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Probabilistic Liability and Judicial Insurance for Environmental Risks

Çevresel Risklere İlişkin Olasılıksal Sorumluluk ve Yargısal Sigorta

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Abstract This study analyzes the responsibility framework for environmental risks from legal, economic, and philosophical perspectives, focusing on both individual and state-level accountability. Recognizing the need for proactive (ex-ante) risk management, we challenge the current frameworks that only respond after damage occurs. Tort liability, which operates on the damage-compensation axis, has disadvantages in terms of environmental protection. Besides, pre-determined norms can lead to standards that are either excessively strict or too lenient than necessary before damage occurs. Moreover, the stochastic nature of environmental risks renders them unsuitable for purely normative consideration. We argue that pure normative approaches fail to consider the case-specific and dynamic nature of environmental risks. Instead, our study proposes probabilistic liability. The legal foundation of probabilistic liability lies in the recognition that the customary no-harm obligation encompasses the risk of harm as well. The research question of our study is: What is the legal consequence of causing a risk of harm? Drawing on insights from the theoretical arguments of the reality of risk, probabilistic causation, and risk attribution, we propose an innovative solution: courts mandating "judicial insurance" for those posing environmental risks. Courts may identify the coverage gap resulting from activities altering risk values and impacting sustainability in the incident under consideration. To address this gap, courts may enforce insurance obligations on operators under market conditions. This introduces a probabilistic liability model applicable to both states and individuals. This novel approach offers a more effective and adaptable mechanism for managing environmental risks while ensuring accountability and sustainability.

Keywords Environmental Risk · Environmental Litigation · Probabilistic Liability · Reality of Risk · Risk Attribution · Judicial Insurance

Anahtar Kelimeler Çevresel Risk · Çevresel Yargılama · Olasılıksal Sorumluluk · Riskin Gerçekliği · Risk İsnadı · Yargısal Sigorta

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Extended Summary

A critical challenge in environmental law is the environmental protection gap. This gap exists because environmental changes that we perceive as "risky" or "polluting" may not translate into immediate, legally actionable damage. For instance, gradual increases in pollution levels might not cause immediate damage but pose a significant long-term risk to ecosystems and human health. To close this gap, banning certain categorical behaviors represents a punitive methodology. Criminal law is concerned with whether a violation has occurred under the criminal norm, rather than the damage. The threshold for criminal liability is indeed the norm itself, while the sanction is categorical. However, the criminal law terminology proposed by Roberto Ago was not adopted in the 2001 ARSIWA. It is particularly challenging to address environmental risks solely through normative responsibility. Norms lack the flexibility to evolve in response to environmental data. Once norms are established, they inherently serve as a basis for responsibility. It is not feasible to argue that these norms are either too flexible or too strict on a case-by-case basis. Furthermore, the ability of the individual who committed a normative violation in the case to present contrary evidence is diminished. Therefore, environmental risks should be addressed through a contentious approach. This implies that instead of the regulation-centric "police" approach in precautionary policy, the dispute resolution-focused "nuisance" approach should be favored.

In the nuisance approach, courts have been criticized for only assessing compensation after damage has occurred or addressing violations of casuistic norms. The limited application of the principle of prevention solely within procedural obligations underscores the need to develop new legal avenues that courts can implement. How should courts establish disputes on environmental risks? How consistent is it to consider all elements of the environment based on property rights, starting from the tragedy of the commons? In our study, we explore the implications of addressing environmental issues, often expressed as negative externalities, through the lens of sovereignty and property concepts. Some argue that optimal environmental protection can be achieved through disputes based on property rights. However, this viewpoint has faced criticism due to the expansive powers granted by property rights. We advocate for sustainability as the guiding principle for environmental protection, rather than solely relying on property rights. Our framework, anchored in sustainability, seeks to elucidate the liability regime stemming from environmental risks.

The advancements in modern physics, exemplified by the 2022 Nobel Prize in physics, have unveiled a probabilistic understanding of physical reality. These developments, highlighting probabilistic causality and attribution, are particularly significant in judicial proceedings where data from natural sciences are utilized. Our study delves into the reality of risk, drawing a distinction between probability and possibility to better understand and address environmental challenges. IPCC characterizes real possible risks by assigning various values such as "virtually certain" or "very likely" to specific probability ranges. The judicial significance of this qualification lies in the judge's ability to impose legal sanctions on individuals and states who cause possible risks. This is because causing risk warrants legal examination, akin to causing harm, due to the probabilistic structure of physical reality, which allows for the attribution of responsibility based on probability assignments.

