

Future Direction for the Life Cycle Strategy through Brazil's Environmental Policy

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Abstract

Brazil's National Environmental Policy (NEP) has been in force through Law No. 6938 since 1981, which some instruments are the definition of standards, licensing, environmental impact assessment, special areas for preservation, incentives for cleaner production, and environmental zoning. On a short-term basis, the most efficient way to include life cycle strategy in the NEP is through financial incentives; however, the future direction will be as part of licensing and zoning. Some legal regulations already implemented in Brazil that encompasses Integrated Product Policy concepts deal to cell battery, tires and agrotoxic packaging.

Keywords:

Integrated Product Policy, Life cycle strategy, Brazil's Environmental Policy

1 INTRODUCTION

In the past, a society's standard of living was determined based solely on the services and products available [1]. This concept, however, was expanded a few decades ago to encompass concepts of environmental quality and a just relationship with humanity.

Today one finds that an uncountable number of existing products and services are, directly or indirectly, responsible for most of the planet's pollution and the depletion of its natural resources. Therefore, a new growth paradigm is needed, based on products that use fewer resources, creating less impact on and risk for the environment. For this goal to be achieved effectively, this strategy should be included in the product or service conception phase [2].

This approach is based on the complete life cycle of products and services, whose stages range from the extraction of raw materials to the production, distribution, use and post-use product management and their activities. Life Cycle Engineering (LCE) emerged in order to devise life cycles with the lowest possible environmental impacts and risks to human health, which are economically viable and socially just. LCE can be defined as an area of Engineering that seeks a greater sustainability of the overall economy of the life cycle of products or services through Engineering techniques, tools and concepts. These techniques, tools and concepts include Ecodesign, Life Cycle Assessment, Clean Production techniques, reverse logistics, disassembly, recycling, remanufacturing, reuse, and geographical information systems, among others.

In Brazil, in terms of environmental actions and policies relating to economic activities, these have so far targeted above all major spot sources of pollution, such as industrial emissions, focusing on the treatment of residues and initiating some actions aimed at process improvements.

However, because the total number of products and services, as well as their diversity, continually increases; because products are increasingly complex; because of the greater diversity of intervening factors along the life cycle; because products are commercialized on a global level; and because many countries, such as the European Union, have already established product-related guidelines [3], it is necessary to incorporate the life cycle dimension into Brazil's environmental policies.

This action will, in an institutionalized manner, incorporate the life cycle concept into industrial practices, environmental agencies, the consumer and every interested party, so that no Brazilian product or service is excluded from international trade for reasons of environmental nonconformity, so that the environmental impacts along the life cycle are dealt with in an integrated way and not simply passed on to some other part, and so that the social condition improves through new jobs. This also means that attempts will be made to rectify the main environmental impacts of the stages of the life cycle wherever there is the greatest probability of reduction, in an economically efficient and socially healthy way. To this end, special care and support must be made available for micro, small and medium-sized companies.

Thus, LCE can be established institutionally through the implementation of policies with an integrated approach that encompass the entire product life cycle, aiming to promote the development of a market of more ecologically correct products and greater consumer awareness. This applies to the Integrated Product Policy (IPP).

The IPP approach aims to complement the existing environmental policies using the environmental improvement potential of the product's entire life cycle, promoting mainly the ecological project, information and incentives for the acquisition and use of more sustainable products by the consumer, and applying the "polluter-payer" principle to product prices. The central element of IPP is to achieve the creation of more ecologically friendly products and to render the user's consumption of these products more efficacious. The intention is not to use an individual instrument, but a mixture of instruments focusing on the product's total life cycle so as to ensure the maximum effect. Therefore, the IPP approach encompasses the life cycle concept, the relation with the market, the participation of the interested parties, continual improvement, and economic and regulatory instruments. Its main objective is to reduce the impacts caused by products throughout their life cycle, using, whenever possible, a market-driven strategy, in order to achieve competitive gains [2].

