

# Biomimicry – a sustainable solution for future

*Abstract:* The Firm of the Past is no longer fit for the purpose. Firms of the past, and the economies in which they operate, have become brittle and retrograde. We are now entering the decade of transformation, and transformational times call for transformational changes. This decade will be about winding down the unsustainable business models of the 20th century and evolving new 21st century business models that are fit for purpose. In the firm of the future, the essence of the business is social, economic and environmental value-creation that emerges from core values based on a common sense of purpose, a holistic understanding of value and values, and impacts to the social, economic and environmental dimensions of the world.

It is our belief that those organizations which re-shape themselves using nature's wisdom will flourish through the enormous opportunities these volatile times bring. It is our belief that the firm of the future is a business inspired by nature. A business inspired by nature follows the successful principles, strategies, and practices developed by and used within nature. In short: Nature has had over 3 billion years to figure out what works and what doesn't – evolution eliminates unsuccessful strategies. A business inspired by nature is resilient and can leverage myriad unpredictable disturbances. A business inspired by nature operates like nature, where waste is food, form fits function, consumption adds value, productivity is optimized, and self-interest benefits the system.

## Introduction

**B**iomimicry is an approach to innovation that seeks sustainable solutions to human challenges by emulating nature's time-tested patterns and strategies. Some of the great saying inspired by nature which acts as stimulus for future technology and emphasizes the need of learning to be adapted from nature are as follows.

“Human ingenuity may make various inventions... but it will never devise any inventions more beautiful, nor simpler, nor more to the purpose than nature does; because in her inventions nothing is wanting and nothing is superfluous.”

– *Leonardo da Vinci*

Pankaj Satija, General Manager (Operations), Tata Steel Limited and Dipak Behera, Head (Mine & Production Planning), Tata Steel Limited

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“I think the biggest innovations of the 21st century will be at the intersection of biology and technology. A new era is beginning.”

–*Steve Jobs*

“When nature has work to be done, she creates a genius to do it.”

–*Ralph Waldo Emerson*

Janine M. Benyus, the author of “Biomimicry- Innovation inspired by Nature” defines beautifully the word as BI-O-MIM-IC-RY (From the Greek bios, life, and mimesis, imitation) and explains it as:

1. Nature as Model: Biomimicry is a new science that studies nature's models and then imitates or takes inspiration from these designs and processes to solve human problems, e.g, a solar cell inspired by a leaf.
2. Nature as Measure: Biomimicry uses an ecological standard to judge the “rightness” of our innovations. After 3.8 billion years of evolution, nature has learned; what works. What is appropriate. What lasts.
3. Nature as Mentor: Biomimicry is a new way of viewing and valuing nature. It introduces an era based not on what we can extract from the natural world, but on what we can learn from it.

## A bit of perspective

As we dive deep in to the history of earth, magnificent facts get revealed which gives us bit of perspective of present day human made industrial revolution vis-à-vis the history of mankind and history of earth if go back and back. If we try to compress the history of earth into a calendar year we would be surprised to know that:

- (a) All human history has taken place in the last half hour of the last day
- (b) The industrial revolution has taken place in last 2 seconds

To recreate the whole phenomenon, the calendar of earth history and happening all around has been pictorially depicted in calendar spanning over one year as given in Fig.4.

