops, consumer confidence dwindles and state deficits lead to higher taxes. It is even tougher when people realize that their jobs are at stake and when 40% of the young and well-educated citizens under 24 are told there is no need for their hard work and creative contributions. How could this ever be justified when there are so many unmet needs? Perhaps we have never had so many people as part of the middle class. At the same time, due to the increase of population, there have never been more people in absolute poverty, void of basic supplies of water, food, energy, healthcare and education.

## Go Beyond the Obvious

When faced with the challenge to respond to basic needs of all on earth with what we have, and admitting that the present system is not providing any adequate short- or long-term solutions, then the time has come to embrace a broad portfolio of innovations that build on

Photo: ZERI Foundation



Paolo Lugari showing how to regenerate the rainforest in Colombia



Testing bioplastics at Novamont - made from agricultural waste only

what we have achieved and benchmarked around the world. We have to look for the breakthroughs that could solidly put us on a path of growth and development, working with all available resources. The time has come for societies to move from the romance with nature and our desire to protect it to a pragmatic redesign of our economic system inspired by ecosystems. Indeed, we have noted that the substitution of one product or process by another has unveiled unintended consequences, even collateral damage. We need to go beyond the obvious, and understand the ramifications of all our actions.

The use of corn as feedstock for both biofuels and bioplastics has increased the cost of tortillas (made from corn), putting food security for millions at risk and further stimulating industry to embrace genetic controls to master standardized and predictable output. The quest for bioplastics may further endanger food security. That is not sustainable development. And while this was certainly never the intention, it is a side effect that business did not notice, until the alarm sounds came from the communities affected. The use of palm oil for biodegradable soaps has destroyed huge tracts of rainforest and with it the habitat of the orangutan. Who is interested to buy soaps that clean up the rivers in Europe, Japan or the United States knowing that the increased production of palm oil is at the expense of the habitat of the primates in Indonesia? That is not sustainable development. The appetite for *shiitake* mushrooms, a delicious and fine substitute for animal protein, has increased the logging of oak trees, which serve as substrate. There is no one who eats *shiitake* and knowingly destroys ancient forests, and yet it happens. Why?

**We, too, must evolve in our quest to become sustainable. Ecosystems provide the design principles for a more entrepreneurial and innovative “Blue Economy.”**

We, too, must go beyond the substitution of one product or one process with another. We must understand how the system works. We have to improve the whole system, not just reduce pollution and limit the negative impact. Ecosystems provide the design for a more entrepreneurial, grassroots-based and innovative “Blue Economy.” And yes, Gaia is not green; she is as blue as can be.

### Cascading Nutrients & Energy

The first design principle is based on the observation in ecosystems that all matter and energy cascade from one species to another, always belonging to another kingdom of nature. What we refer to as “cascad-



The integrated system of Songhai

ing of nutrients” involves partaking of locally available resources, employing all contributors and using the waste for one as the resource for another. This cascading of nutrients can be clearly demonstrated in the astonishing and laudable work by Father Geoffrey Nzamujo at the Songhai Center in Benin, and by Paolo Lugari at Las Gaviotas in Colombia. In their models we see that spent biomass becomes the growing medium for desirable mushrooms, the spent substrate from the mushroom farming becomes protein-rich feed for livestock, their bacteria-inoculated animal manure generates biogas in a digester, the slurry that is released from the digester becomes the nutrient source for algae farming, and the residual water promotes the prolific growth of benthos and phyto- and zooplankton that become fish food. While all these processes are known and described, we never integrated this into a system, just like ecosystems work.

Prof. Jorge Alberto Vieira Costa’s work in Porto Alegre, Brazil, extends this concept from agriculture and forestry to energy generation and mitigating climate change. He redirects CO<sub>2</sub> exhaust from the local coal-fired power station. It provides the nutrient needs of spirulina algae for the production of protein-rich food supplements and sustainably harvested biofuels. It demonstrates how an excessive or unbalanced byproduct (CO<sub>2</sub>) can be converted from pollutant to a valuable resource. The additional investment costs are low since the infrastructure required is already available thanks to the warm water retention basin – i.e., what is locally available.

