

---

**DIGITAL POLLUTION: GOING BEYOND THE LIMITS OF VIRTUAL*****POLUIÇÃO DIGITAL: TRANSCENDENDO OS LIMITES DO VIRTUAL*****MARCELO KOKKE GOMES**

Pós-doutor em Direito Público - Ambiental pela Universidade de Santiago de Compostela - Espanha. Especialista em Processo Constitucional. Mestre e Doutor em Direito pela Pontifícia Universidade Católica do Rio de Janeiro. Professor de Direito da Escola Superior Dom Helder Câmara. Professor de Pós-graduação da PUC-MG. Professor colaborador da Escola da Advocacia-Geral da União. Professor do IDDE - MG. Membro da Associação dos Professores de Direito Ambiental do Brasil. Membro da Academia Latino Americana de Direito Ambiental. Membro do Instituto Brasileiro de Advocacia Pública. Procurador Federal colaborador da Escola da Advocacia-Geral da União. Procurador Federal do Núcleo de matéria ambiental e indígena da Procuradoria Federal no Estado de Minas Gerais - Advocacia-Geral da União.

**MÁRCIO LUÍS DE OLIVEIRA**

Doutorado e Mestrado em Direito (UFMG); Aperfeiçoamento em Direito Internacional Público e Privado (Holanda); Professor Adjunto de Direito Constitucional do Departamento de Direito Público da Faculdade de Direito da UFMG; Professor Adjunto de Graduação e do Mestrado em Direito Ambiental e Desenvolvimento Sustentável da Escola Superior Dom Helder Câmara; Professor Adjunto da Faculdade Milton Campos; Consultor Jurídico e Advogado especializado e atuante em controle de constitucionalidade nos Tribunais.

---

**ABSTRACT**

Digital environment and digital pollution approach requires overcoming an alleged duality between the natural and virtual environments. The digital environment produces risks of impacts on the natural environment, it presents itself as a source of environmental pollution. Environmental protection should promote social-environmental measures in order to explicit the effects of degradation originated from digital environment and, thus, try to measure levels of pollution produced by digital data storage, electronic information generation, internet services and cumulative storage of data at electronic servers. It's necessary to articulate and apply the principle of sustainability to information technology. On that purpose, the preparation and development of this article are based on Spinoza's philosophical method combined with the critical propositional method in order to face the theme. In conclusion, the article supports that the digital environment is inseparably connected to the (natural and social) physical environment, understood as a specific object of environmental law.

**KEYWORDS:** Environmental law; digital environment; digital pollution; sustainability.

**RESUMO**

A abordagem do meio ambiente digital e da poluição digital demandam a superação de uma suposta dualidade entre o ambiente natural e o ambiente virtual. O meio ambiente digital produz riscos de impactos sobre o meio ambiente natural, ele se apresenta como fonte de poluição ambiental. A tutela ambiental deve promover medidas socioambientais de explicitação dos efeitos de degradação oriundos do meio ambiente digital e, deste modo, tentar mensurar os níveis de poluição gerados por arquivamento de dados digitais, geração de informações eletrônicas, serviços de internet e estocagem cumulativa de dados em servidores eletrônicos. É necessário articular e aplicar o princípio da sustentabilidade à tecnologia da informação. Para tanto, a elaboração e desenvolvimento do artigo se sustentam no método filosófico de Spinoza, combinado ao crítico-propositivo, de modo a enfrentar o tema. Em conclusão, o artigo sustenta o meio ambiente digital como conectado de modo

indissolúvel ao meio ambiente físico (natural e social), compreendido como objeto específico do Direito Ambiental.

**PALAVRAS-CHAVE:** Direito ambiental; meio ambiente digital; poluição digital; sustentabilidade.

## **INTRODUCTION**

The environment is subject to anthropic incursions, changes and transformations consciously or unconsciously caused by the human being. Outlining the protection field and the legally acceptable spaces to intervene in the environment is an interdisciplinary subject that allows for reviews. Environmental Law itself sometimes gets the inflow of factual and legal circumstances that tend to broaden its extension and regency scope. How to identify the scientific-dogmatic field of Environmental Law without running the risk of losing specificity and internal coherence of standards (principles and rules), institutes and institutions comparing to the other fields of Law?

The approach to the digital environment and to digital environmental pollution itself is immersed in that troublesome issue of defining what standards are or are not connected to Environmental Law. Thus, the field of scientific-dogmatic comprehensiveness of Environmental Law in what regards digital environment issues requires a methodological and conceptual rigidity. Although all legal fields of expertise somehow affect the social and even the natural environment, not all standards that rule the interactions taking place in the virtual habitat concern Environmental Law.

Electronic Law, limits of the freedom of speech in the web, digital crimes, virtual contract law, taxation of electronic or virtual services are examples of interactions rules by the legal system in its multiple fields, all of them being inserted in the digital environment. However, the examples listed are not encompassed by the normative field of Environmental Law. Thereby, it is necessary to identify the area of influence of Environmental Law in the digital world.

Thus, it is under that perspective that this paper turns back to the following problem theme: does the digital environment produce risks of impacts on the natural environment that could be seen as a scientific-dogmatic object belonging to Environmental Law?

So as to address the problem theme, the research adopts the theoretical framework of Spinoza's philosophical method that, breaking away from the Cartesian rationale of duality between the world of senses and the world of ideas, proposes indissoluble rationality between the sensitive and the intellect or, in his words, "the unity of mind and body". The Cartesian metaphysics understanding separates the dimensions of reality and rationality, which is philosophically overcome in Spinoza. In the field of Environmental Law, Spinoza's postulate becomes relevant in what regards the holistic understanding of environment and, thereby, of the connections between the (natural and social) physical environment and the digital or virtual environment.

In harmony with the problem theme and the theoretical framework, the research presents the following hypothesis: a) the digital environment does not produce risks – neither concrete nor abstract ones – that can impact the (natural and social) physical environment, thus not being encompassed by Environmental Law; b) the digital environment indissolubly connects to the (natural and social) physical environment and therefore it produces concrete and abstract risks that can impact the holistic dimension of the environment, thus being, in what relates to that aspect, a specific object of Environmental Law.

Thereby, the overall objective of the research is to outline a normative field for Environmental Law under the digital perspective by identifying scientific-dogmatic frameworks that would justify the incidence of Environmental Law rules in the virtual world. As specific objectives, the article intends to evidence: a) the holistic dimension of the environment, which would include the indissolubility of the (natural and social) physical and virtual worlds; b) the nature of the concrete or the abstract risk that interests Environmental Law and that could be present in the digital environment; c) typical situations in the virtual world that produce concrete and abstract risks that can impact the (natural and social) physical environment; d) the need to make a suitable legal framework positive to rule the implications of concrete and abstract risks in the connection between the virtual and the physical worlds.

The critical-propositional methodology was used in the preparation of this paper and the dogmatic-analytical one was also complementary adopted. The first method was used in the attempt of reconfiguring the institutes of Environmental Law that would be extendable to the connections between the (natural and social) physical and digital environments. The second method was applied to the dogmatic approach on environmental protection, in its holistic dimension, comparing to the concrete and abstract risks produced by the digital environment that can impact the (natural and social) physical environment. From that methodology, a bibliographic review was carried out to speak of the doctrinal positions on the holistic dimension of the environment. Thus, primary (the legislation) and secondary (national and international doctrine) sources were used in the research, besides example references with data collected and presented in studies carried out by third sources.