From the business standpoint, IPP offers the opportunity of promoting a business-oriented approach for more ecologically friendly markets, based on innovation and on economic growth. Companies that incorporate the life cycle concept will have the possibility not only of being leaders in a process of market transformation, but also of converting their experience into business opportunities. Business development goes hand-in-hand with environmental excellence, for it considers the future needs of society, the availability of natural resources and the public perceptions [4]. Between December 1993 and August 2000, the value of the shares of the companies listed in the *Dow Jones Sustainability Group Index* increased by 240.6%, compared with a 174.1% increase in the *Dow Jones Global Index* [2].

Based on these approaches, the purpose of this study is to indicate future directions for the integration of the life cycle strategy and, hence, of LCR in Brazil's environmental policy.

2 BRAZIL'S ENVIRONMENTAL POLICY

Brazil's Environmental Policy is organized institutionally and legally based on international and national influences.

Within the international ambit, Brazil's participation stood out since the first General Meeting of the United Nations in Stockholm in 1972. Brazil hosted the second world conference on the environment, RIO 92, in July 1992, through an initiative of the United Nations, aiming at the integration of the national environmental policies in a worldwide forum. This conference resulted in the Biodiversity and Climate Conventions, of which Brazil is a signatory [5].

In the national sphere, although the environmental policy is not expressed in the Federal Constitution (promulgated in 1988), it should be formulated along the main lines defined in the chapter on the environment under Article 225 [6].

Brazil's Federal Constitution takes a holistic and modern approach to the issues involved in environmental preservation and sustainable economic

development, assigning responsibility for environmental protection and pollution control to the Union, the states, the federal district and the other districts (Article 23). Within the system of concurring competency, it is the responsibility of the Union to publish general norms, of the states to publish supplementary norms, and of the municipalities to legislate on issues of local interest, as well as to supplement the federal and state laws (Articles 25 and 30) [6].

Thus, still in the sphere of the Union, considered the greatest Brazilian "civil code" in the environmental area, there is the Federal Law no. 6938, of January 31, 1981, which establishes the National Environmental Policy (NEP), its purposes and mechanisms of formulation and application. This law establishes the National Environmental System (NES) and institutes the Environmental Defense Register [7].

The purpose of the NEP is to preserve, improve and recover environmental quality in favor of life, aiming to ensure the conditions for socioeconomic development in the country, the interests of national security and the protection of the dignity of human life. Its principles include the rationalization of the use of soil, subsoil, water and air; the control and zoning of potentially or effectively polluting activities; to stimulate the study and research of technologies directed at the rational use and protection of natural resources, and at environmental education at all educational levels, including community education, aiming to capacitate society to participate actively in the defense of the environment. The NEP describes its instruments under article 9, as follows [7]:

- I – the establishment of standards of environmental quality;
- II – environmental zoning;
- III – environmental impact assessment;
- IV – licensing and revision of effectively or potentially polluting activities;
- V – incentives for the production and installation of equipment and creation or absorption of technology destined for the improvement of environmental quality;
- VI – creation of territorial spaces especially protected by the Federal, State and Municipal authorities, such as areas of environmental protection, of relevant ecological interest, and reserves for extractivism;
- VII – national environmental information system;
- VIII – Federal Technical Register of Activities and instruments of environmental defense;
- IX – disciplinary or compensatory penalties for the non-compliance to measures required for the preservation or correction of environmental degradation;
- X – institution of the Environmental Quality Report, to be published annually by IBAMA – Brazilian Institute of the Environment and Natural Renewable Resources;
- XI – guarantee of the publication of information relating to the Environment, which the Public Authority is obliged to produce when it is inexistent;
- XII – Federal Technical Register of potentially polluting activities and/or activities that use environmental resources.

