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TECHNOLOGICAL INNOVATION GREENING FOR INTEGRATIONAL SUSTAINABILITY

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ABSTRACT

Technological innovation can result in direct benefits and harm, it represents hope, novelty, the challenge for a few and fear, risk, insecurity, danger, and instability for others. The advances of the technique generate tensions, in that they represent a practical application of knowledge, with reflection in the present and in the future. On the one hand, this tension tends to preserve the values of sustainability, suggesting a reassessment of legal aspects of the creation of new categories and, on the other hand, to respond to the pressure of economic agents to explore the 'new'. With these assumptions, the present questioning is based on the challenges of technological innovation for intergenerational sustainability. They are themes related to values and fundamental rights of the human being, thus, of great social options, as an opportunity for discussion in the democratic process, overcoming present perceptions, involving responsibility with future generations.

Keywords: Sustainability; Technological innovation; Fundamental rights.

ECOLOGIZAÇÃO DA INOVAÇÃO TECNOLÓGICA PARA A SUSTENTABILIDADE INTERGERACIONAL

RESUMO

A inovação tecnológica pode resultar em benefícios diretos e malefícios, representa esperança, novidade, desafio para alguns poucos e medo, risco, insegurança, perigo e instabilidade para outros. Os avanços da técnica geram tensões, na medida em que representam uma aplicação prática do conhecimento, com reflexo no presente e no futuro. Essa tensão atém-se, de um lado, a preservar os valores de sustentabilidade, sugerindo uma reavaliação dos aspectos legais ou criação de novas categorias e, de outro, a atender a pressão dos agentes econômicos pela exploração do 'novo'. Com esses pressupostos, o questionamento presente assenta-se nos desafios da inovação tecnológica para a sustentabilidade intergeracional. São temas relacionados a valores e a direitos fundamentais do ser humano, logo, de grandes opções sociais, como oportunidade de discussão no processo democrático, superando as percepções presentes, envolvendo a responsabilidade com as futuras gerações.

Palavras-chave: *Sustentabilidade; Inovação tecnológica; Direitos fundamentais*.

INTRODUCTION [1]

The evolution of the technique and its scientific implementation led to the transformation of work, social life, free time and almost all aspects of culture. The natural environment has gradually been replaced by the technical means, granting the technique an indispensable role in civilization, generating the requirement of regulation and direction of its existence. Sometimes the technique is seen as an invisible element in relation to the produced result, giving rise to a clash with Bacon's theory (1999), defying the reflection and understanding of the new phenomenon, since there is a machination of science and technic[2]. In this sense, the technique must be thought and managed beyond the conception of technology as simply applied science. In line with the 'myth of scientific neutrality'[3], it is also not possible to pursue the naïve attitude of ignoring the ethical challenges of modern technology. On the contrary, it is imperative to go beyond the anthropological (unilateral) conception and to view the technique in a global vision related to epistemological, ethical, cultural, social and metaphysical aspects, with a reciprocal complement between systematic and historical analysis.

This impulse generated by the scientific revolution implies a complete reconstruction of the categories of thought, the construction of a more humane society, with the theoretical possibility of intervening directly in nature, and the pragmatic desire to control it arises:

> [...] which implies a new definition of knowledge, which is no longer contemplation, but use, a new attitude of man towards nature: he stops looking at her as a child looks at the mother, taking it as a model; wants to conquer it, to become 'owner and lord' of it. (LENOBLE, 1990, 270)

Authors like Morin (1984) and Santos (1987) believe that the twentieth century would have inaugurated a period of crisis in the modern scientific paradigm because it is a historical moment that requires radical and profound reform in scientific thought, that manages to overcome all forms of reductionism. The uncontrollable results of technologies that are present in various manifestations such as pollution, the progressive

1 See Boff (2010, p. 3274-3304).

2 In this sense they exemplify the crises of ecological systems and the practice of genetic engineering.

3 On the subject: Japiassu (1975).

exhaustion of nonrenewable natural resources, the overpopulation of the planet and the widening of power differences between social classes, as well as the distance between central and peripheral nations.