In addition to the introduction and the final considerations, the paper is structured into three topics. The first one addresses the digital environment and the information society and evidences the impossibility of splitting the physical and the virtual environments. The second one works with the specificities and the limits of digital pollution, presenting situations of concrete and abstract risk. The third one proposes the need to make a suitable legal framework positive for environmental protection in its holistic dimension and so as to encompass the connections between the (natural and social) physical and the digital environments.

## **2 DIGITAL ENVIRONMENT AND INFORMATION SOCIETY: IMPOSSIBILITY OF SPLITTING PHYSICAL AND VIRTUAL**

This paper is based on a central subject for the understanding of the scientific and dogmatic framework of Environmental Law: the concept of “risk”. Human activities that may result in situations that pose risks to the environment are a material source that justifies making environmental legal standards (principles and rules) incident on social and natural spaces possibly subject to risk positive. Considering the definition of environment adopted in the 1972 Conference of Stockholm, it is understood as an “aggregate of physical, chemical, biological and social components capable of causing

---

direct or indirect effects, in the short or long term, on living beings and human activities” (UNITED NATIONS, 1972). In Brazil, Law n. 6.938 dated August 31, 1981, article 3, item I, defines environment as “the set of conditions, laws, influences and interactions of a physical, chemical and biological nature that allows for, shelters and rules life in all its forms” (BRAZIL, 1981).

The factors that concrete or potentially compromise the level of balance and stability of that set of (physical, chemical or social) components so as to affect living beings reveal themselves as demonstrations of environmental risk and, thereby, are in the field of Environmental Law, under a scientific-dogmatic perspective. On the other hand, Environmental Law sees the environment as an holistic phenomenon and system, that is, it encompasses the completeness of the human and natural habitat in its multiple dimensionality and totality, and it is therefore not subject to fragmented analyses under the penalty of compromising its object of reflection, ruling and protection: life considered in itself. The atomization understanding environmental issues, that is, punctual and unrelated considerations regarding aspects connected to the environment, fails to match the *ratio juris* of Environmental Law once its normative field is focused on the potentiality or concreteness of the “risk” resulting from or connected to human activity on interactions and balance regarding a certain ecosystem.

In this holistic context, the subject of digital environment, on the purpose of being object of Environmental Law, configures itself from the moment when the “risk”, in its concreteness or potentiality, reveals itself as a phenomenon affecting the virtual environment in its interactions with life and the connections between life and the social and natural environments. However, it is important to highlight from scratch that the issue concerning environmental degradation due to the digital environment and to be assessed in this article is not related to the issue of solid waste resulting from the impact of hardware activity itself on the natural environment. The subjects regarding the dynamics of the virtual world that can negatively impact the (natural and social) physical world are themselves going to be addressed herein.

Once the potential or concrete risk on the social or natural environment is the field that rules Environmental Law, the political, economic, social and scientific scenarios – in which the juridicity on the risk interests Environmental Law – are

---

interconnected to the countless and ongoing processes and models of human interaction. That way, humanity, in its social unveiling and its connections with nature, reveals itself as a permanent “risk society” (BECK, 2010).

Thus, the risk society is the sociocultural expression, in a time-space context, on which Environmental Law manifests itself in its scientific-dogmatic dimension so as to arise as a specialized subsystem within the legal system (LUHMANN, 2016).

The risk society, on Environmental Law purposes, expresses itself in the set of actions and interactions that, in a concrete or abstract way, can put its own survival or the survival of the natural environment at risk. Thereby, the risk society operates both in a consequential and an inconsequential way due to an apparent limitation to forecast and calculate the possible risks that human activity can cause to the balance of ecosystems and the society itself. Not rarely, the risk society – in its dynamics and political, economic, social and scientific multiple dimensions – ends up by producing niches and life contexts never existing before in nature or, when existing, highly changed. In other words, social and cultural interactions create new “humanized” spaces on their own bases, which demands specific standards to rule the risk that the creation of the space itself brought up.

On argumentation purposes, suppose there is an experiment laboratory with viruses and bacteria that are fatal to animals and the human being; a laboratory that is built to conduct research for public health and, thus, focused on the improvement of life conditions and the generation of social benefits. The human being, even if motivated by ethical, scientific and technological criteria, gathers in the same place (“environment”) several species of virus or bacteria whose growth and handling are a risk, a threat. Calculating and forecasting their negative effects is limited by the (lack) of knowledge. When creating such environment and taking human beings to work in that habitat, there is a potential and a concrete concatenation of environmental vulnerability elements inside and outside the laboratory. The internal one regards the risk effects for life inside the laboratory, while the external vulnerability concerns the risk that the threat transposes the laboratory. In the situation that was pictured, several legal disciplines are involved. In Environmental Law, the issue is concentrated in the risk, that is, the abstract or concrete, effective or potential threats that the activity

developed in the laboratory can, both internally and externally, directly or indirectly project on human beings.

Environmental Law does not care, for example, about the laboratory's purchase and sale commercial relations, or about the good or service produced by it, or the employees' labor or employment contracts, not even about the laboratory's brand, profitability or losses. Those issues are related to other fields of expertise in the legal system. How the activity of the laboratory in researches with virus and bacteria in a context of threat against human beings inside or outside that environment manifests is important for Environmental Law. The deployments of the risk are obviously not limited to the laboratory's employees. The issue involves test subjects as well as the viruses or bacteria themselves, once experiments may result in mutations or new viruses or bacteria with higher life destruction potential, for example. But it is not possible to disconnect the interior from the exterior. If purchase and sale business relationships or weaknesses regarding labor relations concretely or potentially allow the laboratory to be exposed to external risks, that is, external risks for human beings or the laboratory, the need for Environmental Law to rule the situation cannot be disregarded. Lab waste, handling chemical and biological products and managing risk organisms are unrelentingly subject to the normative regulation of Environmental Law. Indeed, it is important to highlight that the risk inside the laboratory activity is itself subject to Environmental Law, though with connections to other legal areas such as the professional ethics and the academic research codes. Thus, the example reveals that the interior of a place in which environmental risk may be generated cannot be disconnected from its exterior once the holistic characteristics of the environment are decisive. Therefore and for Environmental Law, the internal and external environments are part of a whole that can only be understood in its totality.

A philosophical reference to understand the relationship that backs the internal and external habitats in the field of Environmental Law can be found in Spinoza. From his perspective, it is also possible to look for a logical link to address and understand the interconnection between the physical and the virtual realities. Spinoza highlighted the inseparability between the body and the mind, the interconnection between both comparing to a scission having a Cartesian matrix in which the dynamics of rational would detach from the physical. The dualistic Cartesian logic – the epistemological



---

separation between mind and body, that is, “idea and virtual” disconnect from “sensitive and physical” – is compared to the rationality presented by Spinoza, for whom body and mind have an epistemic unity (GUIMARÃES, 2011, p. 80). The author emphasizes the fact that, for Spinoza, “when considering that the mind is the idea of the body, it is not correct to say that the mind can exist without the body. If there is no body, there is no mind” (GUIMARÃES, 2011, p. 89). Therefore, “the experiences of the mind and the body follow the same order and connection and it is impossible to maintain any moral function of the mind that aims at controlling the body” (GUIMARÃES, 2011, p. 96). And the author warns that the “dualism that marks the relationship between the body and the mind in the Cartesian philosophy is just another expression of an idealistic philosophical tradition that currently projects such understanding on the reality of common sense” (GUIMARÃES, 2011, p. 80).