The above listed instruments are the means to achieve the objectives of the NEP. Among the instruments established by the NEP, the ones that are actually enforced are the establishment of environmental quality standards, licensing, environmental impact assessments for business enterprises, and the creation of specially protected territorial spaces.

Currently, the environmental zoning process is beginning to be implemented and, pursuant to the promulgation of the Environmental Crimes law in 1998, the disciplinary or compensatory penalties for the non-compliance to measures required for the preservation or correction of environmental degradation.

The establishment of environmental quality standards, instrument 1 of the NEP, aims to establish the maximum limits a natural resource can withstand, according to its main use. This may be equated with the environment's withstanding capacity to carry out given functions, which range from its total preservation for ecological or research purposes to human supply.

This system includes the quality standards of the water bodies, which are established based on physical, chemical and biological parameters according to the pertinent legislation, based on the prevailing use of the water resource. For water resources, in addition to the river water quality standard, there is an effluent discharge standard, also established through pertinent legislation [8].

Environmental zoning is fundamental for EIA because it spatially determines the most environmentally fragile areas, considering physical, biological, socioeconomic and cultural factors and the areas with the highest potential for anthropic activities, as well as the spatial definition of specially protected areas. Therefore, environmental zoning should precede the EIA so that, when the location alternatives required for the EIA/EIR (Environmental Impact Assessment/Environmental Impact Report) are analyzed, the macroregions environmentally feasible for the establishment of the enterprise are already defined, after which the EIA/EIR is responsible for presenting the details of the alternative locations.

The environmental licensing of effectively or potentially polluting activities is divided into three phases: the initial license, the installation license, and the operating license. To obtain the initial license, which corresponds to the project phase, requires the presentation of an Environmental Impact Assessment and an Environmental Impact Report (EIA/EIR). The EIA/EIR is the only regulation of instrument 3 of the NEP – the EIA, considered only for business enterprises, and should include all the technological and location alternatives of the project, and be subject to the possibility of its nonexecution [9]. For purposes of this Resolution, environmental impact is considered any alteration of the physical, chemical and biological properties of the environment, caused by any form of material or energy resulting from human activities, which directly or indirectly affects:

- a) the population's health, safety and well-being;
- b) social and economic activities;
- c) the biota;
- d) the environment's esthetic and sanitary conditions; and
- e) the quality of the natural resources.

The efficacy of the instruments, therefore, depends on their integration. Generally, Environmental Licensing requires the Federal Technical Registration of

potentially polluting activities, the disciplinary or compensatory penalties for the non-compliance to the necessary measures of the Federal Technical Registration of Activities and Instruments of environmental defense and the Environmental Impact Assessment (EIA). One of the fundamental conditions for carrying out the EIA is Environmental Zoning, and this, in turn, requires the establishment of standards of environmental quality for the specially protected areas by the national environmental information system, obtained from the Environmental Quality Report, which, if inexistent, is guaranteed by the information on the Environment provided to the Public Authority.

Hence, the basis for any environmental management system to put the NEP objectives into practice based on its instruments is pursuant to the quantity and quality of the information. This information consists both of the physical, biological, socioeconomic and cultural components of the environment – which the public authority should provide, and of the effectively or potentially polluting activities. For this body of information to flow, communication channels must be created between the activities and the environmental agencies.

3 GUIDELINES TO INTEGRATE THE LIFE CYCLE STRATEGY INTO THE NEP

The life cycle strategy can be integrated into the Brazilian Environmental Policy through the NEP, based on a more holistic and product or service-oriented approach rather than solely on a one-time activity. One of the ways is through the integration of some instruments of the IPP into those of the NEP. What is intended is a reformulation in the way the NEP's instruments are applied relating to economic activities, with a view not to a specific enterprise, but to the entire life cycle of the product or service.