These changes emerged in the late nineteenth century, with discoveries that come to break with the mechanistic paradigm, such as Darwin's 'Theory of Evolution by Natural Selection' (2007), published in 1859, whose central concepts are 'random variation' and 'natural selection', which are the cornerstones of any modern evolutionary theory. What was conceived as predictable now opposes a more complex concept of a constantly changing system?

Following the theory of relativity - in the 20th century, are Popper and Kuhn. For Popper, scientific knowledge has to be submitted to rigorous and systematic tests whose objective is the permanent attempt to falsify them. In this way, scientific knowledge could never claim the security of an absolute truth about the phenomena of the world. Scientific knowledge will be the result of a conjecture that has stood the test up to that point, so what is attempted "in science is to describe and (as far as possible) explain reality" (POPPER, 1973, p. 40).

In the centrality of Popper's theory lies the 'demarcation problem', understood as delimiting an area of meaningful discourse for science, distinguishing scientific theories from metaphysics and/or false science. According to the philosopher, meaning always appears in solidarity with the problematic that germinates, without exception, in all areas of knowledge and action of men. The problem is reformulated in order to distinguish an empirical method from a non-empirical or even pseudo-empirical method.

Thus, Popper establishes as criteria for delimiting the scientific potential of a theory, the possibility of refutation, since irrefutability is not a virtue, but an addiction. In this line, the tests constitute an attempt to refute a theory and these may be more testable and, therefore, are more exposed to refutation. The criteria of refutability is not a criterion of meaning or signification, but rather the drawing of a dividing line between scientific discourse and other types of knowledge. The submission of a type of knowledge to constant tests guarantees that, at least tendentially, they approach truth (provisional truth) by eliminating false theories.

A different approach is the proposal of Kuhn (1996) based on the idea that the practice of the scientists does not adapt to Popper's proposal of a permanent attempt to falsify the existing theories. According to the author, the most characteristic aspect of 'normal' science would be the work of confirmation of the dominant paradigm, with scientists seeking to articulate it's structure and to extend the limits of its applicability. From this perspective, the history of science cannot be a history of progress toward objective truth. It is rather an advance, of radical and incompatible changes of vision, so that the aspiration to describe reality becomes more and more dubious.

With this approach, Kuhn (1996) is considered as innovative. His studies are aimed at showing the contrast between two conceptions of science: for one, science is understood as a completely rational and controlled activity (formalist); the other considers science as a concrete activity, built over time and which, in each historical epoch, has its own peculiarities and characteristics (historicist).

In *The Structure of Scientific Revolutions,* the presence of a crisis would give rise to the 'revolution'. The emergence of new theories is usually preceded by a period of pronounced professional insecurity as it requires the large-scale destruction of paradigms and major changes in the problems and techniques of normal science. Insecurity stems from failure "the constant failure of the puzzles of normal science to produce the expected results. The failure of existing rules is the prelude to a search for new rules. " (KUHN, 1996, p. 95). In view of the incapability of solving problems with the use of existing rules, scientists constantly question the principles of science who do their work, starting to adopt them and turn them into a new theory that proposes to resolve the crisis. The failure of a paradigm to solve certain problems is an opportune moment for new solutions to emerge. He exemplifies: "In manufacturing, as in science, the production of new instruments is an extravagance reserved for the occasions that require it. The meaning of crises lies precisely in the fact that they indicate that the time has come to renew the instruments." (KUHN, 1996, p. 105).

Kuhn presents the notion of *paradigm* as something that circumscribes what the scientist observes and problematize. He understands scientific practice and development as equivalent to that of any other social institution, that is, as a result of negotiations and agreements between groups. "If science is the gathering of facts, theories, and methods sewed together in the current texts, then scientists are men who, with or without success, have endeavored to contribute to another element for this particular constellation." (KUHN, 2006, p. 20). And he adds that the development "becomes the gradual process by which these items were added, alone or in combination, to the ever-increasing stock that constitutes knowledge and scientific technique." (KUHN, 2006, p. 20).

