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THE EFFECTIVENESS OF ENVIRONMENTAL LAW GIVEN THE TECHNOLOGICAL INNOVATIONS OF THE XXIST CENTURY

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ABSTRACT

Analysis of the effectiveness of environmental law given the technological innovations of the XXIst century cannot be reduced to a mere study of the effects of the results of environmental norms, in other words the result of the regulation of human relationships that involve the use and appropriation of natural resources. We need to study the legal mechanisms that make it possible to reconcile the interests involved - the development of technological innovation and environmental protection – because if, on the one hand, the progress of science, technology and innovation promotes prosperity, creating conditions for an improvement in the quality of life of human beings in society, on the other this same progress also implies risks and some of its applications may bring about consequences that are irreversible as far as life on the planet is concerned. The aim of this article is to present the theoretical bases for the study of the effectiveness of the law, and in particular of environmental law, when constructing responses to the imperative of reinforced safety when faced with technological innovation, highlighting, therefore, the role of the precaution principle when it comes to constructing conflict adjustment models.

Key words: environmental law; risks; technological innovation.

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"We urgently need to understand the world before thinking about transforming it"
(Jean-Pierre DUPUY)

INTRODUCTION

Analysis of the effectiveness of environmental law, given the technological innovations of the XXIst century, cannot be reduced to a mere study of the effects of the results of environmental norms, in other words the result of the regulation of human relationships that involve the use and appropriation of natural resources. If we were to consider only the "results" of these norms we would be limiting this reflection to a merely economic perspective, a purely instrumental conception of the law, thereby confusing the rule of law with a catalogue of conduct. This is not a matter, therefore, of only reflecting in terms of the binary logic of "all or nothing", of allowing or prohibiting, but of analyzing the legal mechanisms that make it possible to reconcile the interests that are in play – the development of technological innovation and environmental protection. If, on the one hand, the progress of science, technology and innovation promotes prosperity and creates conditions for improving the quality of life of human beings in society, on the other this same progress also implies risks and some of its application may bring about consequences that are irreversible for life on this planet.[1]

What is the role of law, and in particular of environmental law, when it comes to constructing responses to this safety imperative in the face of technological innovations? As a first step we need to define technological innovation and global ecological risks, by studying the relationships between environmental protection and technological innovation. As a second step we shall analyze the principles that guide the actions of individuals, organizations and the State itself, notably the precaution principle, the corner stone of environmental law when it comes to risk management. In fact, if normative public action does not eliminate the socio-environmental conflicts that arise in the face of technological innovation, this action functions, however, as a moderating influence when it proposes adjustment models for regulating these conflicts.

[1] As an example, it is possible to mention the radioactivity discovered by Henri Becquerel (1896), Pierre and Marie Curie (1898), whose use can be beneficial (therapeutic applications indicated for the cure of cancer), but can also be dangerous, causing death (explosion of an atomic weapon – Hiroshima and Nagasaki, 1945 and accident with a nuclear power station – Chernobyl, 1986). Its use places all humanity face to face with its responsibility for perpetuating life.

In short the plurality of normative spaces demands that any study of the effectiveness of environmental law takes into consideration the mutation of the concept of legal order, emphasizing what is relative and universal in the construction of sustainable development by analyzing the superimposition of national, regional and world norms that deal with the environment.

1. TECHNOLOGICAL INNOVATION AND GLOBAL ECOLOGICAL RISKS

The Declaration of the United Nations on the Human Environment, Stockholm (1972) was already affirming in Principle 18:

> *Principle 18 – Science and technology, as part of their contribution to economic and social development, must be applied in order to avoid, identify and control the risks that threaten the environment and to solve environmental problems for the benefit of the common good of humanity.*

In fact, both the Declaration of Stockholm (1972) and the Declaration of the United Nations on Environment and Development, Rio (1992) elected as their principles, cooperation and the free interchange of scientific and technical information, thereby increasing the development, adaptation, spreading and transfer of technology, including new and innovative technologies, for achieving sustainable development.[2] This commitment to sustainable development was taken up again in the Declaration of Johannesburg (2002), which reaffirms the need to ensure access to capacity-building and the use of modern technology that results in development.

