INNOVATIVE ACTIONS THAT CONTRIBUTED TOWARD PROTECTING THE ENVIRONMENT IN BRAZIL

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Инновационные проекты в защиту окружающей среды в Бразилии

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This paper recounts some actions taken that contributed toward solving environmental problems by opening new paths for improving living conditions and stimulating sustainable development patterns. The examples given are projects and solutions conceived in Brazil, but their equivalent in other parts of the world can certainly be identified. The examples described were selected to show the importance of using non-conventional approaches to reach an objective, but their outcomes point to a very interesting conclusion: the innovative approaches also originated several spin-offs that presented, in due time, new solutions for other environmental problems. In this regard a very relevant aspect of such innovative attitudes is the opportunity to transform eventual spin-offs of the solution found into new solutions for other related problems.

Статья рассказывает о некоторых предпринятых действиях, которые способствовали решению проблем окружающей среды путем улучшения условий жизни и стимулирования моделей устойчивого развития. Приведенные примеры являются проектами и решениями, используемыми в Бразилии, но их эквивалент может быть найден и в других частях света. Приведенные примеры были отобраны, чтобы показать важность использования нетрадиционных подходов в достижении цели, но их результаты указывают на очень интересный вывод: инновационные подходы часто дают побочные результаты, которые со временем приводят к новым решениям для других проблем окружающей среды.

Introduction

The solution for an environmental problem arises sometimes from an action that aims at other purposes — in most cases the original motivation for acting is economical, social or legal. Leaving environment as a hidden or minor motivation in the order of precedence does not diminish however the merit of the action taken: usually in a short time the priorities are reversed and the environmental merit tops the list of the project's justifications. The examples described were selected to show the importance of using non-conventional approaches to reach an objective, but their outcomes point to a very interesting conclusion: the innovative approaches also originated several spin-offs that presented, in due time, new solutions for other environmental problems.

Innovation, breakthrough technologies, shift of paradigms, spin-offs and extended view are some keywords to have in mind when time is short for conventional and gradual solutions, and some environmental problems accelerate faster than human actions can correct them.

First example: Substitution of Petroleum Derivatives

Program start: 1970's.

Original motivation:

High cost and shortage of petroleum and its derivatives, due to successive world oil crises.

Conventional approach abandoned (infertile for generating new opportunities and spin-offs):

The rationing of petroleum derivatives and restrictions on the mobility of vehicles, to save fuel.

Reasons for success of the innovative approach:

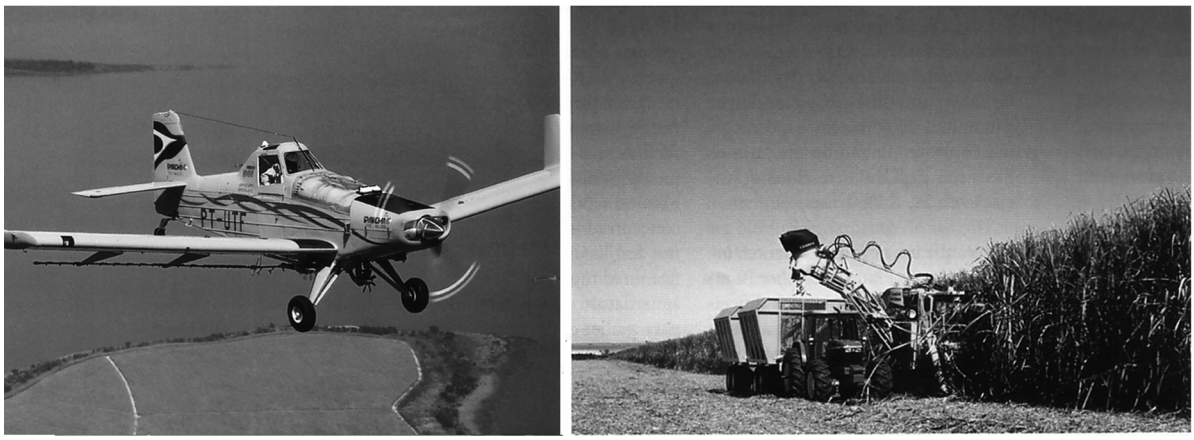
Extant local experience in sugar-cane cultivation and industrial ethanol production; local competence for automotive engine adaptation.