For Marcuse (1982), modern scientific rationality is intrinsically instrumental, that is, the alleged "neutrality" of scientific methodology is in fact at the service of a very specific objective - the domain of nature. On the other, he shows that this instrumental scientific rationality is also responsible, via technology, for political domination. The technique appears here repeatedly as the practical manifestation of instrumental reason.

> The machine is indifferent to the social uses that are given to it, provided that such uses remain within its technical possibilities [...] domination perpetuates itself and extends not only through technology, but *as* technology, and this guarantees the great legitimation of the growing political power that absorbs all spheres of culture. (MARCUSE, 1982, p. 153)

The ideas of Habermas (1983) emphasizes the link between science and dominion over nature, formulates the thesis that, behind the development of each of the areas of knowledge, there is a corresponding interest: interest in controlling the environment. Scientific development from the outset would have been guided by the interest in the technical manipulation of nature, with a view to the liberation of the coercion that it always exerted on humanity.

In the work *Technique and Science as Ideology* (HABERMAS, 1983), the philosopher presents the union between knowledge and interest as the triggering of a process of increasing rationalization, both on the individual taken alone and on society.

One can also refer to Weber's (2001) theory of rationality and its relations with the scientific-technological systems of modern societies. Rationalization (understood as the regulation of human action in pursuit of certain ends) present in the economic sphere is also a product of scientific specialization and technical domination, peculiar to Western civilization, which historically developed even before capitalism itself.

For the author, the concept of 'rationalization' was developed mainly by the Western sciences in their technical possibilities. "This intellectual rationalization [...] to science and technical-scientific" (WEBER, 2001, p. 30), is based on rational principles and the scientific method from the conception of the West. Thus, rationalization is not for the progress of human knowledge in the sense of a better knowledge of its conditions of life, but in an opposite way: it is a distancing of a man with regard to the minimum knowledge of the functioning of scientific-technological civilization. The great consequence of instrumental rationality was the loss of the individual's autonomy and the rupture of the situation. The productive apparatus and the goods are imposed on the social system as a whole. The bureaucracy portrays the process of increasing rationalization that has been subjected to modern Western society, and this process, in turn, with oppressive mechanization and routines imposed on human beings.

In the light of the above on the evolution of the technique, one can see the existence of two traditions of thought, one that emphasizes the search for a mathematical understanding of the world and the second based on the need to perform experiments and practical applicability. These traditions will give the sense of the search for knowledge through knowledge to modern science, whose purpose is associated with the power that the latter can bring about things, as well as about men themselves.

It is worth highlighting the course taken by the development of science and technology in modern societies, which go beyond the objective logic of a linear system, presenting itself as a system of mutual interactions, built and based on the social environment, which refuse the idea of science as neutral understanding of world phenomena, without the influence of social, economic, cultural, and political interests.

We must also add the possible risks to pragmatic aspects of the subject, and the lack of control of the negative consequences triggered by the increase of the technological domain over nature. Particularly noteworthy is the accelerated pace of degradation of the environment, and that not always the advance of technological innovations serves the well-being of human beings in general and a just society. In this field, the contributions of Beck and Giddens (1997), which highlight environmental and technological risks, are relevant as one of the negative aspects in the development of science. The 'risk' becomes the central aspect of society, beyond mere consideration as a side effect of progress.

With this rescue of the evolution of science and the conceptions of technology, it is clear that advances in scientific knowledge alone are insufficient to achieve the development project conceived from a broad sustainable concept in the social, economic, human, cultural and ethical fields. Recent research, in the nuclear area, in genetics, points together risks of science, calling society to discuss its guidelines and applications, as well as implement controls based on weighting, beneficence, justice, and ethics of responsibility.