The final impetus to broaden the *locus standi* of environmental risks lies in their attributable nature. The ability to ascertain diseases and other damages caused by environmental risks enables the assignment of probabilities to the actions responsible for the risk in question. The institution that establishes liability to this extent of probability is ultimately presented as judicial insurance. Conditions of judicial insurance as follows: i- There is a possible risk against environmental sustainability; ii- This risk should be attributed to the defendants and directed to the plaintiffs, and iii- The risk should not create irreversible environmental pollution and should not violate minimum safety standards. Courts can identify the coverage gap resulting from the risk caused by business owners and establish an insurance policy to mitigate this gap. To achieve this, the court may conduct an open tender for insurance companies to insure the determined amount, ensuring premiums align with market conditions. Consequently, individuals and states exposed to risk obtain environmental assurance. Our study advocates for a probabilistic liability model that can be applied at international, human rights, and national levels.

Specific details regarding the jurisdiction, nature, and conditions of judicial insurance are also provided. When causing risk is recognized as a liability, the insurance institution no longer serves as a "license to pollute." In categorical compulsory insurance, insurers' role as environmental commissars is balanced. The moral hazard problem arising after insurance, stemming from the free insurance market, is addressed. Optimal public intervention in environmental risk management is proposed as a dynamic and contested system with risk liability before

international and national courts. Thus, the aim is to diversify legal instruments for achieving environmental sustainability goals.

Introduction

In international environmental law, the pre-damage liability regime is crucial for environmental protection. Pre-damage liability regimes in international environmental law aim to hold actors accountable for the risk of environmental harm, not just proven damage. Changes in environmental risk values stemming from the activities of individuals and states have not been adequately addressed by existing liability law institutions. Because risk changes cannot be equated with damage, institutions such as tort law, human rights judiciaries, and state responsibility frameworks, which primarily operate on the damage-compensation axis, are unable to offer an effective solution. This highlights the need for exploring alternative legal mechanisms or frameworks that can effectively address the probability of damage.

The precautionary practice in environmental risks is shaped by tools applied in regulatory approaches (police) or dispute resolution models (nuisance). Legal systems based solely on pre-established rules (normative responsibility)[1] for environmental liability might not be sufficient. These rules, sometimes based on the principle of "*res ipsa loquitur*" (meaning "the thing speaks for itself"), assign strict liability in certain situations. However, they may not be flexible enough to adapt to the evolving nature of environmental risks and new scientific understanding. Considering the variability of standards stipulated by the concept of due diligence,[2] which is effective in the legal assessment of environmental risks, a policy that emphasizes case-specific investigations is crucial. Traditional legal approaches often fall short in addressing environmental risks. Tort law, which deals with compensating for damages after they occur, requires a clear demonstration of harm to a recognized person or entity. In terms of environmental law, restitution and compensation require the measurability of damage to the extent that it presents a cost. Challenges in this regard are set out in the 2001 ARSIWA commentary.[3] Another issue raised in the 2001 Draft Articles on Prevention and *Alabama* case is that environmental protection involves not only damage but also the risk of damage.[4] However, a comprehensive and efficient solution has not been produced regarding how risk will be handled in the practice of liability law. In addition to the theoretical discussions on principles, contentious rights also come to the fore in related cases. Considering the *Gabčíkovo-Nagymaros* case in particular, the Court rejected Hungary's argument for "*a grave and imminent danger of one of the fundamental interests of the state*", which aims at the possibility of pre-damage sanction with the precautionary principle, due to the "*uncertain nature of the risks*".

The legal distinction between environmental risks or changes and actual legal damage goes beyond procedural difficulties in proving damage. It also presents a substantive law issue. Currently, the framework

[1] Normative responsibility stands for regulating *ex-ante* environmental liability based on categorical *res ipsa loquitur* restrictions. Our study explains that this punitive precautionary system would not dynamically reflect the scientific observations to environmental policies.