Here, the theoretical support is relevant to build an integrated perspective between the physical and virtual realities. The digital environment (virtual reality) cannot be known and understood in its ontology and unfolding without seeing it in a cognitive integration with natural resources, which are expressions of the physical world. The virtual environment cannot be totally disconnected from the physical one once the virtual world is conceived and also unveiled in the real (physical and cultural) world. According to the philosophical logic presented by Spinoza,

[...] no sólo entendemos que el alma humana está unida al cuerpo, sino también lo que debe entenderse por unión de alma y cuerpo. Sin embargo, nadie podrá entenderla adecuadamente, o sea, distintamente, si no conoce primero adecuadamente la naturaleza de nuestro cuerpo”. (SPINOZA, 1983, p. 80)

Under that same rationality paradigm, it is not possible to fully understand the digital environment and even less its implications in terms of environmental pollution without accounting for the inherent associative characteristics between the virtual and the real (natural and social) worlds.

On Environmental Law purposes, the digital environment is similar to the example of the research laboratory. It is a habitat formed by ideas, but that is backed by materiality, that is, the virtual world appears as derivations of the software from its connections with the hardware. Created and made dynamic by human inventiveness,

the virtual world substantiates in a creation that is also creator once in its internal spaces of social and life interconnection – in which ideas and reality mix – other existence and social interaction realities are recreated and built. But similarly to the laboratory, the digital environment cannot be seen as a habitat that is closed in itself. In fact, in its internal dynamics, the virtual world affects the lives of those who allocate themselves in its connections and social interactions or as experiences of unipersonal moments. But its created reality effects are also externally projected. So to speak, the digital environment, as a social existence virtual habitat, fails to disconnect in its ontology and consequences from the physical environment. As already stated, it is unveiling the software from the hardware.

The disconnection is subject to criticism regarding Spinoza's thoughts comparing to the Cartesian constructions (separating idea/virtual from physical/sensitive) as if they were not integrated in a holistic reality. Virtual world and real world – hence, digital environment and physical environment – cannot be understood as dualities, but as reality expressions of an environmental whole that manifests itself. According to Fiorillo and Fuller (2015), splitting the environment into approach areas or aspects does not compromise its holistic nature, but it tries to make the identification of different degradation forms and environmental impacts on the environmental whole feasible.

If the virtual world shows itself as derivations of the software from its connections with the hardware, the digital environment can be understood as one among many expressions of the holistic multiple dimensionality of the environment. Thereby, the digital environment projects on the physical environment its positive and negative effects among which are pollution, the extraction and industrialization of natural resources. That information allows for the banishment of apparent and mistaken ideas such as the understanding that human activity in the digital environment does not generate physical pollution besides virtual pollution itself.

In the digital environment – consisting of derivations of the software from its connections with the hardware –, multiple complex social interactions are built and can generate, in the physical time and space, direct or indirect effects on people and the different human institutions and activities (political, economic, cultural, scientific etc). Thereby, those interactions built in the digital environment also project themselves

---

through their consequences in the physical environment, from local to extraterrestrial, as can be seen from the information collected and virtually transmitted by space devices to the research and launching stations. In fact, the virtual world created by human genius already extends beyond the solar system. The conclusion is that the virtual world does not oppose the real world: the virtual integrates the real world.

That perspective of the digital environment is associated to others as the one expressed by Fiorillo and Fuller, for whom the digital environment is linked to the technological revolution as well as to the dynamics of the information society in which “communication instruments, especially the internet, generate a network of cultural, ideological, economic, social globalization, originating new organization models as well as new socioeconomic markets” (FIORILLO; FULLER, 2015, v. 1, p. 8). And the interconnection that takes place affects the discursive space of sustainable social practices (LEITE; FIORILLO, 2016). Thus, the perspective to focus on the communication structure allows to foresee a space for the freedom of expression and thought to interact in the digital environment where the development of the personality and the communication and community interactions that have the internet as their main stage in a social reality that belongs to the 21<sup>st</sup> century take place (FIORILLO; FULLER, 2015, v. 1, p. 9-11). That situation sharpens when the social contours change the information and its accumulation into a basket of data presented as endless, endorsing a collective social project marked by the “existence of the so-called intellectual technologies, that is, technologies that serve the production of knowledge” (COUTINHO, 2014, p. 224).

From the risk society paradigm (BECK, 2010), the digital environment is mingled with concrete and abstract risks (PARDO, 1999, p. 23-26). Although there are no clear limits between the two kinds of risks, the difference between concrete and abstract risks is based on the control developed and in face of the possibly harming situation. The concrete risk is characterized by the possibility of limiting through rational control, with dynamics and mechanisms to use and connect data and acts that warn before its possible hazard. The individual that uses a computer and manages files or data in social networks or bank operations has a rational probability of risks arising from the use of passwords or protection mechanisms, for example. But there is a higher dimension of quite abstract risks marked by absence or fragility regarding its limitation

or by the unknown and that compresses the level of control or even disables it. It is over the abstract risk that variables on digital environmental pollution are created, many of which disregarding facts and data backed by poor or even ignored scientific knowledge and that totally or partly compromise the rational control of the risk. That may affect users as well as the social and natural environment at time and space unpredictability ranges. As stated above, the abstract risk in the digital environment overcomes the border of virtual, affecting the social and physical environment, that is, the reality it also integrates. Building the identification of virtual from the issue of duality with real as if the virtual was a suprasensitive universe widens the dimension of the uncontrollable in the abstract risk, hindering measurements and reactive captures on physical environmental effects. Although unpredictability is a mark of the risk society, the development of means of social awareness about the risk reinforces the possibilities to control the effects of the degradation from the existence, the maintenance and the permanent update of the digital environment.

Though, how can human action in the virtual world (digital environment) result in environmental degradation in the physical world? What levels of environmental damage, under a digital matrix, are socially ignored and affect the environment in its holistic aspect? Those questions are addressed in the following topic.

### **3 SPECIFICITY AND DELIMITATION OF DIGITAL POLLUTION**

The context of human relations in the field of the information society is progressively affected by the technological revolution and the expansion of the digital environment. Under that perspective, Fiorillo and Oosterbeek (2014) say that there are real social groups that can be called digital cities, although they have a sufficiency and coverage reference that is different from the physical city itself. The digital environment, according to the authors above, sends back to a new concept of territory in which there are cultural and thought expression relations. That is a scenario aimed at accommodating “transitions of the physical nature of cities for the digital territorialization of not only economic and financial but also institutional processes connected to it” (FIORILLO; OOSTERBEEK, 2014, p. 48). But how can that territoriality

transition result in new forms of pollution and environmental impacts materialized in environmental degradation?

The understanding of pollution in the digital environment is noticeable under the holistic aspect of the environment in which the digital environment as well as the physical and cultural environments fit. The abstract risk intended to be addressed herein is exactly the effect of pollution on the physical environment triggered by the activities carried out in digital or virtual environments.

In the Brazilian legal system, Law n. 6.938 dated 1981 sets important concepts for the creation, implementation and assessment of public policies on environmental matters. Based on article 3, one can word the notion of digital environmental degradation as an adverse change regarding the characteristics of the environment resulting from human activity undertaken from physical or natural resources acting in virtual experience or interaction scenarios. Digital degradation activity, when directly or indirectly implying in harmful effects to human health and well-being or even creating adverse conditions for social activities or unfavorably affecting ecosystems, is characterized as digital pollution. Digital environmental degradation, as well as digital pollution itself, may extend beyond the virtual scenario and reach the physical environment.

Although the virtual and the physical environments are habitats with their own characteristics, as already mentioned, they are inseparable due to the holistic dimension of environment. Thus, digital pollution may come out as an abstract risk as far as there is no full control and predictability in regards to the gradation of its impact and harmfulness in the physical environment.