1 THE ECOLOGIZATION OF SUSTAINABLE TECHNOLOGICAL INNOVATION IN THE INTERGERATIONAL PLAN

Technology innovation results from the action of its creators and operators and contemplate the totality of man, his feelings, his desires and his destiny. Jonas (1997, p. 16) distinguishes three aspects of this technology: its formal dynamics, its substantive content, and ethics. Formal dynamics represents a continuous process that progresses through its own laws. While the premodern technique developed slowly, based on the use of means for perfecting and repetitive manufacturing, for recognized purposes and appropriate means, modern technology, in each new and successful stage, leads to other steps in all possible directions: "*el mero 'motivo' se convierte en causa forzosa en cada paso maior o 'importante' e cada inovação "esta segura de difundir-se com rapidez por la comunidad tecnologica."* (JONAS, 1997, p. 18). Thus, known goals can aspire to new techniques, as well as new techniques can aim at unconcealed goals before. Therefore,

> [...] el 'progreso' no es un adorno de la moderna tecnologia ni tampoco una mera opción ofrecida por ella, que podemos ejercer si queremos, sino un impulso inserto em ella misma que, más allá de nuestra voluntad, repercute em el automatismo formal de sus modus operandi y em su oposición com la sociedad que lo disfruta [...] (JONAS, 1997, p. 20)

In the substantial content of modern technique, the author highlights the relationship of technology with man and its possible consequences, new forms of power and objectives that will interfere with the action of human conduct. It points to the Industrial Revolution as a mark of mechanics, of the manufacture of machines for various purposes, which formed the productive chain. Next, the chemical sector is developed, with the transformation of synthetic substances, which replace the natural ones (wool and cotton give rise to synthetic fibers). Afterward, the technique of information and electricity emerges, with the transmission, transformation, and distribution of electric energy. A new phase is marked by molecular biology and genetic manipulation, the object being the man himself. Biotechnology creates the possibility of "reelaborar la constitución humana", of "pensar en la 'imagem del hombre'", and this requires preparation of the various areas of knowledge (JONAS, 1997, p. 16-31).

To formal and substantial aspects, Jonas (1997, p. 33-34) associates ethics with a requirement of human responsibility, since "técnica es um ejercicio del poder humano, es decir, uma forma de actuación, y toda actuación humana está expuesta a su examen moral". For this, the author presents reasons that demonstrate the need to consider ethics in the development of the technique. The first is the 'ambivalence of effects' which can be either good or bad; "el presupuesto para ello es que la ética pueda distinguir claramente entre ambos usos, entre el uso correcto y el errôneo de una y la misma capacidad"; the second is the 'automaticity of the application' of ethics to the permanent activity of technique, and the third reason is the global dimension of space and time (to use in 'global scale'), with repercussions in present and future generations. The responsibility of man, in the face of all living things, lies "beyond anthropocentrism" and must be considered

> [...] en su recién evelada vulnerabilidad frente a las excesivas intervenciones del hombre, su cuota en la atención que merece todo lo que tiene su respeto humano, es decir: todo lo vivo. [...] Como poder planetário de primer orden, ya no puede pensar solo en si mismo. (JONAS, 1997, p. 36).

While the technique extends the power of man over nature, one must evaluate how much one can risk in the big technical bets, analyzing the effects generated: "Solo puede caminar hacia adelante, y tiene que obtener de la técnica misma, com uma dosis de moral moderadora, la medicina para su enfermedad. Éste es el eje de una ética de la técnica. " Éste es el eje de una ética de la técnica. " (JONAS, 1997, p. 38-39).