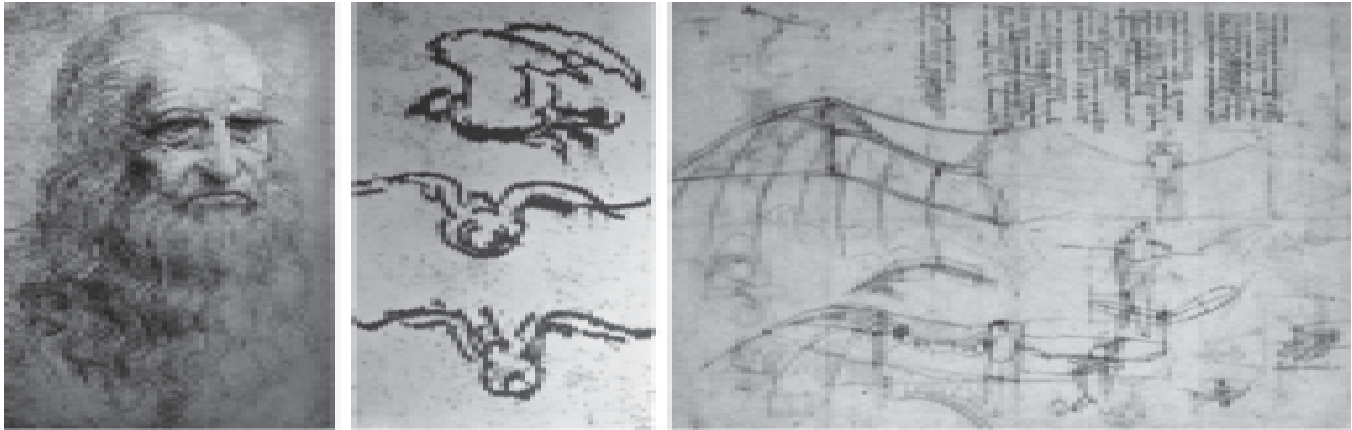


Fig.1 Invention of Leonardo da Vinci inspired from nature



Fig.2 Present concerns contemporary to natural solutions



Fig.3 Showing present day architecture inspired by nature

So, in nutshell it can be summarized that nature has stored a enormous surprise gifts us for us which we the human being need to adapt based on our need and requirement to make the future of mankind more sustainable.

**Case study examples**

How industries have biomimiced till date:

