



From Weed to Work

This article introduces wild herbs as natural composite materials that shape The Blue Economy, which is known as ZERI's philosophy in action. This article is of part of a broad effort by the author and the designer of the Blue Economy to stimulate open source entrepreneurship, competitiveness and employment. For more information about the origin of ZERI <www.zeri.org>

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The World Market for Natural Composite Materials

In 2010, the global natural fiber composite (NCF) materials market topped an estimated market value of just over two billion dollars advancing with an annual growth rate of 15 percent over the past five years. The market is expected to nearly double by 2016 to \$3.8 billion with an annual compounded growth rate of ten percent for the next five years, showing a decade of double digit growth. With over 50 percent of the total sales, Europe is the strongest market with a consistent demand from the automobile industry that is shifting door panels, seat backs, dash boards and even bumpers from synthetic to natural materials. The bumpers and protection trim of cars made from NCF represents already a \$162 million industry, good for 324 million pounds of natural materials. The electronics industry is also shifting to NCF for phone and computer cases.

While Henry Ford built a prototype composite car made from hemp, it was the East German Trabant that produced the first assembly line car body from cotton and polyester. Companies like Audi, BMW and Volvo have shifted towards NCF, a move that has recently been followed by General Motors spurring the United States to become the second largest region in terms of consumption of NCF in the automotive well ahead of Japan. NEC was in 2006 the first electronics company in the world to use kenaf and polylactic acid for mobile phone casing. Johan Museeuw, the Belgian bicycle champion turned racing bike manufacturer developed the first racing bike frame with a flax epoxy, a low cost anti-vibration frame, building on centuries of flax farming in his native country. The construction industry, the second largest market for composite applications is focusing on wood plastics. Demand for carbon and glass fiber suffers from this new competition due to low cost and low weight NFC derived from flax, hemp, kenaf and the abundant sisal that used to be the main raw material for ropes.



Flax fibers offer the highest reinforcement and the best tensile strength. In the car industry, the NCF scores nearly 8 times better than steel, and 14 times better than aluminum based on the price/performance ratio that compares specific strength with the dollar value for function delivered. Rising prices of petroleum based products, strong government support for green products, and high acceptance of end users drives the natural fiber composites in the foreseeable future to record levels.

The Innovation

The key drivers towards innovation in the NCF is lower costs, easy maintenance, low moisture absorption, no corrosion, and higher uniformity than wood. The construction industry has long been criticized for its excessive use of hardwoods like teak that has resulted in a massive deforestation. Now that rice husks and bagasse compete for window frames, fences, outdoor decks and wall panels, an increasing number of manufacturers substitute scarce and regulated tropical wood with NCF. Flax, kenaf and hemp replace synthetics and metals, demonstrating thermal recycling and insulation properties. With the exception of rice husks, which is a waste material, all other natural fibers compete with food for land which is one of the major challenges in striving towards a sustainable society capable of responding to basic needs, starting with water and food.

Carla Wobma and her partner Bob Crebas from the Netherlands supported by the creative research of Jeroen Bos rediscovered the stinging nettle for its fibers, a plant with a long medicinal history. It was documented that as early as 900 AD people used wild nettles as textile. It was a luxury for royals. The nettle is one of the Nine Herbs Charm recorded by the pagan Anglo-Saxons in the 10th century. This perennial was already used in medieval Europe to rid the body of excess water and to treat joint pain. Nettles offer more than a potential medical cure, it is as nutritious as spinach and cucumbers, rich in Vitamins A and C, with a daily allowance of potassium and calcium. As a drink it offers a source of citric acid, and has a natural long shelf life. There is even nettle beer, a popular drink in the UK. Nettle has been traditionally used alongside linen as a raw material for textiles and requires no pesticides since most grows in the wild. It is even a dye, producing yellow from the roots, and yellow-green from the leaves. Bhutan is the only country that has a widespread wild harvesting and fiber production for clothing, especially for the men's jacket known as the Goh.