Thus, until the moment that the technique (PESSINI, 2000, p. 122) used inanimate material (physical and mechanical), it was considered harmless. From the moment that the use of living organisms is made, one inquires about the freedom (the limits) of investigation in that matter. In biological technique "[...] el hombre puede ser objetivo directo de su propia arquitectura, y ello en su constitución física heredada" (JONAS, 1997, p. 110). Moreover, the development of this technique increases man's power over nature, man's power over man, and man's submission to the power of others. In biology, complexity presents itself in unknown factors and unforeseen results, the objects being original: “Lo que hay entre el comienzo y el fin definitivo del experimento es la vida real de indivíduos y quizá de poblaciones enteras” and irreversible processes. As for biological technique, it interferes in other sectors and its results (“ambiguous”) are reflected at a global level. Included in this field are biomedical researches involving recombinant DNA research, in which the product can “conducir a realidades definitivas que se emancipen de la mano de su creador para ganar literalmente vida propia” (JONAS, 1997, p. 65-72). The process of knowledge becomes action, giving rise to a new autonomous, self-reproducing and interactive being. As Jonas puts it, pure science (theory) and applied science (practice) are fleshed out in the research process and the protection of the public goods is a *sine qua non* of the researcher (JONAS, 1997, p. 74). Thus, for the development of research in this biotechnology area, it is necessary to consider basically:

> 1. El *objetivo* de la investigación es práctico desde el principio, a saber: desarrollar una *capacidad* para la *fabricación* de algo que podría ser utili para la medicina, la agricultura y otras cosas, surgiendo el eventual benefício para la teoria como un efecto secundário del êxito práctico.
>
> 2. El *método* de la investigación, es decir el camino al conocimiento, es la producción de hecho de las entidades mismas de las quê se busca el conocimiento y cuya utilidad há de ser puesta a prueba.
>
> 3. Las *entidades* así producidas dentro del contexto investigador no son inertes y activas tan solo por nueva mediación humana, sino vivas, es decir, activas por si mismas, de forma que potencialmente pueden producir por si mismas su ingreso em la esfera práctica, en el mundo exterior, y quitarnos de las manos la decisión sobre su uso o no uso.
>
> 4. La *eventualidad*, que teoricamente no se puede exluir, de recombinaciones genéticas de células germinales *humanas* (gametos o cigotos), a las que permita después llegar a término, las ‘quimeras’resultantes em el fenótipo ya em el primer acto experimental ‘logado’representarían, aunque no pasaran de ahí, actos últimos que dejan a sus espaldas toda teoria no vinculante. (JONAS, 1997, p. 72)

In addition, the unpredictability of the technique leads to questioning what the values of society will be in the future. One of the virtues to be observed is caution in the face of *"de la incertidumbre: in dúbio pro malo"* (Jonas 1997, p. 47-49) and the other is to keep in mind the principle of responsibility based on humanity. Likewise, it is imperative to evaluate the possibility of achieving the objectives of the research with the use of other methods and materials, without making direct use of the manipulation of human material, even if the desired results are obtained more slowly.

Along these lines, it is important to bear in mind the ever closer relationship between technology, economy, and power, with emphasis on the pressure to obtain economic results in investments in technology. This predominance of the economic view causes concern in the legal world. Therefore "[...] the new knowledge is deposited in databases and used in accordance with the means and according to the decisions of those in power. There is a true cognitive dispossession, not only among citizens but also among scientists" (PESSINI, 2000, p. 128). Scientific knowledge "escapes from the hands of its initiator, and the multiple interactions proper to society come into play", sometimes arriving at a "destiny opposed to what was initially sought" (PESSINI, 2000, p. 128).

With a bias towards scientific non-neutrality, Moser (2004, p. 112-113)[4] states that "scientists are not abstract beings: they are born and live within a political, cultural and religious context. [...] The struggle for power is increasingly the struggle for distribution and access to or denial of knowledge, especially in the area of biotechnology. " Thus, in a contemporary context, the Kantian question: "What can be known?" Should contain the question: "What can be done or what can be manufactured?" (MOSER, 2004, p 129)[5]. Hence the certainty that an ethical orientation is necessary in the development of scientific research, with the objective of reconciling technical progress with the values established in society, building a science committed to the truth of knowledge and to individual and social existence.