**1. LEARNING EFFICIENCY FROM KINGFISHERS**

The Shinkansen bullet train of the west Japan railway

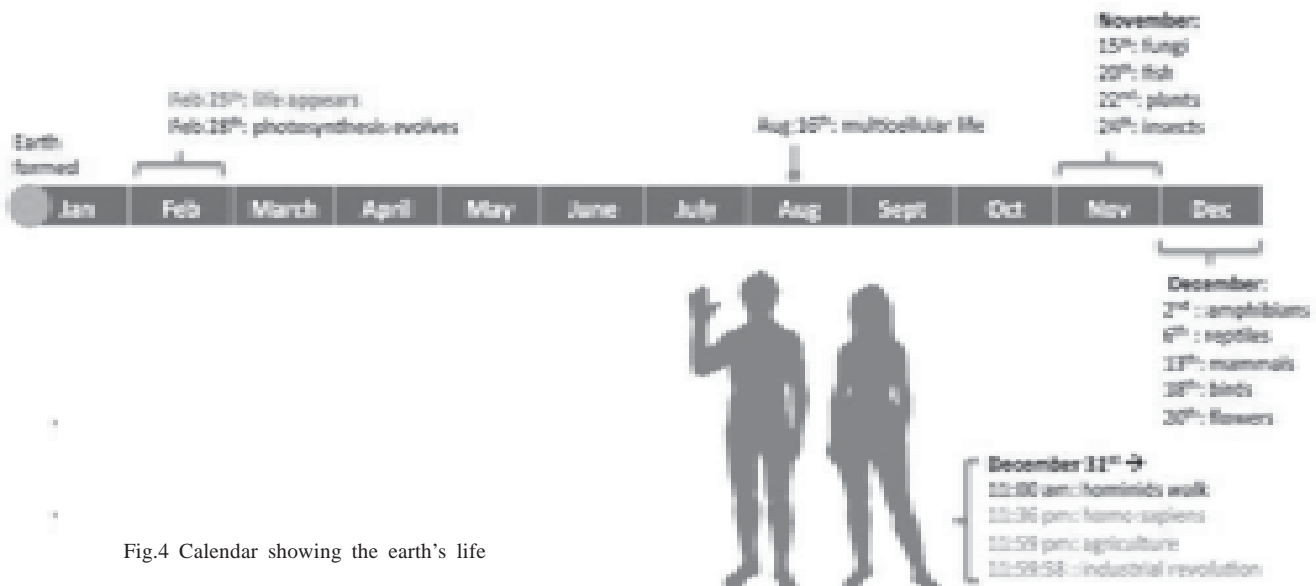


Fig.4 Calendar showing the earth's life

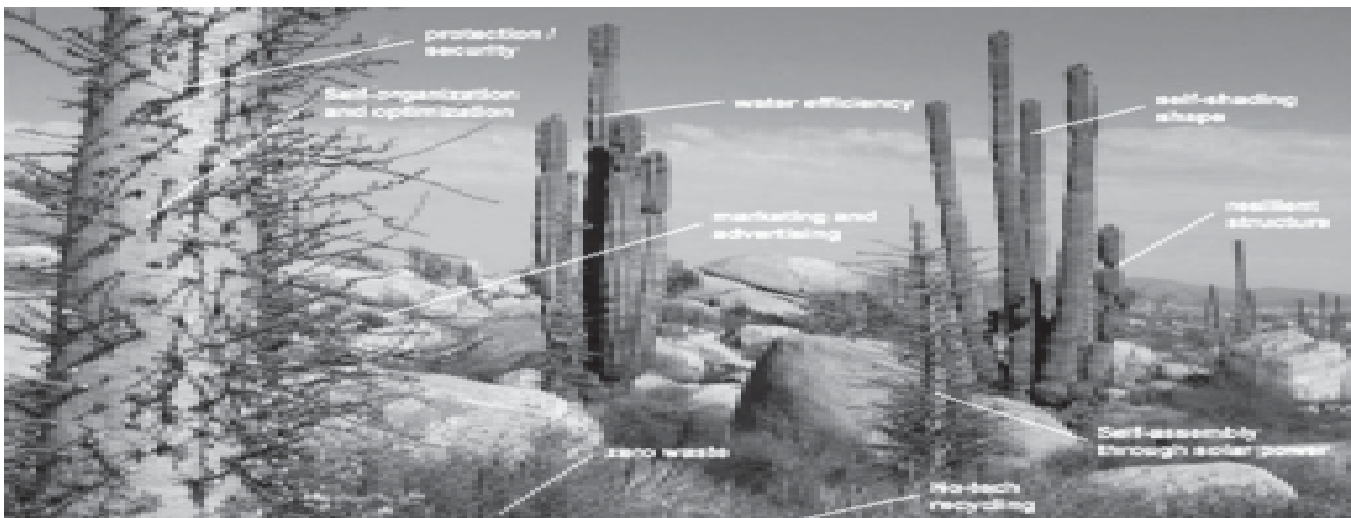


Fig.5 How can this eco system inspire your next task?

company is the fastest train in the world, traveling 200 miles per hour. The problem? Noise. Air pressure changes produced large thunder claps every time the train emerged from a tunnel, causing residents' one-quarter a mile away to complain. Eiji Nakatsu, the train's chief engineer and an avid bird-watcher, asked himself, "Is there something in nature that

travels quickly and smoothly between two very different mediums?" Modeling the front-end of the train after the beak of kingfishers, which dive from the air into bodies of water with very little splash to catch fish, resulted not only in a quieter train, but 15% less electricity use even while the train travels 10% faster.



Fig.6 Biomimcry of kingfisher

## 2. LEARNING FROM LOTUS PLANTS HOW TO CLEAN WITHOUT CLEANERS

Ask any school child or adult how leaves keep water from sticking to them, and they'll almost certainly say, "Because they are so smooth." Yet one of the most water repellent leaves in the world, that of the Lotus (*Nelumbo nucifera*), isn't smooth at all. The myriad crevices of its microscopically rough leaf surface trap a maze of air upon which water droplets float, so that the slightest breeze or tilt in the leaf causes balls of water to roll cleanly off, taking attached dirt particles with them.