On illustration purposes, this paper is going to consider one of the main causes of digital pollution: the use of internet and e-mail, which represent two human activities that are fully connected to the abstract risk dynamics and especially to the practices of hidden pollution. Hidden pollution is characterized by the lack of awareness that a certain action implies in environmental pollution exactly for not understanding its direct repercussion on the physical environment such as the generation of waste and the use of natural resources. It is wrong common sense that the use of tools such as e-mail and site research for information or mere internet access are practices unrelated to the production of harmful environmental effects.

---

Using the internet and e-mail messages is hidden pollution as long as it degrades the physical environment through human action in the digital environment. But, in that example, it is necessary to ask: what is the environmental impact and how is it processed? Internet, electronic mail and social networks form scenarios of the digital environment whose ontology and rationality are unveiled through information transmission. And information transmission requires power for data collection, interchange, filing and research. The generation and consumption of power for information transmission is one of the milestones understanding the impacts of digital pollution. Simple issues come up from an e-mail box or files stored and available for consultation in what the digital language calls “cloud”, that is: a) how is that information filed? b) what is the energetic cost of the devices and servers that maintain, offer and allow for the flow of that complex digital routine all over the planet?

In a study developed by the *Agence de l'Environnement et de la Maîtrise de l'Energie* (ADEME), linked to the French Ministry of Ecology, Sustainable Development and Energy and the Ministry of Higher Education and Research, the cost of power and the environmental impacts caused by digital pollution were determined. The objective of the analysis was the environmental cost to develop human activities in the digital environment<sup>1</sup>. Surprising data is exposed from the assessment. The calculations regarding the impact of digital environmental pollution are schematized by the French agency from a usual, although hypothetical, situation. A company with one hundred employees was presumed. Each employee would receive around 58 e-mail messages per day and would send 33. The impact of the messages sent would substantially increase depending on the number of attachments sent as well as the number of people copied and the amount of time during which the message would be stored at the server. Sending 33 e-mail messages per day with 1-mega attachments to two

---

<sup>1</sup> The French Agency of Environment and Energy Matrix considered for its researches and impact assessment “information transfers implemented when sending electronic mail or a search [in the internet] require in each stage machines that consume power both for manufacturing and operation. That consumption and the material needed for the fabrication of the devices are considered in the calculation of the impact of operation” (free translation) - “les transferts d'informations mis en oeuvre lors de l'envoi d'un courrier ou d'une requête nécessitent à chaque étape des équipements qui consomment de l'énergie tant pour leur fabrication que pour leur fonctionnement. Cette consommation et les matériaux nécessaires à la fabrication des matériels entrent en compte dans le calcul de l'impact de ces opérations.” (AGENCE DE L'ENVIRONNEMENT ET DE LA MAÎTRISE DE L'ENERGIE – ADEME, 2014, p. 5).

---

recipients would generate annual emissions of 180 kg of CO<sub>2</sub>, which corresponds to driving a car for 1,000 km. The research also indicates that when the number of recipients is multiplied by 10, the impact on the climate is multiplied by 4 and that does not consider the consumption of several minerals required for providing the existence in the digital world.<sup>2</sup>

It is immediately perceived that the projection of consumption data promoted by living in the digital environment, simply considering the use of e-mail messages, is colossal. The virtual environment also experiences a unique problem that has no correspondence in the physical aspect of human interactions. People usually clean their paper files. They check drawers, closets, find paper they do not even know why they have kept, they collect what is not necessary anymore and send (or should send) for recycling. That situation does not usually take place in regards to electronic files. People keep in their e-mail boxes more and more information and files, weight that increases especially in a capitalist and consumption environment where there is a growing demand for more availability of digital space. Unnecessary consumption and filing result in high storage costs that, in turn, take to even higher energy output to maintain that progressive stock of information, which would not exist in the past.

Hidden obstacles that generate impacts caused by the virtual environment proliferate under the collective production of unneeded digital pollution. Imagine an electronic file corresponding to a digitalized book that is legally maintained at a certain electronic site in the internet. It could be accessed by anyone through the access link,

---

<sup>2</sup> “In a company with 100 people in France, each collaborator receives about 58 e-mail messages and sends 33 per day. The climate impact of sending an e-mail message with attachments increases according to the weight of the attachments, the number of recipients and time of storage at a server. Sending 33 1-Mega messages to 2 recipients per day and per person generates anual emission levels equivalente to 180 kg of CO<sub>2</sub>, which corresponds to over 1,000 km covered by car. Attention, multiplying by 10 the number of recipients of an e-mail message multiplies by 4 its climate impact. The ‘consumption of primary materials’ impact is not nigliabile: sending an e-mail message witha 1-Mega attachment consumes 7.5g equivalent of iron, that is, the weight of one 1€ coin” (free translation) - “Dans une entreprise de 100 personnes en France, chaque collaborateur reçoit environ 58 courriels et en envoie 33 par jour. L’impact climatique de l’envoi d’un courriel avec pièces jointes augmente sensiblement avec le poids des pièces jointes, le nombre de destinataires et leur temps de stockage sur un serveur. L’envoi de 33 courriels d’1 Mo à 2 destinataires par jour et par personne génère annuellement des émissions équivalentes à 180 kg de CO<sub>2</sub>, ce qui équivaut à plus de 1 000 km parcourus en voiture. Attention ! Multiplier par 10 le nombre des destinataires d’un courriel multiplie par 4 son impact climatique. L’impact « consommation de matières premières » n’est pas négligeable : l’envoi d’un courriel avec une pièce jointe de 1 Mo consomme 7,5 g équivalent de fer, soit le poids d’une pièce de 1€.” (AGENCE DE L’ENVIRONNEMENT ET DE LA MAÎTRISE DE L’ENERGIE – ADEME, 2014, p. 10-11)

---

no need to download and incorporate the file to a cloud or e-mail address. However, users often download the file and circulate it in e-mail messages among friends or acquaintances that in turn transmit it to others and most of them file the e-mail message in their inboxes, where it is stored and consumes energy. Many times, the file is not even read. The situation is reproduced in the use of social networks. The flow of information and shared files is immeasurable, with the consequent loss of calculation possibilities and control of energetic impacts projected in the short, medium and long term. In that scenario, the abstract risk is configured.

The environmental cost of paper can be circumscribed in time. That means there is usually no energetic cost to store paper files. That situation is not reproduced in the digital environment, where the cumulative environmental effect is relevant in configuring pollution. The cumulative effect is characterized by the sequential concentration that overwhelms environmental balance. Punctual activities or impacts sum up and reach power unchained by the condensation of the environmental impact. The condensation of impacts sometimes involves an exponential result that would initially not be included in the sum of actions, that is, the conjunction of isolated factors results in environmental impacts that exceed the sum itself. That is the synergetic effect. The impacts individually assessed result in consequences for the environment that cannot be weighed through the full measurement of the polluting result.<sup>3</sup> The digital environment is on its own an accumulation habitat where virtual elements proliferate at a geometric scale and without having a cleaning reference that avoids increasing environmental costs to maintain and make the data and information stock available.