### Innovations Inspired by Laws of Physics

The second principle is based on the observation that ecosystems rely first and foremost on the laws of physics and only secondarily on chemistry. Physics is predictable. Indeed, the law of gravity, for example, has no known exceptions to its rule; warm air rises and cold water settles closer to the bottom. Following this principle would allow us to reduce or eliminate mined metals, smelting of ore and processed chemicals from our consumption patterns. The physics-based mechanisms developed by the zebras and the termites display more mastery of air and humidity control than any of our current existing mechanical and electronic systems solutions.

The use of gradients in color, with white reflecting the heat, reduces the surface temperature, while black absorbs the heat, increasing the surface temperature. If the surface is hot, then the air rises, creating an under-pressure. If the space next to this is colder and maintains higher pressure, then the pressure differential causes air to flow, and when wind covers a surface, it will cool. The interplay between black and





*Heating and cooling at Lagggarberg, inspired by the termites*

white permits the area to maintain a cool temperature without any need for thermostats or air-conditioning equipment.

We see this in the design of the Lagggarberg School in Sweden, implemented by Anders Nyquist, or the field hospital in Colombian Vichada, designed by a team of Las Gaviotas, where the air is continuously and naturally refreshed without the need for costly pumps and heaters or coolers. These buildings demonstrate that these inspirations from nature can cut capital costs merely by exploiting pressure and temperature differentials. As a result, the modern-day reliance on chemically based insulation is complemented or even replaced by a deeper understanding of the laws of physics, eliminating the unsustainable use of materials and energy in the process. This was applied for the first time at the offices of Daiwa House in Sendai, northern Japan.

### Electronics without Batteries

The same logic is even applied to the generation of electricity. Each year industrialized societies contribute some 40 billion batteries into the pollution overload of toxic landfills each year – mined and processed metals. Yet nature shows us that every ecosystem generates electric currents based on differentials in pressure, pH and temperature.

While these microcurrents in the foreseeable future are too small to replace a coal-fired power station, they are sufficient to provide a perfectly feasible substitute for these billions of “disposable” batteries that are not only expensive to make and to operate, but polluting beyond any logical reason. This has been demonstrated by Germany’s Fraunhofer Institute, which has successfully prototyped a cell phone that generates electricity from the temperature difference between the phone and the body, and converts the pressure from our voice into a piezoelectric source that provides the power to project our words as long as we are talking.

### Search for More Innovations

These few breakthroughs in environmental technologies described above are part of a broad analysis undertaken by the ZERI Foundation. When the NGO celebrated its 10th anniversary of dedication to zero waste and zero emissions with the organization of an international scientific congress at the United Nations University in Tokyo, the participants concluded there is a need to fast-track more



*The vortex machine attached to reverse osmosis reducing energy by 70%*

technologies. And while everyone recognizes the progress made to date, more is needed, faster and cheaper. After three years of detailed analysis of all scientific literature, a broad portfolio of more than 2,000 technologies were identified. The issue was not if there are more innovations to find, but the key challenge is which one of these innovations creates a new business model that out-competes the present standard on the market in quality and price.

The subsequent research undertaken under the direction of the author of this article selected some 100 innovations that are known as “platform” technologies, i.e. these are breakthroughs that could be of use in multiple sectors of the economy, generating multiple benefits. A broad dialogue with corporate strategists, entrepreneurs, financiers and competitiveness experts led to the conclusion that this portfolio of innovations could achieve what the green economy failed to do: compete on the market.

The retained technologies permit us to create an economic future that is not questioning growth but going beyond improved efficiency and reduced carbon footprint. It actually does more with what is available, using benchmarked innovations that stimulate entrepreneurs to take on the market leaders of today. The knowledge of the vortex, as part of fluid dynamics, is well known to scientists, but few companies are capable of turning this into a main industry since they lack the core competences needed to embrace these innovations.