This will be possible as man imposes himself on this new power, maintaining his autonomy, under the guidance of a new ethical imperative, "an unconditional imperative, founded ontologically", directed at the collective action that affects all mankind. This imperative could only be expressed in two ways:

4 The author refers to the reading of the work (MAIA, N. F, 2004, p. 128-129).

5 In the same vein is the position of Gilbert Hottois (1990, p. 89).

> Obra de tal manera que los efectos de tua acción no sean destructivos para la futura posibilidad de una vida humana auténtica em la Tierra'. O estas dos formulaciones positivas: 'Incluye em tu elección actual, como objeto también de tu querer, la futura integridad del hombre': o bien: 'Obra de tal manera que los efectos de tu acción sean compatibles com la permanência de una vida humana auténtica em la Tierra. (JONAS, 1995, p. 9-10 and 36)

This new imperative implies the responsibility of man in the development of technology, considering the coexistence with unforeseen results. Only the creative participation in progress, with the increase of the presence of specialists in the various areas and the involvement of society, can establish limits to the technological increment based on ethical behaviors and values that guarantee a future to humanity.

For Habermas (1980, p. 318), technical and scientific progress contains a project of domination, represents an ideology of advanced industrial society, which replaces and paralyzes the needs of emancipation. According to this philosopher, the patterns of instrumental action 'colonize' the other spheres of social life, not only because of the singular circumstance that capitalism is a system founded on economics, but also by the definitive place occupied by the apology of technique and science in the universe of values and ethical and moral standards.

With this emphasis, Habermas (1980, p. 58) positions science and technology as part of the same social phenomenon of domination, through the control of nature, extended to man. In this sense, technology promotes the great rationalization of man's lack of freedom and demonstrates the technical impossibility of being autonomous and determining his own life. The lack of freedom appears as a submission to the technical apparatus, which extends the amenities of life and increases labor productivity. In this way, technological rationality protects (rather than suppresses) the legitimacy of domination, and the instrumentalist horizon of reason opens up over a rationally totalitarian society (HABERMAS, 1980, p. 58)

The rationality of science and technology is immanently a rationality of manipulation, domination (HABERMAS, 1994, p. 64 ss.). It is characterized by "an increasing potential of surplus productive forces constituting as always a threat to the institutional framework", and may also represent the legitimation of production relations. So we can't assume the innocence of science. What's more, the technological universe

> [...] es 'como tal' indiferente frente a los fines políticos – puede servir de acelerador o de freno a una sociedad. Una calculadora electrónica puede servir lo mismo a un régime socialista que a un régime capitalista; un ciclotrón puede ser un buen instrumento, lo mismo para una guerra que para un partido pacifista (HABERMAS, 1999, p. 64)[6]

On the subject, the considerations of Jonas (1995, p. 271-272) are representative "la ciência, que se há convertido em su hermana gemela – em que el 'progreso' como tal, em si automovimiento, es um hecho indudable, em el sentido de que cada etapa es necesariamente superior a la anterior".

In the view of Capra (1982, p. 41)[7] technology "is aimed at control, mass production, and standardization, and is, for the most part, subject to centralized management seeking the illusion of limitless growth. " Many argue for the development of new techniques, even without being clear about the consequences that may arise. As Jonas (1995, p. 272) points out, technique modifies the world and determines the real forms and conditions of human life: the present ambivalence points to the transformation of habits and conditions of life by technique. Man loses autonomy in function of the phatic and psychological pressure of the technological order on the masses. In view of this, global risks can no longer be considered in terms of individual responsibility, as in matters related to genetic manipulation with the environment, but as universal issues whose effect comes from human actions, "mediated by sciences, lie largely within the common vital interests of mankind: for the first time in the history of the human race, beings are called upon to assume, on a planetary scale, the task of a joint responsibility for the effects of their actions (OLIVEIRA, 2001, p. 175).