Bob and Jeroen studied production research in the UK, Czech Republic, Germany and the Netherlands demonstrating that each hectare provides six tons of nettle which delivers 600 to 780 kilograms of nettle fiber. The nettle fiber still commands a price on the market which is four to five times higher than the cost of cotton. This offers a competitive revenue that compares favorably to €2,000/ha for corn and €1,000/ha for sunflowers. Whereas most natural resources require annual planting, nettles are perennials requiring no water. This permits a dramatic shift in energy, labor and capital inputs compared to cotton.



Jeroen Bos and the Crebas family unlocked nettle fibers through experimentation with heated vacuum cylinders to extract the fibers. They piloted a trial factory combining rotting, fermenting and water purification, all operated with rainwater generating for each ton of processed nettle 50 to 55 cubic meters of biogas which contains up to 75 percent methane. Jeroen focused on optimizing the process, including the use of self-generated gas to dry the fibers. Using the fermentation principles that have been described in other cases (see Case 51) suggest that the manufacturing of the raw fibers from nettles could generate all required energy from its own operations achieving a zero emissions target provided different waste streams are combined.

Then the Netl team bathes the raw fibers with glycerine, a natural by-product of soap manufacturing, which permits the production of individual fibers. A farming and manufacturing process that uses what it has, has the potential to generate its own power and recycles water continuously extracting more nutrients and matter, that is kept simple while it achieves high quality output at competitive cost provides a perspective of how to apply the principles of The Blue Economy. Therefore the nettle fibers could well be called “a Blue fiber”.

First Cash Flow

In 2006, Bob Crebas went on to create the company Netl, and Carla finetuned the spinning with Italian, British and French experts, while the nettle yarn is knitted into cloth in Lithuania and in the Netherlands according to her innovative women dress designs. The couple went on to create a 48 hectare nettle park, set up an integrated production system from farming to final products, with the first clothing line offered on the international market in the beginning of 2012. In a first phase, there could be four farming sites in Europe, while clustering expert companies and generating demand replacing the water and pesticide intensive cotton fibers that even have fallen out of favor by the Chinese (See Case 77). The potential is strong, and the business model is competitive even if the cost price is not up to the level of cotton today, the value that is generated both to the customer and the environment provides the multiple benefits and revenues that are urgently needed to steer the clothing business towards a competitive sustainability.

The Opportunity

While Netl is busy developing the park and the clothes, other entrepreneurs like Paul van Zoggel, also from the Netherlands, are joining the effort. The innovative product portfolio includes the design of a series of new fibers spun from nettle, alginate-based yarns and silk, the triumvirate of fibers from the Blue Economy. The process water is rich in organic matter, and while it does not have the appearance of a soup, it contains vitamins, iron and potassium which is at least an ideal soil enrichment, and could be further processed to extract a natural mix of nutrients. However, studying the properties of nettle fibers and learning about the success of flax, the first NCF product is ready for trial: a breadbox and a drinking cup. The Netherlands Aerospace Laboratory recognized



the specific stiffness compared to glass fiber, while the tensile strength is higher than any other natural fiber and is considering it as an option for the future.

The shift from cotton to nettle in textiles is a remarkable improvement on all counts. This complements flax, linen, kenaf and hemp with a wild plant that can be farmed on degraded and even contaminated land (just do not drink the soup), generates jobs and offers a desirable complement to a market that will face a strong increase in demand for fibers both from industry and consumers. Nettle offers a return to traditions that were already around a millennium ago. The vision may well be to combine the nettle that cleans up the contaminated Earth with algae, that clean up the contaminated air from CO₂ and water that is loaded with organic matter, jointly securing that we use topsoil wisely, have air to breathe and water to drink. There are entrepreneurs who join the bandwagon in Germany, take the risk and through the innovative pre-order business model innovators lead the way to surf the market dynamics.

Gunter Pauli is the author of the Report to the Club of Rome:
“Blue Economy: 100 Innovations - 10 years - 100 million jobs” published in 35 languages worldwide.

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For further background on the 100 cases: www.TheBlueEconomy.org