[2] Jorge E. Viñuales, 'Due Diligence in International Environmental Law: A Fine- grained Cartography' in Heike Krieger, Anne Peters and Leonhard Kreuzer (eds), *Due Diligence in the International Legal Order* (Oxford University Press 2020) 126.

[3] *Draft articles on Responsibility of States for Internationally Wrongful Acts, with Commentaries* (2 edn, Yearbook of the International Law Commission 2001) 101, para. 15.

[4] International Law Commission, *Draft Articles on Prevention of Transboundary Harm from Hazardous Activities* (Yearbook of the International Law Commission 2001); Nataša Nedeski and André Nollkaemper, 'A Guide to Tackling the Collective Causation Problem in International Climate Change Litigation' EJIL Talk <https://www.ejiltalk.org/a-guide-to-tackling-the-collective-causation-problem-in-international-climate-change-litigation/ > accessed 22/04/2024; Viñuales (n 2) 122. In fact, practices such as the prevention principle, the precautionary principle, and environmental impact assessment clearly demonstrate the necessity of establishing a robust legal infrastructure for environmental risk management, rather than focusing solely on the outcome of "damage." This study aims to contribute to this legal framework by exploring probabilistic liability and judicial insurance mechanisms.

might not adequately capture subtle environmental changes that haven't yet caused quantifiable damage to the assets of a legal person (e.g., property, resources, ecosystem services). This poses a challenge because it might be difficult to hold actors accountable and prevent further environmental degradation. To address this gap, legal frameworks need to consider how environmental changes can be recognized and addressed even before they translate into significant economic or physical damage to the "assets" of individuals, communities, or states. This could involve developing mechanisms to assess potential risks and ensure timely accountability for environmental violations. Our research question comes after the fact that "risky" or "pollution" does not always mean legally acceptable damage: "How can we diversify our legal instruments in case of possible environmental risks?" More specifically, "If the customary rule of no-harm obligation also prohibits the risk of harm,[5] what should be the legal consequences of causing the risk of harm?" Current liability systems struggle to keep pace with environmental protection needs, necessitating novel approaches like risk responsibility institutions. In addition, environmental sustainability encompasses different variables and symptoms than changes in the assets of legally recognized persons. Risk responsibility will, at the very least, provide an ex-ante operation by removing contentious rights from being reserved for the aftermath of the damage. The legal consequence of the risk-causing phenomenon will be provided by the insurance institution, which is the most established legal practice for risk. Furthermore, in addition to questioning the adequacy of categorical guarantees in compulsory insurance currently organized for hazardous activities, problems such as adverse selection and moral hazard will be eliminated through dynamic risk responsibility. Considering the differences between national and international law, the idea of imposing an obligation on persons or states that cause risks to insure these risks is applicable at both levels. Our study highlights the police-nuisance dialectic instead of national-international differences. According to this distinction made by Morag-Levine in her article 'The History of Precaution', the police approach emphasizes regulations that include *res ipsa loquitur* restrictions in precautionary policies. The nuisance approach, on the other hand, focuses on the judicial resolution of environmental disputes. The main problem at this point is that nuisance-based precautionary policies, which prioritize judicial application, only discuss norm violations or compensation for damages. The *Urgenda* and *Leghari* cases, referred to as the activist judiciary, envisage the administration's duty to establish norms from the same perspective. The paradigm we propose is an approach that elaborates on the risk of damage, not norm violation or damage.

In our study, a theoretical inquiry will be made based on cases and scientific views on environmental risks. First, the reality of risk, then its importance in nuisance-based precaution, and third, the attribution of risk are discussed. As a result of these inquiries, the details of our proposal, which allows the courts to establish an insurance provision regarding environmental risks, are explained in the last chapter. Thus, a new responsibility paradigm is proposed based on the basic dynamics of the nuisance-based approach.

I. The Reality of Risk

In the modern sense, scientific studies have acknowledged the physical reality's probabilistic and stochastic nature.[6] This texture requires *ex-post* determinist approaches to be questioned in the field of

[5] Nedeski and Nollkaemper (n 4).