1.1. TECHNOLOGICAL INNOVATION

Innovation may be defined as the “development of new ways of producing, applying and distributing knowledge” (MACIEL, 2005, p. 34). But innovation is not only technological, it also includes the social, political and economic innovation that arises from a series of articulated factors – factors that are social, cultural and of the very way society is organized. In fact, it is possible to distinguish two prisms in the process of technological

[2] Principle 20 of the Declaration of Stockholm (1972); Principle 9 of the Declaration of Rio (1992).

innovation: one which reflects a conservative perspective of innovation and one which represents a social renewal factor (ANDRADE, 2004, p. 94). In the first case substitution of a certain process or technological device, an increase in technologies within already existing technological standards (*lock-in*), or the search for solutions when the innovation chain has exhausted itself, may occur, imposing technological processes considered as '*end of the pipe'*, of the curative type – pollution treatment, *a posteriori*. In the second case there is a search for alternative innovation strategies starting with the original paths (*breakthroughs*).

If, on the one hand, the technological innovations of the XXIst century may be responsible for important progress in the solution of environmental problems, such as for example, control of industrial processes and the greater efficiency of the observation systems generated by information technology, the treatment of waste or the restoration of environments degraded by biotechnology, the production of energy and the treatment of air, water and soil pollution using new technology and finally the development of the manipulation of genetic resources (SILVA, 2005), on the other we cannot deny that these new technologies also give rise to new risks (future risks and those that are intrinsically linked), such as:

> "Genetic risks and those linked to biotechnology, the combined effects of chemical or toxic carcinogenic contaminants, new illnesses or new viruses, the domain of complex technological procedures, risks linked to new information technologies (non-ionizing radiation and the creation of virtual worlds), the increase in scientific uncertainty and misinformation, the aggravation of conflicts relating to resources (water, fishing, energy, ...) and finally the increased frequency of meteorological events linked to global warming " (THEYS, 1999, p.17).

However, without research and technological innovation, how can we determine the alternatives for responding to the needs of the present without compromising the satisfaction of the needs of future generations? The technological development process is, therefore, coupled with the needs of contemporary society for social, economic and political transformation. Public policies of science, technology and innovation must identify the local specific aspects, potentialities and needs, seeking to achieve sustainable

development by means of the generation of knowledge. This process of technological development depends, however, on a:

> "(...) continuous, uninterrupted and permanent action to finance research into and knowledge of the unknown factors and distinguish real risks from imaginary ones, exposing myths or proving the realities, urgencies and priorities in all fields of the different Amazon sub-regions" (BECHIMOL, 2001, p. 164)

It is not possible, therefore, to talk about technological innovation without dealing with the question of risks.

1.2. GLOBAL ECOLOGICAL RISKS

As Mireille Delmas-Marty states, risks bring us out of the virtual space into the real space, but also distances us, albeit only apparently, from the legal field, because the element that characterizes risks is uncertainty (2004, p. 353). Risk represents a possible, more or less foreseeable danger, in other words, the probability of a threat or exposure to the safety or the very existence of a person, or even of a thing, becoming a reality (SILVA, 2004, p. 83). Zero risk does not exist and the issue that contemporary societies face is not the suppression of all risk, since they are part of our very existence. The real issue that is posed is that of adopting a procedure for evaluating these risks and the choice of risks that we wish to run, in other words, of the need for such an activity for the full development of these societies.