Environmental benefits:

Promotion of the renewable energy concept; demonstration (in large scale) of a petroleum-free solution for moving people and goods; development and production of bio fuels and biodegradable materials.

Program's spin-offs:

Ethanol production in large scale (higher efficiency); bio diesel production extracted from several tropical crops and palm trees; energy co-generation from sugar cane bagass; carbon credits (CDM projects inserted in Kyoto Protocol); multi-fuel engines (Flexfuel cars); development of bio polymers; genetic improvement of plants used as raw-materials for bio fuels production.



Pic. 1. Left — plane with 100% ethanol fuel, Right — sugar-cane harvest.

Project rationale and results:

The need to save or even to entirely replace fossil fuels used in vehicles during recent oil crises gave origin to a massive bio-energy production program that now covers the whole country. The first petroleum world crisis that erupted in 1973 was to some extent beneficial to Brazil because important steps have been taken since then to replace fossil fuels with renewable sources of energy. The successive increases in petroleum prices since the year 1973 in addition to Brazil's severe dependence on imported petroleum at that time, has vigorously encouraged the development of substitutive fuels based on biomass. The most successful of these efforts was Proalcool, a program that in few years led to a drastic change in the conception of vehicles manufactured locally. During the1980's more than 95% of the new automobiles were running on hydrated ethanol, displacing the use of petroleum by practically 100%. Even the older cars, originally designed for the use of gasoline, run with a 25% addition of ethanol in the fuel they use.

The development of engines that can run with various fuels and their mixtures is also an important breakthrough of this shift to the biomass fuels. More than 80% of the cars produced and sold in Brazil in 2006 are powered by engines based on the Flexfuel concept that automatically accepts the use of ethanol or gasoline at any ratio of mixture.

A new program proposed in 2004 by the federal government envisages the substitution of the diesel oil (mostly used by truck and locomotive engines) for vegetable oil — the so called bio diesel — produced from biomass that can be extracted from various tropical palms, as well as from soybeans, cotton, sunflowers, peanuts, castor beans and several other vegetables which yield excellent results in the tropics. In addition, the processing of all this biomass at the plantations sites can enhance the use of local manpower easing the problem of labour migration to large cities and represents a true eco-social approach to the energy problem.

The absence of sulphur and other pollutants in the bio fuels, and the complete elimination of lead addition to the gasoline (condemned practice abolished in Brazil since 1974) augmented the environmental merit of these projects and programs.

This growth in the use of fuels based on biomass can gradually lead to a complete transition from fossil fuels to renewable sources of energy, both in private and public transportation. In spite of a steady increase in the local petroleum production — that brings Brazil now to the enviable condition of a self-sufficient country and even a net exporter of oil — the increase in the use of biomass for electric power generation can also be noticed. Cogeneration projects using bagasse (the crushed sugar cane waste resulting from the sugar or ethanol production) as a subsidiary fuel reduce the environmental impact caused by the industrial production units, and are fully eligible for the Clean Development Mechanism established by the Kyoto Protocol on climate change: an additional fact that increases the competitiveness of the projects. The replacement of fossil fuels with biomass renewable fuels is clearly identified as a trend that will permanently influence the use of energy, consisting in a relevant shift in paradigm.

Second example: Recycling of Packaging Materials

Program start: 1980's

Original motivation:

Recovery of aluminium value in beverage cans.

Conventional approach abandoned (infertile for generating new opportunities and spin-offs):

Forbidding the use of aluminium cans or imposing surcharges to reduce their use and consumption.

Reasons for success of the innovative approach:

Already existing tradition in scrap collection and metals recovery; availability of low-cost man power to quickly multiplying into a collector's network.

Pic. 2. Press for the recycling of aluminium beverage cans.

Environmental benefits:

Energy saving and preservation of non-renewable natural resources (bauxite mainly); cleaning the urban environment.

Program's spin-offs:

Motivation to set up equivalent recycling programs for other packaging materials (plastics, glass, steel cans, cardboard containers, etc); stimulus for developing a breakthrough technology for recycling composite packaging materials, with the use of a thermal plasma process; new jobs for large contingents of independent garbage collectors, mostly unskilled or momentarily unemployed persons.