[6] The 2022 Nobel Prize in Physics was awarded for work on the proof of quantum probability calculus, negating the idea of a "mechanism (*spukhafte Fernwirkung*) that might be thought to be not fully known" in the properties of entangled particles. Our study makes a distinction regarding the application of responsibility before and after the damage. The precaution, that express *ex-ante* practice for environmental protection includes police and nuisance policies. See. Noga Morag-Levine, 'The History of Precaution' [Oxford University Press] 62 The American Journal of Comparative Law 1095 Our proposal is regarding the nuisance aspect of precaution. The scientific basis of this proposal, which is based on the temporality of responsibility, is entropy, which is the basis of linear time. For the relation of entropy to probability, see. Greg M Anderson and David A Crerar, 'Statistical Interpretation of Entropy' in *Thermodynamics in Geochemistry: The Equilibrium Model* (Oxford Academic, Oxford University Press 1993) <https://doi.org/10.1093/oso/9780195064643.003.0010> accessed 6/1/2023

environmental responsibility law. Indeed, the prevention and mitigation responsibilities for the expected risks have been discussed in the literature, while the tort mechanism focuses on the *ex-post*.[7] The paradigm of science, which is the language of human-environment relations in the modern sense, starting with the ideal of reaching certain knowledge and turning to the science of uncertainty, is decisive in the dynamics of responsibility.[8] Reasons such as the inability to make purely objective observations, the inability to derive deterministic causality from the observed mechanisms, and the critical and skeptical approach to all kinds of information have led science to produce refutable conjectures. Conjectures underlie the legal rules and principles needed for optimal precaution in managing uncertainty. The phenomenon we define as risk in precaution practices reveals the internalization of linear time-dependent changes in legal and economic systems. When quantifying the qualities observed in nature, we encounter the concepts of probability and possibility. Hopster does not clearly see the relationship between probability and "real" possibility.[9] There may be a lack of knowledge that leads people to take precautions.[10] The precautionary approach becomes particularly relevant when considering the realistic value range of potential outcomes and credible threats associated with various activities.[11] Certain evidence is needed to determine "real possibilities" where the latter is preferred.[12] Evidential probability at this point can play an active role in defining real possibilities.[13] Therefore, some probabilities can be scientifically attributed to the occurrence of an important result.[14] In this context, the IPCC has assigned various values to certain probability ranges, such as virtually certain or very likely.[15] These qualitative values also appear at the level of second-order probabilities.[16] Second-order probabilities assess the epistemic questioning and reliability of evidence, unlike first-order probabilities, that refer to the evidence itself.[17] Issues such as the probabilistic relationship of the evidence and expert

[7] Michael Davis, *Thinking like an engineer: studies in the ethics of a profession* (Oxford University Press 1998) Mike W. Martin and Roland Schinzinger, *Ethics in engineering* (4th , [international] edn, McGraw-Hill 2005) Ibo van de Poel and Lambèr Royakkers, *Ethics, Technology and Engineering* (2011); Ibo van de Poel and Jessica Nihlén Fahlquist, 'Risk and Responsibility' in Sabine Roeser and others (eds), *Handbook of Risk Theory: Epistemology, Decision Theory, Ethics, and Social Implications of Risk* (Springer Netherlands 2012) <https://doi.org/10.1007/978-94-007-1433-5_35> 884.

[8] Kostas Kampourakis and others, 'Uncertainty Is Inherent in Science' in *Uncertainty: How It Makes Science Advance* (Oxford Academic, Oxford University Press 2019) <https://doi.org/10.1093/oso/9780190871666.003.0011> accessed 5/17/2023; Edward R. Dougherty, 'The Evolution of Scientific Knowledge: From Certainty to Uncertainty ' in (SPIE 2018) <https://lens.org/006-835-727-815-897>

[9] Jeroen Hopster, 'Climate Uncertainty, Real Possibilities and the Precautionary Principle' Erkenntnis 10.

[10] Stephen M. Gardiner, 'A core precautionary principle' 14 Journal of Political Philosophy 33, 47.; Hopster (n 9) 10.

[11] Gardiner (n 10) 51.; Hopster (n 9) 10.

[12] Hopster (n 9) 10.

