Editorial

A Scientific and Technological Revolution for the Brazilian Amazon

The model for the rural development of the Brazilian Amazon, based on the replacement of the forests by agriculture and cattle ranching, has long been outdated. The gross agricultural product from the Amazon forest represents less than 0.5% of the Brazilian GNP. The conclusion is inescapable: fifty years of deforestation have not resulted in wealth or better quality of life for most Brazilian Amazonidas. It is urgent that we halt the advance of deforestation. Opposed to this realization, the present economic scenario conspires against the Amazon, placing a higher premium on agricultural commodities such as soybeans and meat. Furthermore, the high probability that biofuels will soon become a new commodity presents an additional threat of continuing the traditional model of ever increasing deforestation of tropical forests and the Brazilian savannas, the *cerrados.*

The challenge is to reconcile the maintenance of traditional agricultural activities, but with increased efficiency - keeping in mind that over 750,000 square kilometers of the Brazilian Amazon have already been deforested while another equal portion finds itself in an accelerated process of degradation - with renewable natural resources, biodiversity, water, renewable energy sources etc. A corollary to this greater challenge is the definition of a novel Science and Technology to serve as a basis for a new model of regional development.

It must first of all be made clear that the great challenge to change the regional developmental model is political and that science and technology alone are insufficient. Nevertheless, science and technology must play a key role in sustainable development of the Amazon, considering the pressing necessity of new knowledge to fully develop the productive chains, starting with biodiversity and for valorizing environmental services of ecosystems. It has thus become vital to develop a real scientific and technological revolution for the Amazon, a revolution held as the central and strategic priority of the regional development policy and that may possibly represent the greatest challenge to be faced by the Brazilian scientific community for the next thirty years.

For industrialized nations as well, the most tangible benefits of science and technology are not those originating directly from new knowledge, but those derived from the use of already existing knowledge translated into goods and services. Even more relevant than the advance of knowledge *per se*, is the creation of a workforce capable of understanding and applying existing knowledge. Technological capacity building has proved to be a fundamental tool to maintain the emerging economies of sizeable developing countries such as China, India and Brazil. Over the last fifty years, Brazil has been capable of creating islands of excellence in science and technology, which are more similar to those of developed countries than those of lower or middle income. However, historical regional inequalities, especially those in education, have created impediments drastically limiting intensive use of science and technology for the economies and social development of the poorer, less favored regions, including the Amazon and the Brazilian Northeast. Poverty is almost always associated with environmental degradation, which, in a vicious circle, affects the income and quality of life of the poorer of the population, in addition to impacting health and the capacity to adapt to environmental and climate changes. However, the paradigm of intense application of existing knowledge does not apply to the sustainable development of the Amazon, inasmuch as the existing and, in fact, practiced knowledge for the rural agricultural development has not proven to be appropriate for the humid tropics because of the high social and environmental cost incurred. In other words, the fact that there is no fully developed and industrialized tropical country results in a lack of models to emulate.

In practical terms, the necessary science and technological revolution for the Amazon should create the favorable conditions to "add value to the heart of the forest", in Professor Bertha Becker's words, which demands the development of an innovative economy, based on the forest and its aquatic resources, with the economic valorization of its biodiversity. Nowadays, very few productive chains based on the Amazon's natural products reach the global markets with benefits to an ample social strata. Actually, quite the opposite has been occurring: more and more products from regions other than the Amazon are being used within the Amazon region to replace traditional products. In fact, it is very feasible to develop from fifty to one hundred productive chains based on biodiversity and capable of reaching global markets, thereby generating, within ten to twenty years, a new forest-and-aquatic resource-based economy with intensive economic use of the biodiversity and strong local value aggregation *via* industrialization. This new economy has the potential of becoming much larger than the present one which is based on the replacement or destructive exploitation of the forest.

Although this diagnosis is not a new one, the question remains: why has this new economic reality not yet begun to develop since it is clear enough today that there is a national desire to interrupt the present state of development based on deforestation? In other words, how can we meet the national wish to find a sustainable way for the future of the Amazon? Thus, a new vision of science and technology is imperative. Among other general conditions, such as the improvement of basic education, it is essential to create a network of new institutions for higher learning, post-graduation, basic research and advanced technology with specific focus on both the forest and the aquatic resources. These institutions should be created so as to radically decentralize science and technology throughout the vast Amazon, maximizing the diversity and the potential of its sub-regions. Such an innovative network of science and technology should include five or six new technological institutions, grouping together from 500 to 600 faculty, researchers, engineers and technicians in each one, thereby multiplying the number of active researchers in the Amazon by three or four. In addition, these institutions - connected to a network of associated laboratories reaching every distant corner of the Amazon and interconnected by cutting-edge information technology - would serve as regional poles of this new technological development model, just as, from the 50's to the 70's, the Aeronautics Institute of Technology (Instituto Tecnológico de Aeronáutica - ITA) in São José dos Campos, in the State of São Paulo, did for the rapid development of the Brazilian aircraft industry, one of the world's most important nowadays. Therefore, what the Amazon needs is many of these Amazon Technological Institutes to seed an innovative industrial model for that region. These institutes should be involved with the development and value aggregation in the entire productive chain of dozens of products from the Amazon, from bioprospecting, product development to commercialization and global marketing. Although it may seem a simplistic recipe for regional development, no tropical country has ever adopted it on a large scale. Cutting-edge technology would make it possible for some institutions to develop sophisticated research in biotechnology and nanoscience applied to biomimicry, that is, learning about the way complex biological systems find answers on a nanomolecular scale, to be reproduced in practical applications, a new scientific area to be explored for the tropical ecosystems.

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