It is a matter of distinguishing between admissible and inadmissible risks, a complex, but necessary qualification (NOINVILLE, 2003, p. 3-4). If the notion of levels used by the exact sciences refers to quantitative data, establishing, for example, levels for the concentration of certain pollutants in the environment, for the law this notion of levels has a double function: to determine a limit and also to establish a transgression relationship to a norm (MORAND-DEVILLER, 2004). That is why, when faced with non-quantifiable risks, it is essential that they are qualified as admissible risks that may be accepted by society and are necessary for its development, or as inadmissible risks, in

other words, those that are intolerable, because they bring with them the possibility of a threat to the safety or the very existence of humanity. This requires not only a technical exercise, but also a political and social one when it comes to determining risks that are admissible under our control.

Global risks are the result of the interaction of technological risks with the natural risks that are situated on a planetary scale and that have long term effects (DELMAS-MARTY, 2004, p. 356). In this category are to be found ecological risks, like the risks related to climate change, bio-technological risks, or even those related to nano-technologies.[3] The aim of the distancing of these risks constitutes the objective of the protection of the environment and environmental management to the extent in which what is wanted is to ensure the right to the environment for everyone (SILVA, 2004, p. 83). As we are dealing with global risks, the responses for introducing a supplementary safety logic in the face of the uncertainty can only be achieved via global mechanism, such as those provided for in the United Nations Framework Convention on Climate Change (1992) or in the Convention on Biological Diversity (1992) and in their respective protocols, the Kyoto Protocol (1998)[4] and the Cartagena Protocol on Bio-safety (2000).[5] These legal mechanisms – conservation *in situ* and clean development mechanisms, for example – include local, regional and global protection logic.

1.3. RELATIONSHIP BETWEEN TECHNOLOGICAL INNOVATION AND ENVIRONMENTAL PROTECTION

[3] Nano-technology refers to “the technological application of objects and devices that have at least one of their physical dimensions smaller than, or in the order of, a few dozen nanometers. Nano (from the Greek for “dwarf”) is a prefix used in science to indicate one part in a billion and therefore a nanometer (1nm) corresponds to one billionth of a meter” (MELO & PIMENTA, 2004, p. 9). “Along with the enormous possibilities for scientific development offered by the nano-sciences and nano-technologies, nano-particles may in fact spread in an uncontrolled manner through the environment, the same molecules that would allow us to overcome the cerebral barrier carrying essential medication may become the a vector of unknown pathogens, new arms may be based on the special properties of nano-systems, etc. The list is extensive, but as in any new branch of knowledge, it is not because of the prohibition or decreeing of research moratoria, but by the better information to the lay public and through the appropriate social control of scientific activities that the enormous potential of nano-technologies may be better exploited for the good of humanity”. (*Idem,* p. 19)

[4] The Protocol of Kyoto came into force on February 16, 2005, even without the participation of the United States.

[5] The Protocol of Cartagena on Bio-safety came into force on September 11, 2003.

The relationships between technological innovation and environmental protection may be complementary or antagonistic. In the first case this relationship may be analyzed from the minimalist or maximalist perspectives.[6] The minimalist view consists in glimpsing a possibility for research and technological innovation that has a direct relationship with the environment. Environmental concerns would drive the adoption of clean and innovative mechanisms. In this sense we might talk about clean technologies as those that, at the same time, seek to achieve three objectives: a minimum consumption of raw materials and energy, a reduction in the generation of waste and effluents and a reduction in risks. Clean technologies considered as "traditional" are sectorial, such as waste reduction, a reduction in the use of toxic products and a reduction in pollutants at source. Clean technologies that may be classified as "modern or contemporary" are based on an integrated view of the environmental problem and seek to reduce environmental impact, starting with the life cycle of products or an ecological conception of procedures. As Chapter 34 of Agenda 21 teaches:

> "34.3. Environmentally healthy technologies are not merely isolated technologies, but whole systems that include technological and scientific knowledge, procedures, goods, services and equipment, as well as organization and handling procedures. This means that when we analyze technology transfer, we must also deal with the aspects of the choice of technology relative to the development of human resources and to an increase in local institutional and technical strengthening, including those aspects that are relevant to both genders. Environmentally healthy technologies must be compatible with the nationally determined socio-economic, cultural and environmental priorities".