[13] For example, the complete melting of West Antarctic glaciers 1.5 to 2 degrees Celsius above preindustrial levels is a proposition supported by evidential probability. See. F Pattyn, C Ritz and E Hanna, 'The Greenland and Antarctic Ice Sheets under 1.5 °C Global Warming' 8 Nature Climate Change 1053; Hopster (n 9) 11.

[14] Dominic Roser, 'The Irrelevance of the Risk-Uncertainty Distinction' 23 Science and Engineering Ethics 1387; Russell Powell, 'What's the Harm? An Evolutionary Theoretical Critique of the Precautionary Principle' 20 Kennedy Institute of Ethics Journal 181; Hopster (n 9) 11.

[15] Michael D. Mastrandrea and others, 'The IPCC AR5 guidance note on consistent treatment of uncertainties: a common approach across the working groups' 108 Climatic Change 675; Hopster (n 9) 12.

[16] Toby Ord, Rafaela Hillerbrand and Anders Sandberg, 'Probing the Improbable: Methodological Challenges for Risks with Low Probabilities and High Stakes' 13 Journal of Risk Research 191; Hopster (n 9) 12. On the value dependence on risk, see. Paul B. Thompson, 'Risking or being willing: Hamlet and the DC-10' 19 The Journal of Value Inquiry 301; Douglas MacLean, *Values at Risk* (Rowman & Allanheld 1985); K. S. Shrader-Frechette, (University of California Press 1991); Sven Ove Hansson, *Setting the Limit: Occupational Health Standards and the Limits of Science* (Oxford University Press 1998); Sven Ove Hansson, 'A Panorama of the Philosophy of Risk ' in Sabine Roeser and others (eds), *Handbook of Risk Theory: Epistemology, Decision Theory, Ethics, and Social Implications of Risk* (Springer 2012) 29. See also. Mary Gibson, 'Quantified Risk Assessment' in James M. Humber and Robert F. Almeder (eds), *Quantitative Risk Assessment: Biomedical Ethics Reviews · 1986* (Humana Press 1987) <https://doi.org/10.1007/978-1-59259-656-0_7>

[17] Ord, Hillerbrand and Sandberg (n 16) 12.

[18] In Aristotle's terminology, *Sophia* has an impact on *phronesis* and human action when it reveals evidence that it can make predictions for the future. This categorical transitivity brings doxastic tools such as *phronesis*-specific expert consensus to the field of physics that is a part of *Sophia*.

[19] Mastrandrea and others; Hopster (n 9) 12.

consensus[18] on the evidence are taken into account in these assessments.[19] The possibility of probabilities requires considering the probabilities of both orders.

These qualitative values, which act as a bridge in the transition from probability to possibility, should not be confused with facts.[20] Primarily, nonepistemic values developed for risk policies and epistemic values are different concepts. Epistemic values related to the functioning of science include reaching the truth, simplicity, explanatory power and avoiding mistakes.[21] These standards of evidence are important elements that support the notion of "real possibility" in risk assessment.[22] In fact, establishing a *quid juris* reality by assigning qualitative values to the qualities in nature after quantifying them is a dialectical reaction. Thus, risk should be seen as a synthetic concept that has a physical reality domain[23] but is constructed by attributing certain values. Otherwise, accepting it as a purely natural or normative concept means ignoring the components of the concept.[24]

In conclusion, risk is not a nominal phenomenon expressing a mere assumption about the future[25] but rather a reality with theoretical and practical validity. Risk theorists see risk as a natural concept rather than a normative concept.[26] In the next chapter, the nature of the risk will be evaluated judicially.

II. Judicial Importance of the Reality of Risk

When the reality aspect of the risk is evaluated judgmentally, it is expected that the probability scale should exceed *de minimis* limit.[27] In the reasoning of evidential probabilities, it is necessary to consider philosophical distinctions. Rational probability calculations also refer to a *quid facti* basis in the above title. While distinguishing between rational and factual truths, Leibniz justifies rational truths with the contradiction that the opposite contains and factual truths with the principle of sufficient reason.[28] It has been demonstrated above that the evidence for risks can produce "factual" truths or real possibilities. This means a different paradigm that points to the ability to develop new *ex-ante* procedural tools apart from classical environmental judgments that assess already incurred damage and past norm violations. In fact, damage in the retrospective aspect of factual truth is not only a factual but also a legal phenomenon in terms of epistemic and in the context of meeting legal conditions such as being directed to a legally recognized person. Even if we characterize a change in the environment as "pollution" or "risky", this distinction leads

[20] Hansson (n 16) 32-33.