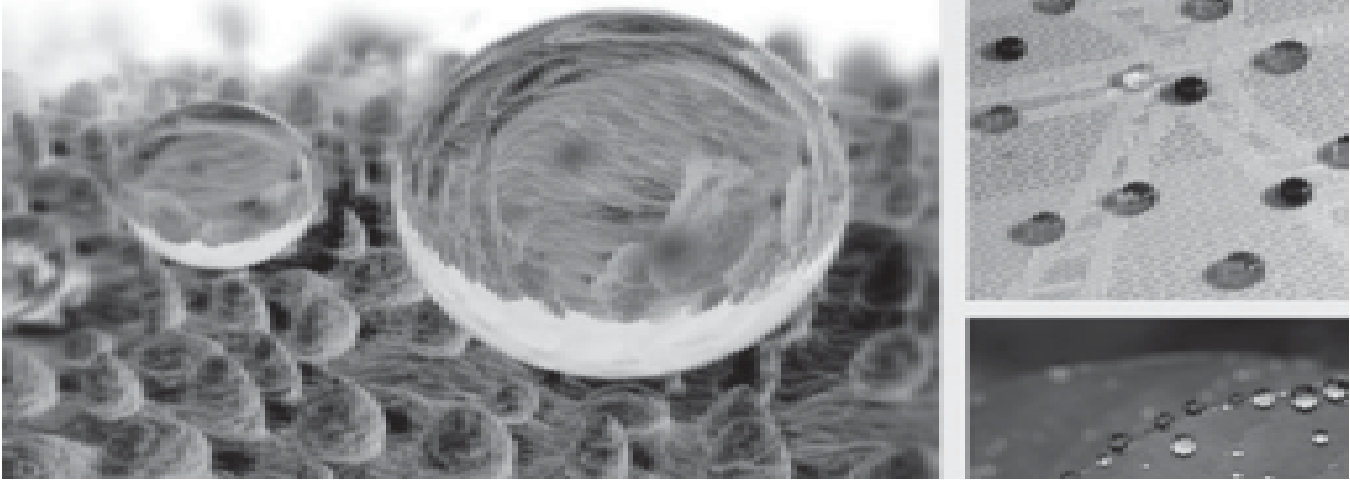


Fig.7 Biomimicry of lotus plant

Now, microscopically rough surface additives have been introduced into a new generation of paint, glass, and fabric finishes, greatly reducing the need for chemical or laborious cleaning. For example, Green Shield, a fabric finish made by G3i based on the “lotus effect,” achieves the same water and stain repellency as conventional fabric finishes while using 8 times less harmful fluorinated chemicals.

### 3. LEARNING FROM TREES AND BONES HOW TO OPTIMIZE STRENGTH AND MATERIALS

The next time you drive through a forest, go ahead and thank the trees out your window for helping on your car’s crash safety and gas mileage. Trees engineer themselves in a number of ways to maximize their strength, such as arranging their fibers to minimize stress and adding material where strength is needed (take a look at the extra material beneath a heavy branch, for instance). Bones – unlike trees in that they must carry moving loads – go a step further by removing material where it’s not needed, optimizing their structure for their dynamic workloads.

Engineers have incorporated these and other lessons

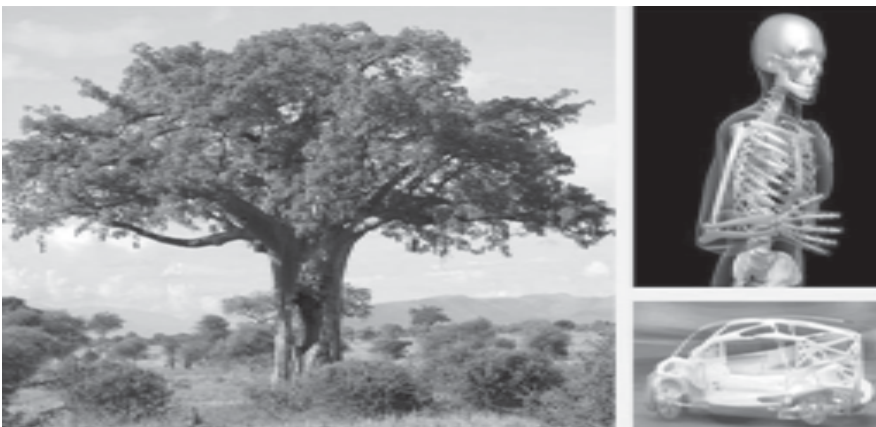


Fig.8 Biomimicry of trees

learned from how trees and bones optimize their strength and minimize their use of materials into software design programs, such as Claus Mattheck’s “Soft Kill Option” software, which are revolutionizing industrial design. Using these programs to design cars, for example, has resulted in new vehicle designs that are as crash-safe as conventional cars, yet up to 30% lighter.