Since the origin of internet in 1974, diversity of uses and the “digital social inclusion” process have advanced at a frantic pace, which reveals the progression of environmental impacts resulting from the maintenance and impetus of an environment having an increasing number of utilities and actors and that is resistant to content recycling in regards to data removal from the system, causing uncontrolled accumulation. In an interview to The Guardian in 2015, Professor Andrew Ellis from

---

<sup>3</sup> “The cumulative and synergetic impacts are frequently seen as synonyms. When the accumulation of effects on the environment is considered in space and time, the expression ‘cumulative impacts’ is used to name the sum of effects resulting from an action or several simultaneous actions. On the other hand, synergetic impacts are the phenomenon represented by the total impacts of an action or more actions so that the effect is bigger than the sum of the impacts individually assessed.” (FARIA, 2013)



---

Aston University stated that 8% of power generation in the United Kingdom was aimed at the use of internet and that the use could get to the consumption of 100% of the annual power produced by 2035 (THE GUARDIAN JOURNAL, November 13, 2015).

The lack of social and even institutional perception of digital pollution means disregarding its harmful effects, which are generally also ignored by the virtual research networks. The cost of power consumption by the digital environment, that is, the expression of the effective environmental impact of human interactions in the virtual environment, when searches are carried out in the internet – such as Google searches –, was estimated by the French agency ADEME at 287,600 tons of CO<sub>2</sub>, only considering the 29 million French internauts and an average of 949 searches per year. The impact would correspond to 1.5 million kilometers covered by car.<sup>4</sup> Regarding Brazil, there is a lack of concrete data concerning the effects of digital pollution. However, it is possible to draw the information from the progress of inclusion and access to the digital environment. The National Survey per Sample Household carried out by IBGE in 2014 established an increase of 11.4% in the use of internet comparing to 2013, estimating that during that year about 95.4 million people accessed the internet<sup>5</sup>. No doubt that increasing access to the internet is a communication exercise, getting knowledge and transmitting information and, as such, it proves to be a relevant path for digital social inclusion and to establish fundamental rights, guarantees and obligations. Nevertheless, the issue remains on keeping environmental impacts such as affecting natural resources and other possible repercussions on the collective well-being silent. If the negative environmental impacts due to digital pollution produced by 29 million internauts in France reaches the equivalent to 287,600 tons of CO<sub>2</sub> a year,

---

<sup>4</sup> “Each one of the 29 million French internauts carries out about 949 searches in the internet per year, which corresponds to the emission of about 287,600 tons equivalent of CO<sub>2</sub>, that is, over 1.5 million km covered by car”. (free translations) – “Chacun des 29 millions d’internautes français effectue en moyenne 949 recherches internet par an, ce qui correspond à l’émission d’environ 287.600 tonnes équivalent CO<sub>2</sub>, c’est à dire plus de 1,5 millions de km parcourus en voiture.” (AGENCE DE L’ENVIRONNEMENT ET DE LA MAÎTRISE DE L’ENERGIE – ADEME, 2014, p.10-11.)

<sup>5</sup> “In Brazil, approximately 95.4 million people being 10 years old or over accessed the Internet during the reference period of the survey in 2014. It was a growth of 11.4% (or 9.8 million) users comparing to the year of 2013. In all Great Regions there was a growth regarding the contingente of internauts from 2013 to 2014: 19.3% in the North, 14.6% in the Northeast, 9.5% in the Southeast, 10.0% in the South and 12.0% in the Mideast. From 2013 to 2014, the proportion of internauts grew from 49.4% to 54.4% of the total population. In 2014, the Southeast (61.8%), South (58.2%) and Mideast (60.0%) registered averages above the national average (54.4%), while the North (45.2%) and the Northeast (42.1%) registered the lowest levels.” (BRAZILIAN INSTITUTE OF GEOGRAPHY AND STATISTICS – IBGE, 2014)

the 95.4 million users of the network in Brazil, according to information dated 2014, possibly imply in much higher figures than the French ones.

The environmental impact of pollution from the digital environment carries abstract risks that add to the synergy and accumulation factors, requiring servers and data centers that progressively demand more energy with a social culture of information storage that is replicated and against the elimination of digital content unnecessarily stored. The digital environment is still seen as a parallel reality apart from the physical environment, without being fully aware that the virtual is real in what concerns the effects of socioenvironmental impacts. But there still is another aspect regarding environmental pollution that cannot be disregarded. It is the socioenvironmental impact projected on the psychological stability of people with behavioral consequences that is characterized as pollution once it harms the wellness of the population.

The ongoing communication flow implies in the reconstruction of the social pressure over the so-called “face work” that, in the digital environment, it is one of the main forms of “experience”. Face work is a consequence of the integration of the individual to a social network that, in the virtual environment, is usually started by creating, structuring, maintaining and feeding a profile to socially introduce and selfproject the individual into the collectivity that he/she intends to integrate and from which he/she claims acceptance and interaction, exposing him/herself in an environment that has demands but, at the same time, allows for self-accomplishment from the feeling of social belonging. According to Recuero,

The face is maintained through ‘face work’, that is, negotiations among actors so as to maintain positive social values attributed to the proposed face and that have to be legitimated by the others. Face work, thereby, is directly related to social capital. Proposing and receiving legitimacy from a certain face in a certain conversation is essentially a negotiation of value that involves backing the actor that claims the face, being aware of interaction standards, information and other forms of social capital (Bertolini and Bravo, 2004). Successfully being or maintaining a face causes, Goffman (1967) explains, positive feelings and values for an actor and a certain group once it generates some kind of social security. (RECUERO, 2014, p. 118).

But the author warns that:

---

[...] interacting also poses risks to the face. Those risks are based on the possibility that acts threatening the face come up from interaction situations. Goffman (1967) argues that risk may lead to attempts to safeguard and even receive the actor that fails to take part in the interaction to avoid threats. In general, interaction standards proclaim respect towards the faces of others. Thus, threat acts are the ones that put the proposed face at risk, breaking the interaction standards (for example, offensive speech, discredit and etc.). Thus, interacting is always a risk.” (RECUERO, 2014, p. 118)

Human beings have always tried to socially build their own images and strive to make constant reconstruction effective by both changing and preserving it. However, with the progress of life in the digital environment, public exposition and presentation are constant. The exposition is permanent, correspondence and answer requirements are simultaneously exalted by a short-sighted culture. The social answer to the construction of the face work or someone's exposition to someone else is marked by the instantaneity that is typical to the speed of internet. Social (individual and collective) reactions are expected at the same speed that is expected from the result of a Google search.

The flow of social interactions, formerly experienced through the predominantly physical presence of the actors, is greatly replaced by the physical distance in favor of the virtual proximity. Instantaneous communication, easy access to the digital environment, the permanent cultural demand for social capital and the conflict inherent to the human condition make the virtual environment a *locus* of possible tension and anxiety. The millenary physical standard of social interaction is literally subverted by the digital technological matrix as a reference of human relations in all routine experiences and segments.

The technological standard of social interaction manifests itself through face work by remodeling the social capital, understood herein as a socially projected esteem or appreciation support that becomes virtual social capital quantified by the success or collective endorsement captured in the virtual environment. Face work in the virtual world offers comfort to people in regards to the artificial and linked drawing it may outline on its own social presentation, as Mariana Zanata Thibes and Pedro Felipe de Andrade Mancini say, contrasting with the physical social relationships as the individual's act of exposing him/herself “is made easier when the body materiality is suppressed, is made more complex by the multiplication of the observers, by the

---

difficulty to know by whom one is observed and by the accumulation of information available on individuals in the network” (THIBES; MANCINI, 2013, p. 152).

Besides, the distinction of the limits between public and private, the contours of intimacy, not only find cloudiness, but also share an environment of competition for more collection and accumulation of esteem social capital among users in the digital world (THIBES; MANCINI, 2013, p. 152-153). The outlines of the social conflicts remodel themselves in an indetermination of wellness and, thus, of the healthy or harmful development in the environment itself. The digital environment also replaces references, which affects, regardless the fact of setting an evaluating characteristic, the parameter of social orientation.