Project rationale and results:

A long time Brazilian tradition in scrap collection and raw materials recycling, based originally on plain economical motivation has led to a fast adoption of the new «recycling-for-environment» approach with very successful results regarding paper, metals, glass, plastics and other recyclables. The already existent sorting areas and processing facilities, conceived originally for handling miscellaneous scrapped materials, together with the low cost of labour could sustain for many years some nationwide recycling programs even before the stimulus added by the new environment protection policies. Glass bottles and galvanized steel packaging have a long time tradition as recyclables and have had their collecting networks well established for many years. As can be noticed, these traditional recycling networks started on a purely economic rationale, but their merit as an effort to clean the environment and reduce the amount of garbage to be disposed of was soon realized. Such are interesting examples of environmental solutions that resulted after the economic equation was solved.

A program worthy of special reference is the recycling of aluminium beverage cans. This countrywide program of aluminium recycling sustains around 160 000 workers in Brazil, most of whom are unskilled or momentarily unemployed. It has also become a model for other recyclables. The cans are voluntarily collected and in 2005 they added up to the exceptionally high figure of 97,5% of all cans produced in the country. Since its start in the 1980's a comprehensive system was set in place, including collector teams, locals for delivery (where the collectors are paid in cash for their «production»), metal smelting facilities and, last but not least important, the assurance of a stable market to absorb all the recycled metal. Saving in energy reaches 95% when we compare the secondary aluminium recovered from the cans, with the production of primary aluminium. In addition, the need for mineral ore (bauxite) and other non-renewable production inputs is entirely eliminated.

Lately this program has helped to conceive other extensive recycling initiatives. The processing of composite cardboard packaging (with layers of aluminium and LDPE) now uses thermal plasma technology. This is a recent development that to some extent uses the experience of the aluminium cans collecting network to amass large amounts of composite packages. The collecting and processing of other plastic packaging materials also grows steadily, particularly that of the PET (polyethylene terephtalate) beverage bottles.

On the other hand and contrary to these examples it is important to note that a type of packaging which by law obliges recycling is not economical to process — the agro-toxic containers discarded in farms. These are materials that require particular care after their use and transportation due to their toxicity, and their final destination must be in approved facilities. In this particular case, the environment is the mandatory reason for the processing.

Third example: Restoration of the original environment in Tijuca Forest area

Program start: 1840's—1860's.

Original motivation:

Protection of water sources used for supplying urban population in Rio de Janeiro.

Conventional approach abandoned (infertile for generating new opportunities and spin-offs):

Obtaining the water supply from more distant sources or drilling wells within the city.

Reasons for success of the innovative approach:

Clairvoyance of the imperial ruler (a scientist and humanist himself) and political will to implement the restoration project.

Environmental benefits:

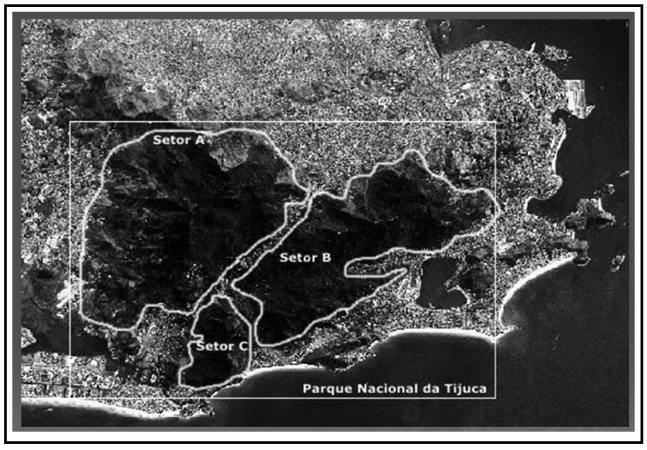
Climate and water conservation; formation of a permanent public leisure area.

Program's spin-offs:

Development of the concept of riparian forest protection (preservation of forested areas adjacent to bodies of water); introduction of the concept of nature parks; protection and dissemination of native trees species; growing experience in forest stewardship and reforestation.