### 4. LEARNING FROM CHIMPANZEES HOW TO HEAL OURSELVES

One-quarter of all modern medicines are derived directly from plants, and there are hundreds of thousands of other plant species yet to examine, each with dozens of unique chemical compounds that could prove of medicinal value. If one wanted to discover more valuable medicines, where would one start looking? It could take millions of years, literally, to sort through this enormous variety of plants and plant compounds to find ones with medicinal value. Fortunately, this is exactly what researchers have discovered that chimpanzees (*Pan spp.*) have already done, over millions of years of evolutionary time.

By observing how chimps and other species cope with illness, researchers have acquired leads on plants with promising medical applications to human health. Trees from the *Vernonia* genus, for example, which chimpanzees regularly seek out when ill, have been found to contain chemical compounds that show promise in treating parasites such as pinworm, hookworm, and giardia in humans.

### 5. LEARNING FROM DOLPHINS HOW TO WARN PEOPLE ABOUT TSUNAMIS

Tsunami waves dozens of feet high when they reach shore may only be tens of centimeters high as they travel through the deep ocean. In order to



Fig.9 Biomimery of chimpanzees

destructively interfere with one another as they travel, compromising the accuracy of information. Unless, that is, you are a dolphin.

Dolphins are able to recognize the calls of specific individuals (“signature whistles”) up to 25 kilometers away, demonstrating their ability to communicate and process sound information accurately despite the challenging medium of water. By employing several frequencies in each transmission, dolphins have found a way to cope with the sound scattering behavior of their high frequency, rapid transmissions, and still get their message reliably heard. Emulating dolphins’ unique frequency-modulating acoustics, a company called EvoLogics has developed a high-performance underwater modem for data transmission, which is currently employed in the tsunami early warning system throughout the Indian Ocean.



Fig.10 Biomimery of dolphins

#### 6. LEARNING FROM HUMAN LUNGS HOW TO SEQUESTER CARBON

Studying the way human lungs work is inspiring new technologies that remove carbon dioxide from sources like flue stacks, preventing this greenhouse gas from reaching our atmosphere and warming the planet. Our lungs have 3 major adaptations which give them their carbon dioxide (CO<sub>2</sub>) removal effectiveness: a super thin membrane, allowing CO<sub>2</sub> to travel across and out quickly (how thin? About one thousandth of the period at the end of this sentence), an enormous surface area (if you laid flat your lungs’ gas exchange surface, it would be 70 times your body surface area – about the size of a volley ball court), and specialized chemical translators, namely carbonic anhydrase, which allows CO<sub>2</sub> to be removed from our bloodstream thousands of times faster than possible without it.

reliably detect them and warn people before they reach land, sensitive pressure sensors must be located underneath passing waves in waters as deep as 6000 meters. The data must then be transmitted up to a buoy at the ocean’s surface, where it is relayed to a satellite for distribution to an early warning center. Transmitting data through miles of water has proven difficult, however: sound waves, while unique in being able to travel long distances through water, reverberate and



Fig.11 Biomimery of human lungs

In tests by a company called Carbozyme Inc., human-made filters inspired by the way our lungs work removed over 90% of the CO<sub>2</sub> travelling through flue stacks. Meanwhile, other technologies based on the carbonic anhydrase enzyme found in animals such as mollusks have successfully transformed CO<sub>2</sub> into limestone, which can be stored or used as a building supply.

Nature has stored lot of examples from us and now mankind has taken a big lap to imitate some of the learning to its stride. Needless to say these nature inspired breakthrough innovations are change agents for future and would many such are also waiting along to set the path for a sustainable future.

### **Conclusion**

We have entered the decade of transformation and transformational times call for transformational changes.

Businesses that wish to survive and thrive through these volatile times must transform themselves from a firm of the past to a firm of the future. The firm of the future brings the values of sustainability to its core and, in doing so, generates value for itself, its communities and the ecosystems in which it operates. The firm of the future is a business inspired by nature, functioning like an adaptive living organism, thriving within everchanging business and socio-economic systems, resilient to disruptions and interdependent within the largest ecosystem of all –Earth.

### **References**

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