[6] This idea of a minimalist vision of the relationship of research freedom and environmental protection is developed by Laurent FONBAUSTIER (2005) when he analyses Art. 9 of the French Environmental Charter (" *Charte de l´environnement*") that provides " Art. 9. Research and innovation must contribute to the preservation and valuing of the environment" ("*Art. 9. La recherche et l´innovation doivent apporter leur contribution à la préservation et à la mise en valeur de l´environnement*"). With its Environmental Charter France recognized the fundamental rights and duties relative to environmental protection (text adopted on February 28, 2005 by the Parliament (senators and congressmen meeting together in Congress) and enacted on March 1, 2005 by President of the Republic, Jacques Chirac).

Therefore, the National Environment Policy elected, among its instruments, production incentives, the installation of equipment and the creation or absorption of technology that focus on improvements in environmental quality (Art. 9, V of Law, 6.938/81). However, the integration between technological innovation and environmental protection is not merely a matter of allocating incentives, but requires a reflection on the very use and development of research and innovations and their respective consequences for society.

From the maximalist point of view the relationship between technological innovation and environmental protection preaches including the environmental variable in all innovative procedures and processes, thus seeking to reinforce environmental safety and protection, in other words, a reduction in the uncertainty that is at the very heart of innovation. In other words, one seeks to implement the logic of precaution when it comes to science, technology and innovation.

If the relationships between environmental protection and technological innovation may be complementary, they can also be antagonistic. In this second case there are conflicts: on one side are the defenders of the development of technological innovation, without the minimum concern for the environmental impact that arises from their research, and on the other are those that plead for indeterminate moratoria. How can such conflicts be adjusted, minimized or prevented? All the actors involved – scientists, politicians, in fact everybody that has some power over decisions, including civil society – need to understand the meaning of the philosophy and principle of precaution (EWALD, 2001) and how this principle becomes a reality.

2. MODEL OF CONFLICT ADJUSTMENT: THE ROLE OF THE PRECAUTION PRINCIPLE

The precaution principle expresses the state's will when it comes to handling policies relating to natural resources and risks and allows for the implementation of a socio-environmental conflict adjustment model in the face of technological innovation. This principle, adopted by the United Nations Conference on the environment and development in 1992, shows how dynamic international law is, by including the need for adopting a new

posture when faced with scientific risks and uncertainties. Therefore, the Declaration of Rio (1992) established that:

> *"In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. When there are threats of serious or irreversible damage ,lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation." (Principle 15).* [7]

2.1. PRECAUTION PRINCIPLE AND PUBLIC POLICIES

Public policies should no longer be conceived in the sense of intervention in human activities, as is the case with the development of technological innovation, "but as a general directive, both for the action of individuals and organizations, as well as for the State itself" (BUCCI, 2002, p. 247). If the law does not determine conduct, as Pierre Lascoumes states, it has a propositional function and guides actions (LASCOUMES, 1998, p. 157). In this sense, there is a need to guide public policies, particularly those that focus on the development of science, technology and innovation, so that they include the precaution principle.

In this way the Department of Science and Technology of the State of Amazonas prioritizes the development of new technology that is integrated with the region. So this Department, in partnership with the Department of Sustainable Development, has launched the program "*Science and Sustainability in the Amazon*" whose central axes are: a) the participation of social actors in the identification of problems and the alternatives to solve them; b) sustainable development and solidarity; c) the training and capacity