### Platform Technologies

The vortex is known as the most efficient way for water to move. And

Photo: ZERI Foundation



Mushroom farming on coffee waste in the tropics

as we know rivers never flow in a straight line, but rather meander. And within the river, water never moves in squares, but rather swirls. The mathematical models that underpin these movements, actually caused by both the law of gravity and molecular structures of water, have now been patented. These insights offer ways to purify water without filters, desalinate seawater without membranes, and cleanse polluted water without air pumps. There are dozens of small companies that emerge as solution providers and while the technological applications are still in their infancy, Saraya Co. from Osaka, Japan, has secured the application license to bring this innovative approach to the market in Asia.

The majority of innovations identified through this long-term research known, as “The Blue Economy,” inspired by the Blue Planet Earth with a blue sky and a blue ocean, are now turning into a major platform for stimulating entrepreneurs, changing the economy not from the top down, but rather from the bottom up. This permits taking thousands of technologies to the market, testing and trying them in different environments, and spreading the know-how of the most diverse applications. While governments are struggling to identify the macroeconomic policies required to steer the world economy towards growth, entrepreneurs in both North and South, and East and West could simply change the rules of the game on the ground and make a difference.

The introduction of these new technologies has to be looked at in the same way that the historic fight evolved between David and Goliath. We know David won. But why? He changed the rules of the game. Instead of going for a boxing or wrestling match, he decided to throw some stones and refrained from telling his opponent. This is how the forces on the market will operate in the decade to come. Innovations will be based on competences that are not even known by the market leaders today. New products, services and processes will emerge based on knowledge that none of the corporate leaders know. As a consequence, the entrepreneur who positions this breakthrough on the market has the chance to outperform the strongest in the business.

The opportunity that innovates and stimulates entrepreneurship has never been that big. It is therefore the responsibility of NGOs like my ZERI Foundation to expose the next generation to the creative business models that have been benchmarked in different parts of the world. We adhere to the principle that we “expose, and do not impose.” As a consequence, I present a successful business case from somewhere in the world each week over 100 weeks (nearly two years). The goal is to provide the clear logic on how these breakthroughs are not only

Photo: ZERI Foundation



Farming mushrooms on coffee waste from coffee shops in San Francisco

offering a chance to improve but how we can simply do business, while achieving social objectives, promoting environmental stewardship and responding to the basic needs in society.

Achim Steiner, executive director of UNEP, and Ashok Khosla, president of IUCN, stated in their foreword to the latest report to the Club of Rome: “We can find ways of utilizing physics, chemistry and biology just as ecosystems do with renewable materials and sustainable practices. This is no longer the realm of science-fiction; it is actually happening here and now. With appropriate policies to support research and development, and promotional strategies that accomplish their delivery through market mechanisms, such materials and methods offer abundant opportunities for accelerating their adaptation to address pressing global issues.”

This will require changes as proposed by “The Blue Economy,” a proposal that was debated with scholars, economists, policymakers, financiers and entrepreneurs where we ensure that innovations are not simply doing less bad, but are contributing to more good. **JS**

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*The Blue Economy\** is both a book and a set of worldwide initiatives. Based on an extensive research program that identified more than 2,200 technologies, of which 100 have been retained, a portfolio emerged of innovations that permit us to respond to basic needs, while generating jobs and building social capital. The transformation of these pioneering cases into successes on the market will be accomplished by millions of entrepreneurs who will change the rules of the game inspired by initiatives like the launch of *The Blue Economy*. Further information and resources can be found at <http://zeri.org> and at <http://www.blueeconomy.de>.

\**The Blue Economy*, published by Paradigm Publications, Taos, New Mexico, the United States, is available worldwide since spring 2010.

UNEP has secured the translation into Chinese, Russian and Arabic. For further information and links, please email [info@zeri.org](mailto:info@zeri.org)

*Gunter Pauli, founder of ZERI (Zero Emissions Research and Initiatives) in 1994, aims to design business models without waste or emissions. He is an entrepreneur whose activities span business, science, education and the arts. His latest book, “The Blue Economy: 10 Years, 100 Innovations, 100 Million Jobs” (also presented as a report to the Club of Rome), describes a business model that uses available resources to generate livelihood, provides food security and responds to the basic needs of all with what we have while generating jobs.*