Communication distance sometimes implies in the replacement of rooted references of “experienced information” with “merely descriptive information”. Whether in the past the relevance of older people, symbolized by the elder, laid on them being a bridge of knowledge and reference from the past, the digital world allows for the direct and immediate location of answers by means of internet searches. Simultaneously, information bombing, a result of the digital environment’s progressive and immeasurable stock, makes room for superficiality and discardability in which the anxiety for the answer is associated to the impatience to enjoy it. The impact of digital pollution is also expressed in the human being’s psychological and behavioral conformation, an impact that may negatively affect his/her well-being and healthy communication flow in the society. The individual is tangled inside the virtual environment, projecting him/herself in an environment of competition for the group’s esteem social capital in which several face works are aggregated in concurrent and sometimes predatory expositions (CAVEDON; FERREIRA; FREITAS, 2015, p. 215).

Once again the abstract risk expresses itself. The conduct conformation and the potential for harmful effects created by the anguish generated by the transformation of the different alleys of life in response to technological mechanisms and the anxiety for the reaction or instantaneous response revealed in the digital environment interfere in the rite of understanding the environment as a whole. The digital environment endows people with an apparent expectation of controlling the risk that does not exist in the physical environment, overshadowing the level of risk that is inherent to the dynamics of the contemporary society. The seeming control and power are factors that

---

tend to encover the abstract risk and the existing environmental and socioenvironmental impacts.

And it is precisely in the context of concrete and abstract risk that a legal framework to protect the digital environment is necessary. That is going to be approached in the following topic.

#### 4 LEGAL FRAMEWORK FOR THE DIGITAL ENVIRONMENT

The importance of the digital world for the social construction and reconstruction involved in the self achievement and the emancipation of the human being is undeniable. Environmental gains allowed by digital communication mechanisms such as video conferencing, which made displacement unnecessary and reduced energy costs of transportation, are equally important, besides the multiplier potential of plural knowledge and democratic participation provided by communicative interaction offered by the internet.

However, human intervention in this field regarding the environment, the digital environment, cannot take place without considering environmental impacts and the generation of pollution related to it. The issue here is the need to make normative frameworks positive for effective environmental impact and for impacts deriving from the digital environment by means of public policies that are able to regulate and to present solutions concerning different subjects related to that virtual habitat such as, for example, the impacts of telecommunication systems under the holistic perspective of the environment.<sup>6</sup>

The first challenge posed to the protection of the virtual environment is social and institutional awareness that digital environmental pollution exists as a physical

---

<sup>6</sup> In a relevant paper on the subject, Couto *et al* say: "In summary, from the assumption that the acquisition of a certain level of technological Independence is an important fator in the assimilation of any state-of-the-art technology by the cultural structure of a society, one should notice that it is essential to have an innovation stategy for the acquisition of technological independence based on the concepts of *design for environment* (term that is usually used to characterize environmentally friendly designs) balanced in a harmonious mix of technological capacity and assessment of a life cycle, which may contribute to mitigate the impacts of the telecommunication systems on the environment" (COUTO; *et al*, 2013, p.67).

---

reality. Therefore, it requires overcoming the civilization paradigm of the “dualism of worlds” as if virtual was not real, as already mentioned above. That demands social understanding that digital pollution is pollution that affects the effective use of environmental assets, that demands natural resources and generates waste besides impacting the socioenvironmental levels when influencing the dynamics of human well-being.

There is an important civil regulatory framework for the internet in the Brazilian legal system that is the object of Law n. 12.965 dated April 23, 2014. However, the law referred to is totally silent in regards to the regulation of digital environmental impacts and also to a digital environmental education policy. Users’ rights, guarantees and obligations in the legislation are restricted to individual and collective aspects, but in what concerns contracts, consumer protection, safeguard of intimacy and private life and legal liability<sup>7</sup>, it is far from touching environmental impacts resulting from the use of internet.

Attention is drawn to the attributions granted to federal bodies in article 24 of Law n. 12.965 dated 2014. Although environmental education and the promotion of the sustainable use of any technology are attributions of state bodies with the collaboration of private companies and the organized civil society, the subject is not clearly and

---

<sup>7</sup> Art. 7. Internet access is essential to the exercise of citizenship and the user is guaranteed the following rights: I - inviolability of privacy and private life, protection and compensation for material or moral damages resulting from violation; II - inviolability and secrecy of the communication flow over the internet, except by judicial order, according to the law; III - inviolability and secrecy of stored private communications, except by court order; IV - not suspension of the internet connection, except for debt directly arising from its use; V - maintenance of the quality of the internet connection hired; VI - clear and complete information in service provision contracts, detailing the protection regime regarding connection records and records of access to internet applications as well as of network management practices that may affect quality; VII - not providing third parties with personal data, including connection records and access to internet applications, except by free, express and informed consent or in the cases provided by law; VIII – clear and complete information on the collection, use, storage, processing and protection of personal data, which may only be used for purposes that: a) justify collection; b) are not forbidden by the legislation; and c) are specified in service provision contracts or terms of use for internet applications; IX - express consent on the collection, use, storage and processing of personal data, which should take place in a prominent way from the other contract clauses; X - permanent exclusion of the personal data you have provided to a certain internet application, at your request, at the end of the relationship between the parties, except for the cases of mandatory record keeping provided for in this Law; XI - advertising and clarity concerning eventual use policies related to internet connection providers and internet applications; XII - accessibility, considering the physical-motor, perceptive, sensorial, intellectual and mental characteristics of the user, according to the law; and XIII - application of consumer protection and defense standards in consumer relations conducted on the Internet.

---

objectively stated as a guideline in Law n. 12.965 dated 2014<sup>8</sup>. There is a current deficit of environmental education for awareness regarding the effective or potential impact of the use of tools and instruments offered by the digital environment. In regards to the civil framework, inspection of the digital environment is mainly restricted to internet, data and information service provision, that is, just the exploration and competition in telecommunication services and consumer rights, according to Decree n. 8.771 dated May 11, 2016<sup>9</sup>.

In the context of the Brazilian legal system and under the perspective of a new culture for the assurance and effectiveness of individual and collective fundamental rights, guarantees and obligations (OLIVEIRA, 2016), legal protection of the digital environment has to be guided by sustainability public policy standards and measures (CUSTÓDIO; OLIVEIRA, 2015) as well as social awareness of environmental impacts caused by pollution. The virtual habitat is necessarily immersed in the National Policy for the Environment once it is included in its holistic concept. Thus, suitable and effective protection requires a rupture in regards to the civilization paradigm of duality between the real and the virtual worlds mentioned above. Consequently, it is important to expand to the virtual environment the provisions in Law n. 6.938 dated 1981 especially article 2, item X that establishes environmental education as an obligation in order to allow for the active participation of the society in the understanding of

---

<sup>8</sup> Art. 24. Guidelines for the actions carried out by the Federal Government, the States, the Federal District and the Municipalities in the development of internet in Brazil: I - establishing multiple participation, transparent, collaborative and democratic governance mechanisms with the participation of the government, the business sector, the civil society and the academic community; II - promoting the rationalization of the management, expansion and use of the internet with the participation of the Internet Steering Committee in Brazil; III – promoting the rationalization and technological interoperability of e-government services among the different branches and spheres of the Federation to allow for the exchange of information and the speed of procedures; IV – promoting interoperability among different systems and terminals, including the different federative spheres and various sectors of society; V – preferential adoption of open and free technologies, standards and formats; VI - publicity and dissemination of public data and information, in an open and structured way; VII - optimizing network infrastructure and stimulating the implementation of data storage, management and dissemination centers in the country, promoting technical quality, innovation and diffusion of internet applications, no harm to openness, neutrality and participative nature; VIII – developing actions and programs for internet use qualification; IX - promoting culture and citizenship; and X - provision of public assistance services to citizens in an integrated, efficient and simplified way by means of multiple access channels, including remote ones.