Among the instruments of the NEP which can incorporate the life cycle approach are the establishment of environmental quality standards; environmental zoning; environmental impact assessment; licensing and the review of activities that are actually or potentially polluting; incentives for the production and installation of equipment and the creation or absorption of technologies aimed at improving environmental quality; the disciplinary or compensatory penalties for the non-compliance to the measures required for the preservation or correction of environmental degradation; and the federal technical registration of potentially polluting activities and/or of activities that use environmental resources.

The standards of environmental quality, albeit not flexible, may encompass the IPP approach by establishing quotas for recycling and for recycled materials to be used in certain products; by determining toxic materials to be banned; sustainable consumption standards; norms for the management of product post-use, ranging from collection and recycling to final disposal; norms for the use of products and specific environmental standards for given products to be achieved periodically by the life cycle activities of given products in order to achieve ongoing improvements. It is here that the tools of LCE come into play, such as reverse logistics, post-use product management, recycling, reuse, clean production and ecodesign.

Based on the product's life cycle, environmental zoning can evaluate the location of the life cycle activities and establish the areas with the highest environmental potential to absorb the impacts produced without causing harm to humans and the environment. In addition to the socioenvironmental aspect, it is

possible to identify areas that offer environmental viability and integrate the life cycle activities in logistically and economically attractive ways. Geoprocessing tools and geographic information systems are therefore an integral part of LCE.

Instrument 3 of the NEP, the assessment of environmental impacts, can present the life cycle strategy in two distinct ways: a) in its regulations (for businesses) that are already established in the EIA/EIR, or b) based on some other regulation focused on the product or service. Using the first way, the EIA/EIRs should be based not only on the productive processes of the enterprise to be evaluated but also on the entire life cycle of the product or service. Similarly, following the guidelines of the existing Resolution, in addition to evaluating the life cycle activities, their locations would also be analyzed. The other form of incorporating the life cycle strategy into the instrument of environmental impact assessment would be through a new regulation based on the life cycle, which would be destined for certain products that cause considerable environmental impact over their overall life cycle. For both these forms of integrating the life cycle approach into this NEP instrument, the essential tool is the Life Cycle Assessment (LCA), with clean production, ecodesign, geoprocessing, geographical information systems, product post-use management and their practices also making up the mechanisms of LCE for this instrument.

Environmental licensing for a product-oriented policy should focus on the product to be placed on the market, rather than on the specific business enterprise. The license should be granted based on environmental impact assessments of the product's life cycle, according to one of the aforementioned ways. To this end, initial licenses to be granted based on the assessment of the entire life cycle of the product or service and the LCE for this purpose would be the same as those for the environmental impact assessment instrument.

The focus of the instrument of incentives for the production and installation of equipment and the creation or absorption of technologies aimed at improving environmental quality can be expanded to encompass the entire product or service life cycle. This is the instrument most closely resembling the IPP approach, for it is oriented toward the market, the product project, and the polluter-payer principle, and can inform the consumer about products whose life cycle has been improved and that have been granted incentives. In addition, it can be executed in a short period of time without major structural management changes.

These incentives should be destined for initiatives based on environmental improvements of the product or service life cycle, and can be applied through tax reductions and lower interest rates on financial loans, as well as through aids, subsidies or support for technological transformations that lead to products and services whose overall life cycles are more environmentally friendly. These incentives should be prioritized for micro, small and medium sized companies due to their economic and social

importance and because of the environmental impacts resulting from their activities.

Another form of encouraging companies to implement environmental adaptations to the life cycle is the incorporation of negative environmental impacts into the prices of products that harm or damage the environment during their life cycle. The establishment of prices that reflect the environmental impact a product produces during its life cycle is an incentive for ongoing product improvements from the environmental standpoint along their life cycle. Moreover, such prices provide the user with important information, leading them to purchase less environmentally harmful products.

Also by means of this instrument, there could be an incentive in public contracts for products and services whose life cycle is more environmentally friendly, and the imposition of obligations relating to the conception of such products or services to render environmentally friendly product conception and production more profitable.