Project rationale and results:

Contrary to the two other examples already mentioned, several environmental concepts (although not yet



Pic. 3. Map plan of restored Tijuca Forest area around the city of Rio de Janeiro.

clearly exposed and understood at that time), were identified at the origin of this project decision and implementation. This is due to the clairvoyance of the project's mentor, the Emperor himself.

The young Brazilian emperor Dom Pedro II was crowned at only 15 years of age in 1840, and ruled until 1889 when Brazil became a republic like all other countries in the Americas. The concerns with the preservation of nature, present in the minds of eminent scientists who visited the new country, soon captivated the young ruler who took important steps to protect the luxuriant nature around the imperial capital city of Rio de Janeiro. Large depleted areas, once covered by the tropical forest within the limits of the city were showing at that time the importance of preserving the local sources of water and the canopy of the forest in order to control the climate in the region.

The tropical forest that surrounded the city had been severely cut down to set free areas for sugar cane and coffee plantations. Coffee farming had already climbed to the summit of the hills and almost to the peak of the high mountain where today the Christ's monument stands and is well known to the tourists. Fresh water to supply the country's capital city was becoming scarce whilst the tropical climate became harsher after the forest removal. A prolonged drought in 1824 had already lead to the decision to protect the areas around the water springs in anticipation of the modern practices of protecting water's edge vegetation (riparian areas), and in line with the current concepts of water management. A most serious draught in the year 1844 with the worst consequences on water supply to the population led the imperial government to expropriate the land in order to reforest these areas — the lesson of cause-effect provoked by wrong farming practices was being learnt.

In 1861, under the Emperor's personal instructions, a new law was issued turning all this land into a forest park, «to conserve the climate and protect the natural springs that supply water to the city». The whole area was then replanted with the same native species that covered it before deforestation. The use of exotic (or imported) species was not accepted in the text of the new law, pioneering the protection of the local biodiversity. During the following 12 years, more than seventy thousand saplings were planted under the Emperor's personal supervision giving origin to the world's largest urban forest that stands until today.

The concept of protecting the water sources, together with a better understanding of the direct relationship between the local climate and the existence of forests can be easily traced in this project as conceived at the very early stages of the ecological science. Tijuca Forest, as it is called, with its 32 km^2 has officially been a National Park since 1967, and was listed as a Unesco Biosphere Reserve in 1991. Its revival as a forest amidst a large city can be considered a milestone in the human fight against the exhaustion of nature.

All this happened around 150 years ago setting up some new concepts of nature conservation now universally adopted.

Conclusions

The concept of paradigms shift, exposed by Thomas Kuhn in his book «The Structure of Scientific Revolutions» published almost fifty years ago, is clearly recognizable in all three examples described. Conventional solutions were put aside in benefit of innovative approaches, leading to new proposals and eventually to new technologies. With the help of lateral thinking and brainstorming techniques, innovative solutions can be conceived for many problems, leading sometimes to breakthrough technologies based on entirely new paradigms.

The examples given also illustrate the benefits to the environment that can be rescued from the innovative posture of the entrepreneurs, when they adopt an «extended view of our world», as proposed by Walter Kofler.

Looking for spin-off opportunities while exploring innovative solutions for a problem can also embrace other areas — promoting eco-social sustainability and public health, stimulating competitiveness, conserving natural resources, designing «green» products, developing «green» processes, creating new jobs and, most important, disseminating environmental education at the different levels of the society.

In his writings two hundred years ago Jose Bonifacio, scientist and mentor of the Brazilian political independence, prophesied facts that became truths — he foresaw how important it is to conserve the natural habitat and preserve the wooded areas, and he went even further when he proposed the protection of whales against indiscriminate killing. He was ahead of his time in the 19th century, and several decades before the word «ecology» was used by Haeckel for the first time. He did not

live to see the petroleum era that dominated the 20th century, but he would certainly be an advocate of the biomass renewable energy era that will probably replace the fossil fuels in a few more decades.

In the early years of the 21st century, society is changing the focus of its environmental concerns, moving from the solution of specific and already identified impacts to the rather global concepts of sustainability and survival. A global approach to alleviate environmental stresses should not ignore however the importance of developing innovative technologies aligned with the local social conditions and economic requirements, preferably with the employment of local manpower and the use of local resources.

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