Taking responsibility as an innate characteristic of human beings, demonstrated by the ability to choose between action alternatives and the evaluation of the results that it may cause in other beings, it is clear that the responsibility is to the "being" that "is bearer of value" and the value constitutes a right in relation to actions. In this conception, responsibility is understood as "the mediation between the two constituent poles of all

6 In this sense: "Hasta fines del siglo XIX no se registra una interdependencia de ciencia y técnica. Hasta entonces la ciencia moderna no contribuyó a la aceleración del desarrollo técnico y, por tanto, tampoco a la presión racionalizadora que ejerce desde abajo. [...] A mi juicio, la tesis fundamental de Marcuse de que la ciencia y la técnica cumplen también hoy funciones de legitimación del dominio nos proporciona la clave para analizar esa nueva constelación" (HABERMAS, 1999, p. 64).

7 This view rests on the Darwinian theory of the nineteenth century, they believe to be the social life a constant struggle for existence (CAPRA, 1982, p. 41-42).

action: freedom and the valuable character of being" (OLIVEIRA, 2001, p. 2004).

Once these considerations have been transposed in the area of genetic engineering development, the surprising use of the technique is accompanied by uncertainties, without the scientists being able to clarify the safe intentions of their discoveries and procedures, nor even if they will one day be safe. Scientists are human persons, involved in society and can make mistakes, just like any human. That is, advances in biotechnology should be encouraged and protected, moving beyond classical models, mechanistic and reductionist approaches, with the adoption of "holistic and ecological approaches" of scientists (CAPRA 1982, p. 46).

Aside from these concerns about the advancement of science, another issue is that the results are not available to all. In fact, there is a widening gap between those who have access to innovations and those who remain on the margins of progress, since the benefits of innovations are accessible at high costs, hence to a layer of economic 'privileged'. And at this point, as Moser (2004, p. 426) observes, "when biotechnology puts itself at the service of the rich and powerful, it ends up deviating in its very reason for being. For these, everything; for the billions of hungry, nor even the slightest daily care and satisfaction of the more immediate needs."

It can be added that biotechnology research, initially linked and maintained by the public power, has proliferated in private companies, with great resources, in order to develop and obtain new products. The lack of state investments in universities and research institutions, especially in developing countries, results in the export of 'privileged brains' to private companies or to developed countries, capable of providing the necessary conditions for the development of their research and guaranteeing the protection of privileges by the state where they are located.

Of course, the results of the implementation of biotechnology have a direct impact on the economy and ensure international competitiveness. An example of this happens in the food sector, with the development of a diagnostic and bioconservation system for fermented products, enzymes, and hybrid yeasts. There are also genetically modified varieties - tomatoes, potatoes, cotton, soybeans, tobacco, among others - that are resistant to herbicides, viruses, and insects. Particularly in medicine, biotechnology is revolutionizing the therapeutic methods of treating hereditary diseases. Some products, such as human insulin, were the hallmarks of a new generation of natural and artificial medicines.

Advancement in science gives impetus to the need for forms of protection (patent or otherwise) in order to implement new technologies. According to Jeremy Rifkin (1999, p. 9-10), biotechnology gives rise to a new operational matrix, based on the "localization, manipulation and exploitation of genetic resources by scientists and companies, in the granting of gene patents, cell lines, genetically engineered tissue, organs, and organisms." In addition, it conducts a census of Earth's biosphere, maps "about 100, 000 genes that make up the human genome, " uses the computer to "decipher, exchange, catalog, and organize genetic information" and suggests a new way for the future to reorganize the economy and society (RIFKIN, 1999, p. 9-10).

So it seems that the great challenge is to reconcile the development of science and technology with the ethical and responsible foundation, establishing basic guidelines for the development of research. To do this, the motto of the scientists will have as reference the human being and the satisfaction of the needs of all, including those nations that do not have the funds, nor the knowledge necessary to participate in the great scientific projects. Not forgetting that the way in which the technique is used is that it may be the differential so that the political and democratic options will be decisive for tracing the paths of humanity.