In addition to incentives for companies, support should be available for research institutions for the investigation and development of new solutions for human demands, reducing the use of natural resources and environmental impacts.

The disciplinary or compensatory penalties mentioned in the NEP instrument may or may not be related with non-compliance to the established measures relating to the conformity of the life cycle of certain products. The responsibility should be allocated similarly to that of the principle of polluter payer, according to the final product company responsible.

Last but not least, there is the federal technical registration of activities that are potentially polluting and/or that use environmental resources, which should report based on the life cycle assessment of their products or services. In addition to serving as a database about the life cycle for assessments, underpinning the conception of products or audits, this registration provides a way to obtain information about products and services that can be made available to the general public and particularly to the consumer, to environmental bodies, NGOs and research institutes.

These, therefore, are some ways of integrating the IPP approach into the NEP instruments, thereby effectively institutionalizing the practice of LCE in Brazil. Careful considerations must be made for these measures to be incorporated so as to increase the competitiveness and global efficiency of companies, with special attention focusing on micro, small and medium sized Brazilian companies.

4 LEGAL INSTRUMENTS BASED ON THE LIFE CYCLE CONCEPT IN FORCE IN BRAZIL

In Brazil, an example of a legislative instrument that encompasses IPP concepts is CONAMA's (National Council for the Environment) Resolution No. 257, of June 30, 1999, which deals with the negative impacts on the environment caused by the inappropriate disposal of used electrochemical batteries.¹

This resolution establishes the producer's post-consumption responsibility, as described under article 1: "Batteries whose compositions contain lead, cadmium, mercury and compounds thereof required for the working of any type of device, vehicle or system, mobile or fixed, as well as electroelectronic products containing such materials in the structure in nonreplaceable form, after they are worn out, should be delivered by the user to the establishments that commercialize them or to the technical

assistance network authorized by their respective manufacturers, to be passed on to the manufacturers or importers, who, in turn, shall adopt, directly or through third parties, the environmentally appropriate procedures for their reuse, recycling, treatment or final disposal." However, this resolution is little restrictive and allows batteries to be discarded in landfills.

Article 6 of this resolution determines that: "As of January 1, 2001, the fabrication, importation and commercialization of batteries shall conform to the following limits:

I – they should contain up to 0.010% in weight of mercury, in the case of alkaline-manganese and zinc-manganese type batteries;

II – up to 0.015% in weight of cadmium, in the case of alkaline-manganese and zinc-manganese type batteries;

III – up to 0.200% in weight of lead, in the case of alkaline-manganese and zinc-manganese type batteries."

Moreover, according to this resolution, it is forbidden to dispose of these residues "in natura" in open dumps; in water bodies, on beaches, swamps, empty lots, wells, underground caves, rainwater drainage systems, sewers, underground electricity or telephone pipes, or burn them in the open or in inappropriate containers (article 8).

However, article 13 permits the disposal of batteries that conform to the limits established under article 6 in domestic garbage destined for licensed landfills, failing to consider that 60% of the country's municipalities do not have sanitary landfills and that 96% of the waste produced daily is carelessly discharged into the environment.

Another CONAMA resolution that establishes the manufacturer's post-consumption responsibility is No. 258, of August 26, 1999, which establishes the obligation of tire manufacturers or importers to collect used tires, as described under article 1 of this resolution, which states: "The manufacturers and importers of pneumatic tires shall collect the nonserviceable tires existing in the national territory and be responsible for their final, environmentally appropriate disposal, according to what is defined in this Resolution regarding the quantities manufactured and/or imported".

Although the Brazilian environmental laws are some of the strictest and most updated in the world, no device has yet been enacted for the proper control of the disposal of solid wastes. For this reason, a national solid wastes policy (bill no. 203 of 1991, drawn up by the Federal Senate) is being formulated to render executable a responsible program of reuse, recycling and disposal of products at the end of their life cycle. The wastes originating from electroelectronic products, for instance, are part of this reality and are mentioned in detail under subsection IX of this bill.