<sup>9</sup> Art. 17. Anatel shall work on the regulation, inspection and determination of violations pursuant to Law n. 9.472 dated July 16, 1997. Art. 18. The National Agency for the Consumer shall work on the inspection and determination of violations pursuant to Law n. 8.078 dated September 11, 1990. Art. 19. The determination of violations to the economic order is a responsibility of the Brazilian System for the Defense of Competition pursuant to Law n. 12.529 dated November 30, 2011.

---

environmental impact, whose hermeneutics should primarily be application to information storage and environmental costs of the use of tools available in the digital environment.

Environmental education is essential overcoming a culture that is strange to environmental impacts and pollution resulting from the use of information technology. In Brazil, Law n. 9.795 dated April 27, 1999 created the National Policy for Environmental Education. It includes in article 1, concerning environmental education, “the processes through which the individual and the collectivity build social values, knowledge, skills, attitudes and competences aimed at the conservation of the environment, an asset for the common use of the people that is essential to a healthy quality of life and its sustainability. The holistic environmental focus is expressly referred to in article 4, item I of the law, setting it a basic principle of education. The provision in article 5, item I adds to the holistic characteristics when setting the promotion of the “development of an integrated understanding regarding the environment in its multiple and complex relations involving ecological, psychological, legal, political, economic, scientific, cultural and ethical aspects” as one of the objectives of education.

The integrated understanding of the environment is not compatible with the edition, interpretation and application of legal standards and with the institutional, economic and social practices that separate the environment and the digital pollution from activities related to the exploration and use of natural resources. The problem of cumulative and synergic effects has to be considered even regarding energy consumption and the production of unmeasurable or uncontrollable abstract risks, including for climate consequences. In that scenario, it is important to give priority to the incidence of the precaution and prevention principles regarding the impacts generated by the progressive storage and movement of data in the digital environment. The factual expression of the impact resulting from the use of technologies for the greenhouse effect was evidenced in a report written by the Bio Intelligence Service (2008, p. 128)<sup>10</sup> according to which the use of technologies in 2008 caused about 2% of all greenhouse effect gas emissions in the European Union.

---

<sup>10</sup> The study is developed from the definition of Information and Communication Technology – ICT, addressing the levels of pollution associated to it: “in terms of equivalent CO<sub>2</sub> emissions, the ICT sector



---

In the Brazilian legal system, article 3 of Law n. 12.187 dated December 29, 2009, which created the National Policy on Climate Change, establishes the adoption of measures aimed at reducing environmental impacts due to anthropic interferences on the climate system as a diffuse and intergenerational obligation. The generation of environmental impacts by digital pollution is seen as an anthropic impact factor on the emission of pollutants. Approaching a progressively sustainable use of the tools inserted in the digital environment, aiming at awareness and reduction of the level of impacts caused by digital pollution, is a necessary inference in controlling emissions and climate effects themselves.

In what concerns environmental impacts of digital pollution on social wellness, especially behavioral and psychological impacts, environmental protection has to promote socioenvironmental measures to define the effects of the digital environment on the communication and identity human action, in the creation, implementation and assessment of public policies. That legal-institutional attitude requires an approximation between the National Policy for the Environment and the National Policy for Health, also considering the provision in article 3 of Law n. 8.080 on public health dated 1990 that lists the environment (in its holistic dimension) as one of the decisive and conditioning elements of the population's health. The conclusion is that legal protection of the digital environment – in the field of Environmental Law – necessarily communicates with the legal regime to make the right to health effective. Finally, the good social life quality has to be subject to public policies for sustainability in the virtual environment and repercussions on the physical environment. On that purpose, the first challenge is to construct a suitable legal framework for the promotion of effective public policies for environmental protection and education that encompasses hidden impacts from digital environmental pollution and that works to deconstruct the dissociation culture between the virtual and the physical environments. The use of smart networks, clean power systems in the use of the necessary natural resources to develop and maintain the virtual environment, besides awareness aimed at the sustainable and healthy use of those new technologies in that new social habitat are essential measures to fight digital pollution.

---

represented 2% of the total EU CO<sub>2</sub> emissions and is estimated to reach 4.2% in 2020 in a BAU scenario against 3% in an Eco-scenario.” (BIO INTELLIGENCE SERVICE, 2008, p. 128)

## **CONCLUSION**

The research, by means of theoretical support, starts from the assumption that the digital environment is real and thus it is not separated from the (natural and social) physical environment and that the holistic and appropriate understanding of the environment requires overcoming the Cartesian logics of dichotomy between the digital and the physical habitats. That dichotomic rationality – already overcome by Spinoza's philosophical logic of reunification between sensitive and intellect, but still culturally present in the society regarding its understanding of the virtual world as opposed to the real world – obscures the possibility to identify events as well as concrete and abstract risk control mechanisms in the virtual environment that cause impacts on the (natural and social) physical environment, generating what can be called "hidden and unconscious degradation" and, thereby, aside from social and institutional information. That culture of "unconsciousness of the virtual that is real" would result in a serious sociological deficit regarding the perception of the interaction between the digital and the physical worlds, weakening the appropriate adjustment of the virtual environment and making it difficult to adopt public policies for effective environmental protection in its holistic dimension.

Along the paper, the theory of the concrete and abstract risk in the virtual environment over the physical environment as a specific subject of Environmental Law is addressed under the focus of risk society and digital era. When such analysis was prepared, concrete and abstract risk situations pertaining to the dynamics of the virtual world were detected. They take place in the digital environment and harmfully impact the (natural and social) physical environment.

So as to understand the concrete and abstract risk of the virtual world over the (natural and social) physical world, two factual situations were assessed. In the first one, digital information management, storage, operation and flow issues that impact the exploration of natural resources were approached. Power consumption and its consequences of climate changes were specifically addressed. In the second one, the analysis covered subjects related to the individual and collective experiences in the virtual world that result in situations that harm social wellness, which is definitely affected by virtual reality, providing for crises regarding the behavioral and

psychological standards as well as the flow that produces the image and the “face work” developed in the virtual scenario that require suitable measures from policies focused on public health.

Consequently, the research confirms the lack of scientific-dogmatic legal framework that appropriately addresses the digital environment under the perspective of its potential to pollute and degrade the (natural and social) physical environment. Thereby, this paper suggests that, in the field of Law, a connection is made between legal standards and institutes to bring the National Policy for the Environment closer to the internet civil regulatory framework with special focus on environmental education, bringing about the climate effects caused by the physical repercussion of pollution from anthropic actions in the digital world. In those terms, the research suggests opening room for discussion so that sustainability is approached in the use of virtual resources and tools, special attention given to cumulative and synergetic effects that may be unchained from the standard of virtual social practices and technological resources that wrongly foster the replicated and endless accumulation of files and information.

Concerning the effects of degradation and crises related to the social dynamics due to virtual social practices and negatively affecting individual and collective wellness, the digital environmental issue should be assessed in line with public health management. The guideline is that harmful social behavior taking place in the digital environment is seen as a public health issue, that is, having a bias that is legally relevant in the social environment. Thereby, the proposition encompasses both confrontations related to the construction of the “face work” and the predatory competitiveness due to the accumulation of social capital that cause identity crises, anguish and communication isolation.