Vasques (2004, p. 509), presents the Habermasian proposal for an "ethics of the species", which "commits the citizen of the *commonsense* as a moral person, participant in democratic processes that lead to a legitimate, pertinent legislation, according to priorities, also in matters of bioethics ". For the philosopher, society has to decide on issues of such a present and future repercussion, since the destiny of the species is at stake, as in relation to human cloning. In this sense, "this model of moral argumentation is not only an excellent emancipatory resource in the face of the objective pretensions of a certain genetic engineering, but in this new confrontation with scientific positivism the discursive ethics is honed and gained in depth by strengthening democratic participation and legislation based on popular sovereignty: neither the philosopher nor the scientist nor the specialist, the citizens, will have the last reason (VASQUES, 2004, p. 510).

In the event of a collision of fundamental rights and freedom of scientific and technological research, the issue will be analyzed in the light of the fact that scientific freedom is not absolute and, in the event of conflicts between fundamental rights or principles, it should be noted that no technological advance whose invasion provokes an injury to a fundamental right, such as the dignity of the human person, may be supported by a system based on the recognition of human rights. As defined by Sarlet (2002), the dignity of the person guarantees the respect of the being, regardless of the social and cultural conditions to which it is bound, "dignity, being a quality inherent to the essence of the human being, constitutes an absolute legal right, therefore, inalienable, non-renounceable and intangible [...]" (SARLET, 2002, p. 123).

FINAL CONSIDERATIONS

Contemporary criticism of science recognizes the existence of a link between the knowledge of something and the control or mastery of what has come to be understood. In the search for possible alternatives, Habermas presents the rescue of communicative rationality, through the amplification of the function of language as an instrument in the search for understanding and human interaction. His proposal for an emancipated society necessarily goes through the search for an intersubjectively established consensus based on communication.

It is obvious that the technological advances will still generate much controversy. Opinions on the subject are dynamic, consider the context and are influenced by the perception of the risks and the advantages of its application. Some premises are fundamental in this area, such as the development of effective communication between the scientific community and society, the institutionalization of formal consultations with society (plebiscites, referendums) and ensuring that risks (precautionary principle/duty of vigilance) of biotechnology have been carefully evaluated.

Therefore, these are great social options, an opportunity in which the discussion will involve society in the democratic process and will overcome the technical space. The new legal order (new regulatory categories) will then have as its foundation the values elaborated by sustainability, based on the ethics of responsibility.

The starting point will be a minimum of consensus, which can be obtained through international agreements establishing parameters for the development of science, starting with the formation of common bases oriented to fundamental rights and accessible to the participation of all human beings. Thus, it is up to the global society to establish the limit of harmonious coexistence between the protection of their ways submitted to research and scientific advance, preserving scientific freedom, without radicalizing it as a techno-scientific imperative.

Overcoming gaps in jurisdiction, participation and encouragement are the present and future motes. With regard to the jurisdictional gap, it is necessary to overcome the "discrepancy between a globalized world and separate, national, policy-making units. " (SARLET, 2002, p. 29). The policy challenges go beyond the national space, becoming global nowadays, inserted in the demands of the new international political scene. Likewise, the 'participation gap' will have to be overcome and extended in the diffusion of democracy, reassessing decision-making by multilateral organizations "keeping the issues of legitimacy and representativeness in mind" (SARLET, 2002, p. 26). To this end, "all actors must have a voice, must have an adequate opportunity to make their expected contribution, and must have access to the goods that result" (SARLET, 2002, p. 29). And the 'incentive gap', understood in international cooperation, "international cooperation must be an integral part of the national creation of public policies" (SARLET, 2002, p. 27).

Therefore, development policies are interwoven with policies to promote intergenerational sustainability. Proposals such as diversifying economic sustainability, through investments in basic infrastructure, education and quality of life, associated with increased investment in renewable sources and alternative energy, are a means of realizing social, economic and diffuse rights, as well as to implement the current generation's caution and responsibility towards the needs of future generations.

Sustainability demands actions capable of transforming Cartesian techno-economic models into resolutions that promote a real quality of life for current and future generations, respecting our cultural diversities and enhancing our regional characteristics, since sustainability is a right for all.

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