Still with regard to the wastes from electroelectronic devices (Waste from Electric and Electronic Equipment – WEEE), in Europe, directive 2002/96/EC (published in 2003 and to be enacted in 2004 as a national law in most of the member states) establishes rules for

manufacturers and importers governing the appropriate management of these wastes. These rules also apply to Brazilian industries that export to Europe.

In Brazil, this type of waste (known as technological garbage) is included in the abovementioned bill and in bill no. 4344/98, which rules on technological waste. Nevertheless, there is only a brief statement about how these wastes should be dealt with in the future, without specifying anything in detail or offering suggestions about how to proceed. It is hoped that, during the process of transformation of this bill into a law, detailed procedures will be specified for the management of these wastes, as in the case of the European Community's directive 2002/96/EC.

As for the consumer's responsibility, there are also specific rules in the national and state laws about the consumer's obligation to use certain harmful products appropriately. An example of this is the responsibility of the rural producer regarding the use of agrotoxic products, whose packaging must be collected, washed three consecutive times and returned to the establishment from which it was purchased. The latter is responsible for returning the packaging to the manufacturer, who must subject it to appropriate treatment. There are project specifications for this type of packaging with regard to the safe transport of agrotoxic products and its labeling with information about the product.

5 CONCLUSIONS AND FINAL REMARKS

Brazil today shows a shift in the focus of environment-related business actions from the end of the line to process management. Nevertheless, improvements in the process can be made in terms of the product life cycle, which would give rise to an integrated approach for the environmental interferences that take place during this life cycle. This would lead to the greater efficacy of environmental improvements, increasing the product-related economic activities and the number of jobs, and aligning Brazil with global market requirements.

A path toward the institutional incorporation of the life cycle strategy in the daily routine of companies, consumers, environmental agencies and all interested parties in Brazil is through the Brazilian Environmental Policy, more specifically, through the application of some of the instruments of the National Environmental Policy.

Among the instruments whose application is feasible from the life cycle standpoint in Brazil, the incentives appear to be the instrument that can be most rapidly implemented, since they do not require extensive structural or organizational changes on the part of either the State or companies. Moreover, this instrument is closer to the IPP approach, since it is facultative, strongly market-oriented, and can stimulate ongoing improvements and the participation of the interested parties. Furthermore, this instrument has to be regulated and the most modern approach for this would be through the product or service life cycle approach.

To establish the mode of the incentive and other important decisions, there must be an intensive involvement of all the actors through open dialogue in order to apply the complete life cycle philosophy at every potential level of action. These actors include nongovernmental organizations, industry, academia, research organs, government, and environmental agencies, so that this cooperation is used as a systemic base for the drawing up of norms. Participation should be effective and encouraged

to occur from the definition of the mode of the incentive to the form of monitoring and ongoing improvement of the instrument.

The guarantee of reliable, accessible and transparent information about the characteristics of products must be offered to the consumer to enable him to choose the highest quality product with the longest service life and – with the environmental impacts reflected in the price – at a low cost.

In principle, all products and services should be included in this approach, whose main objective is to achieve a global improvement of the environmental impacts of the products. However, the Brazilian law establishes stricter rules for products that are effectively or potentially more harmful to the environment, as verified throughout their entire life cycle.

The legal instruments based on the life cycle concept in force in Brazil should have better monitoring by the State and periodical reporting to the population.

Therefore, for the life cycle strategy to be put into practice in Brazil's everyday life, many structural actions need to be taken, from the creation of databanks to forms of monitoring, and from meetings with interested parties to the adaptation of companies to the new order, among others. Be that as it may, it is evident that, through instrument V of the NEP, incentives for environmental improvements based on the life cycle and the IPP approach, as well as the application of LCE, can be carried out institutionally and in the short term through their integration into Brazil's Environmental Policy.

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