In that context, the research and the paper get to the following conclusion: in response to the problem theme (does the digital environment produce risks of impacts on the natural environment that could be seen as a scientific-dogmatic object belonging to Environmental Law?) and, backed by the theoretical framework adopted (the holistic notion of environment, which sees the virtual reality as inseparable from the physical reality), the research verifies the occurrence of the second hypothesis presented in the introduction, that is, the digital environment is connected to the (natural and social)

---

physical environment in an indissoluble way and so as to produce concrete and abstract risks with a potential to impact the holistic dimension of the environment and becoming a specific object of Environmental Law from that perspective.

## REFERENCES

AGENCE DE L'ENVIRONNEMENT ET DE LA MAÎTRISE DE L'ÉNERGIE – ADEME. **Internet, courriels: réduire les impacts**. Guide pratique. France, 2014. Available at: <<http://www.ademe.fr/internet-courriels-reduire-impacts>>. Accessed on April 5, 2017.

BECK, Ulrich. **Sociedade de risco: rumo a uma outra modernidade**. Translated by Sebastião Nascimento. São Paulo: Ed. 34, 2010.

BIO INTELLIGENCE SERVICE. **Impacts of Information and Communication Technologies on Energy Efficiency, final report. September 2008**. Available at: <[http://www.e5.org/downloads/ICT/biofraunhofere5-study-ict4ee-final-report\\_en.pdf](http://www.e5.org/downloads/ICT/biofraunhofere5-study-ict4ee-final-report_en.pdf)>. Accessed on April 24, 2017

CAVEDON, Ricardo; FERREIRA, Heline Silvini; FREITAS, Cinthia Obladen de Almendra. *O meio ambiente digital sob a ótica da Teoria da Sociedade de Risco: os avanços da informática em debate*. **Revista Direito Ambiental e sociedade**, v. 5, n. 1, 2015, p. 194-223. Available at: <<http://www.uces.br/etc/revistas/index.php/direitoambiental/article/view/3912/2318>>. Accessed on April 25, 2017.

COUTINHO, Ricardo Silva. *O meio ambiente digital e a tutela dos bens culturais*. **Revista Brasileira de Meio Ambiente Digital e Sociedade de Informação**. Vol. 1, número 1, ano 2014, São Paulo, p. 221-244.

COUTO, Renan Evangelista et al. *A análise do impacto dos sistemas de telecomunicações na perspectiva do meio ambiente*. **Relatórios de Pesquisa em engenharia de produção**, v.13, n.5, p. 54-68. Available at: <[http://www.producao.uff.br/antigo/conteudo/rpep/volume132013/RelPesq\\_V13\\_2013\\_05.pdf](http://www.producao.uff.br/antigo/conteudo/rpep/volume132013/RelPesq_V13_2013_05.pdf)>. Accessed on April 27, 2017.

CUSTÓDIO, Maraluce Maria; OLIVEIRA, Márcio Luís de. Eco-efficiency in bidding processes to purchase everyday supplies for the Brazilian federal administration. **Veredas do Direito**, Belo Horizonte, v.12, n.24, p.33-61, Jul/Dec 2015. Available at: <<http://www.domhelder.edu.br/revista/index.php/veredas/article/view/647/454>>. Accessed on May 5, 2017.

FARIA, Ivan Dutra. **Compensação ambiental: os fundamentos e as normas; a gestão e os conflitos**. Available at:

---

<<http://www2.senado.gov.br/bdsf/bitstream/id/99899/1/textoparadiscussao43IVAN DUTRAFARIA.pdf>>. Accessed on September 26, 2013.

FIORILLO, Celso Antônio Pacheco. OOSTERBEEK, Luiz. *Tutela jurídica das 'cidades digitais' na sociedade de informação como instrumento de inclusão cultural, social, econômica e ambiental, em face do Direito Ambiental constitucional brasileiro*. **Revista Brasileira de Meio Ambiente Digital e Sociedade de Informação**, v. 1, nº 1, São Paulo, 2014.

FIORILLO, Celso Antônio Pacheco; FULLER, Greice Patrícia. *Tutela Constitucional da Internet no Brasil em face do Meio Ambiente Digital*. In: **Os 20 anos da internet no Brasil, seus reflexos no meio ambiente digital e sua tutela jurídica na sociedade de informação**. São Paulo: FMU, 2015, v. 1.

GUIMARAES, Francisco. **Direito, ética e política em Spinoza: uma cartografia da imanência**. Rio de Janeiro: Lumen Juris Editora, 2011.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA – IBGE. **Pesquisa Nacional por Amostra de Domicílios. Síntese de indicadores**. Rio de Janeiro, 2014. Available at: <<http://biblioteca.ibge.gov.br/visualizacao/livros/liv94935.pdf>>. Accessed on April 15, 2017.

LEITE, Flávia Piva Almeida; FIORILLO, Celso Antônio Pacheco. *Sustentabilidade no meio ambiente cultural – o exercício da liberdade de expressão na sociedade de informação*. **Veredas do Direito: Direito Ambiental e Desenvolvimento Sustentável**, [S.l.], v. 13, n. 26, p. 337-360, out. 2016. ISSN 21798699. Available at: <<http://www.domhelder.edu.br/revista/index.php/veredas/article/view/858/510>>. Accessed on April 28, 2017. doi:<http://dx.doi.org/10.18623/rvd.v13i26.858>.

LUHMANN, Niklas. **O direito da sociedade**. Translated by Saulo Krieger and Alexandre Agnolon. São Paulo: Martins Fontes, 2016.

OLIVEIRA, Márcio Luís de. **A Constituição juridicamente adequada**. 2ª ed. Belo Horizonte: D'Plácido, 2016.

PARDO, José Esteve. **Técnica, riesgo y derecho**. Barcelona: Ariel, 1999.

RECUERO, Raquel. *Curtir, compartilhar, comentar: trabalho de face, conversação e redes sociais no Facebook*. **Verso e Reverso**, vol. XXVIII, n. 68, May-August 2014, p. 114-124.

SPINOZA, Baruch. **Ética: demonstrada según el orden geométrico**. Madrid: Editora Nacional, 1980.

THE GUARDIAN JOURNAL. **Can the digital revolution be environmentally sustainable?**. November 13, 2015. Available at: <<https://www.theguardian.com/global/blog/2015/nov/13/digital-revolution-environmental-sustainable>>. Accessed on April 21, 2017.

THIBES, Mariana Zanata; MANCINI, Pedro Felipe de Andrade. *A apresentação do eu na sociabilidade virtual: a economia libidinal da amizade*. *Ide* (São Paulo), São Paulo, v. 35, n. 55, p. 149-163, jan. 2013. Available at <[http://pepsic.bvsalud.org/scielo.php?script=sci\\_arttext&pid=S0101-31062013000100012&lng=pt&nrm=iso](http://pepsic.bvsalud.org/scielo.php?script=sci_arttext&pid=S0101-31062013000100012&lng=pt&nrm=iso)>. Accessed on April 28, 2017.

UNITED NATIONS. **Report of the United Nations Conference on the human environment**. Stockholm, 5-16 June, 1972. Available at: <[http://www.un.org/en/ga/search/view\\_doc.asp?symbol=A/CONF.48/14/Rev.1](http://www.un.org/en/ga/search/view_doc.asp?symbol=A/CONF.48/14/Rev.1)>. Accessed on April 20, 2017.