[7] The first international text that recognized the precaution principle was the World Nature Charter, adopted by the general assembly of the United Nations in 1982 (Declaration § 11). Subsequently this principle was taken up again in different international conventions on protection of the environment. Among the international declarations and conventions where there is reference to the precaution principle we can mention, for example: a) the ministerial declaration adopted in the second International Conference to protect the North Sea (1987) (§ VII and XV.1), confirmed by the ministerial declaration adopted in the third International Conference in 1990, for protection of the North Sea (preamble); b) the Protocol of Montreal of 1987, referring to substances that destroy the ozone layer (preamble and § 6 modified in 1990) c) Convention-quadro??? Of the United Nations on climate change of 1992 (Article 3 (3))(preamble); d) Convention on Biological Diversity of 1992 (preamble). *Cf.* SILVA (2004, p.75).

development of researchers; d) raising the indices of human development by strengthening rural and traditional communities. [8]

2.2. PRECAUTION PRINCIPLE AND RISK MANAGEMENT

Turning the precaution principle into a reality includes the analysis and management of risks. It is possible to distinguish three elements that go to make up the structure of risk analysis: risk evaluation, risk management and risk communication (SILVA, 2004, p 86). We would highlight that recourse to precautionary measures does not only depend on political choice, since every political choice must be based on constitutional rules and the precaution principle is part of the spirit of the environmental protection system that is established by the constitutional text, when it sanctions the right of all generations, both present and future, to an ecologically balanced environment.

Among the evaluation techniques and devices available we can mention the definition of "*standards*" of precaution and attitude when faced with risks; the development of expert reports and an increase in control techniques. In defining precaution standards, through research into the activities that potentially imply risks, one seeks to adopt parameters and procedures to be used when faced with these risks. An active attitude to risk is based both on the development of applied scientific and technical research, thus extending the country's capacity for research, as well as in carrying out previous environmental impact studies. The constitutional demand that a prior environmental impact study should be carried out for any civil construction work or activity that may potentially cause significant degradation of the environment seeks, in this way, to turn the precaution principle into a concrete reality. [9] The possible existence of activities that develop technological innovations that cause environmental degradation means that such activities have to carry out a prior environmental impact study. One is not looking to create obstacles to the development of science, technology and innovation, but only to raise doubts and uncertainties as to the risks involved with these activities, the risks of damage. In like manner one questions the true need for developing such technology for improving

[8] Documents of the Department of Science and technology of the State of Amazonas. Manaus, 2003.

[9] Clause IV, paragraph 1 of Article 225 of the Federal Constitution of 1988 : "*IV – demand in the form of law, for the installation of any work or activity that is potentially the causer of significant degradation of the environment, a prior study of the environmental impact*".

the conditions of the quality of life of the Brazilian population. The environmental impact study provides, therefore, an action base for public administration as they turn the precaution principle into a reality.

The development of expert reports and increases in techniques of control, vigilance and traceability complement the list of techniques and devices for evaluating risks. The 1988 constitutional text determines that it is the responsibility of Public Authorities to control the production, sale, employment of techniques, methods and substances that are a risk to life, the quality of life and the environment. [10] In fact, as François Ewald points out:

> "Precaution knocks down the barrier between laboratories and society, experiences and experimentation. Society itself becomes an immense laboratory. We experience ourselves in the flesh. When faced with the presumed risk we are all, at one and the same time, both experimenter and experimented upon, wise men and guinea pigs" (EWALD, 2001, p. 53).

There is, therefore, a need to register collective choices as far as technological innovation is concerned, by broadening the concept of democracy and encouraging the spreading of information and knowledge.

CONCLUSIONS

What is universal in environmental law is the search for quality of life for human beings, including the prospect of a sustainable and sustained development. Its effectiveness, therefore, comprises understanding the meaning of environmental norms and their application. Reflecting upon this effectiveness in the face of technological innovation leads to the need to include the logic of precaution in this dynamic of innovation. It is precisely when the precaution principle becomes a reality that the development of technological innovation can and should reveal the transforming potential of knowledge when it comes to constructing a more fair and solidary society.

[10] Clause V, paragraph 1 of Article 225 of the Federal Constitution of 1988.

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