

BUSINESS INNOVATION INSPIRED BY EVOLUTION

For Professor Nelson Gómez, biological evolution is a great metaphor for explaining entrepreneurial innovation. Computational methods based on evolution could be used as genuine accelerators for innovation in organizations.

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Helping firms create efficient innovations through the use of evolution-inspired computational methods and the behavior of living systems is an idea being developed by Professor Nelson Gómez, a researcher at the Center of Innovation of the Universidad del Rosario's School of Management and Business. He claims the premise is clear: life is the paradigm for invention.

Business innovation can be studied and managed on at least four levels. The macroscopic level looks at design and evaluation of public policies oriented towards pushing the pace of innovation in a country; the mesoscopic level focuses on regions and involves local institutions that promote innovation, business enterprise, and entrepreneurial development; the microscopic level seeks an understanding of the logic of innovative process, aiming to provide firms with the tools they need to innovate; and finally, the nanoscopic level identifies individuals in order to stimulate their skills in innovation, such as their creativity.

Gómez's work is channeled on the microscopic level, in other words focusing companies themselves. "Life is in itself an innovation. Its evolution on Earth dramatically transformed the look and geochemistry of the planet, the composition of the atmosphere, climate dynamics, and the general tendency of the universe towards thermal equilibrium," he ventures.

Examples of biological innovations include photosynthesis, pluricellular organisms, flowering plants, winged animals, the appearance of eyes as perception mechanisms, social organisms, and the brain, among others.

Innovation, whether in companies or in a living system, is characterized by being a dynamic and emergent system. This means that innovation comes from the interaction of multiple components and cannot be reduced to an analytical explanation of these. "The human brain is a good example. We know about neurons and their workings; yet this understanding does not mean we comprehend why we think, feel, or have a sense of humour or irony. It offers no guarantee either that we understand what the mind is," explains the expert.

Carrying on with this metaphor, Prof. Gómez points out that the innovation represented by the brain is not the result of an aggregate of individual capacities of neurons but an emergent effect of dynamic interactions between them.

In this sense, innovation is a network of interactions that provide the innovator with abilities that are qualitatively new, that frequently change the rules for the system and its surroundings.

Once an innovation emerges, the system that generates it ceases to be its old self. For example, when multicellular organisms appeared, life took a radically new route, one that opened the way to a world full of possibilities. Business innovation can be understood in exactly this way.

THE LINK BETWEEN BIOLOGICAL EVOLUTION AND BUSINESS INNOVATION

As well as influencing products and services, business innovation can also apply to organizational models; in experiences provided for customers; in the design and management of supply networks; in distribution modes and channels; and in strategies used by firms in order to adapt flexibly to volatile modern environments. In a general sense, business innovation is an emergent process involving both renewal of the elements or relations of a system and the relation between an organization and its environment.



Helping firms create efficient innovations through the use of evolution-inspired computational methods and the behavior of living systems is the proposal of Professor Nelson Gómez.

Different models have been put forward in an attempt to explain how business innovation operates. These have mainly been based on analytical or systemic postures. Nevertheless, there is an increasing consensus that explanations inspired by the theory of evolution paint a precise picture of the most outstanding features of entrepreneurial innovator. Regrettably, these evolutive approaches have remained, almost without exceptions, in the metaphorical or conceptual realm.

Nevertheless, the scientific field of artificial life, which was consolidated back in 1987, has allowed for the creation of biological and evolutive dynamics in artificial media such as software, hardware, or (bio)chemical substances. This new science, whose fundamental method is simulation, arose with the aim of explaining life via the synthesis of its fundamental processes in artificial media. What is interesting is that once an artificial system with the capacity to evolve is created, for example, you then have an engineering model that can be applied to problems in the real world.

Advances in artificial life have enabled Prof. Gómez to take the following premises into consideration: through biological evolution, living beings have managed to solve problems of extraordinary complexity in order to keep the life of the species going; it is possible to capture the logic of fundamental processes of life in artificial media, such as a computer; on managing to implement a process such as evolution within a computer, you have—by extension—a system capable of solving problems typical to the human context; since business innovation processes share the same logic as biological evolution, it is possible to construct artificial evolutionary systems that accelerate the production of innovations in an artificial context.

And the challenge this researcher aims to meet leads off precisely from these premises: simulating evolutionary processes in the computer to generate solutions that are specific to innovation. For example, if your aim is to find the best routes for a logistics problem concerning distribution, a collective of software agents in which each agent represents a specific route can interchange their genetic information and



evolve through a selection mechanism aimed at finding the best route possible. Different fields in engineering and scientific research chime with this vision, including: morphogenetic engineering, organic computing, swarm intelligence, evolutionary computing, and agent-based simulation. Thus, the transference of biological evolution to business innovation is clearly established by recent developments in the engineering of complex systems and bio-inspired computing.

FROM THEORY TO PRACTICE

The focus proposed by the research team has already been put into practice successfully in contexts such as product design. One notable case, which provides a conceptual proof for scientists and entrepreneurs, is the design by NASA of antennas using sophisticated evolutionary computing techniques. The computing method allowed antennas to 'evolve' for critical missions involving wide-ranging, counterintuitive, and conflictive design requirements, such as unusual radiation patterns. The resulting designs fall outside what telecommunications engineers could manage to conceive.

Meanwhile, the Innovation Center also tried out this focus on a problem of assigning spaces within the University. Through an evolutionary computing model, it proposed an efficient solution to the problem of assigning meeting rooms and managing the availability of these in the institution's En-



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trepreneurship and Innovation headquarters. The solution led to levels of occupation more or less equal throughout the week, with the permanent availability of at least one meeting room for contingencies. Even though the solution was not definitively implemented, the results of the exercise were promising.

Despite such examples, a focus that both explains the innovative process and allows for innovations to be developed efficiently in any company context has never previously appeared. The Innovation Center team is currently undertaking a research project led by Prof. Gómez and aimed at establishing a conceptual, methodological, and technological framework that, in a second stage of the research, can open the way for designing an accelerator of business innovations based on unconventional computing techniques.

Right now, its developments are theoretical, but the goal pursued by the Center of Innovation will always be a practical one: helping companies, especially in Colombia, to develop innovations in an efficient and sustainable way. ■