[21] Carl G. Hempel, 'Inductive inconsistencies' 12 Synthese 439; Isaac Levi, 'On the Seriousness of Mistakes' [Cambridge University Press] 29 Philosophy of Science 47; Robert Feleppa, 'Epistemic utility and theory acceptance: Comments on Hempel' 46 Synthese 413; John C. Harsanyi, 'Bayesian decision theory, subjective and objective probabilities, and acceptance of empirical hypotheses' 57 Synthese 341; Hansson (n 16) 32.

[22] Hansson (n 16) 33.

[23] What is meant here is not an a priori reality. It is the reality of the phenomenon on which the risk interpretation is based. On the fact that the risk is not based on an a priori reality, see. Boel Berner, 'Constructing risk and safety in technological practice: an introduction' in Boel Berner and Jane Summerton (eds), *Constructing Risk and Safety in Technological Practice* (Routledge 2003) <https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1467-9566.2007.01059_3.x> 6-7; Niklas Möller, 'The Concepts of Risk and Safety' in Sabine Roeser and others (eds), *Handbook of Risk Theory: Epistemology, Decision Theory, Ethics, and Social Implications of Risk* (Springer 2012) 79.

[24] For individual and cultural views on risk, see. Mary Douglas and Aaron B. Wildavsky, *Risk and culture : an essay on the selection of technical and environmental dangers* (1st pbk. print edn, University of California Press 1983) Paul Slovic, *The perception of risk* (Earthscan Publications 2000) Judith A. Bradbury, 'The Policy Implications of Differing Concepts of Risk' [Sage Publications, Inc.] 14 Science, Technology, & Human Values 380, 77.

[25] The nominal aspect of risk is an undeniably important component. In addition, risk is not a purely nominal phenomenon, nor does the nominal aspect of risk imply an ordinary assumption. For the relationship between risk and trust, see. Philip J. Nickel and Krist Vaesen, 'Risk and Trust' in Sabine Roeser and others (eds), *Handbook of Risk Theory: Epistemology, Decision Theory, Ethics, and Social Implications of Risk* (Springer Netherlands 2012) <https://doi.org/10.1007/978-94-007-1433-5_34>

[26] Möller (n 23) 71.

[27] On the relation between real possibility and *de minimis*, see. Hopster (n 9) 11.

[28] Brandon Look, 'Gottfried Wilhelm Leibniz' The Stanford Encyclopedia of Philosophy <https://plato.stanford.edu/archives/spr2020/entries/leibniz/> accessed 22/04/2024.

to cases in which we cannot characterize it as "damage". At this point, it is necessary to develop nuisance-based facilities instead of normative *res ipsa loquitur* restrictions to close the environmental protection gap of tort law.[29] Possible risks in the forward-looking aspect of factual truth may also be subject to judgment in certain legal circumstances to address certain practical needs. At this point, we mention the realist law school that emphasizes conflict resolution and judicial practices.

The sociology-based reaction that emerged in the early 20th century as a reaction to the introverted understanding of rational law showed itself as the Free School of Law (*Freirechtschule*) and the School of Jurisprudence of Interests (*Interessenjurisprudenz*) in Germany, the Free Scientific Research School (*Libre Researches Scientifique*) and Scientific School (*Ecole Scientifique*) in France, and Sociological Jurisprudence in the US.[30] These ideas developed in the U.S. gave birth to the realist legal movement.[31] The behaviorist approach that we encounter in the international legal literature[32] is another mainstay of the realist law school.[33] Although it is based on the observational approach against rational logic, it has references such as the sense of justice that evokes ideal law.[34] However, judicial practices that allow social and environmental realities to be taken into account dynamically are a distinctive feature of this movement.[35] The realist law view coincides with the requirement for a case-specific approach in the management of environmental risks. We can consider "real" possible risks that are as factual as damage. In addition, the sociological approach in the realist legal movement corresponds to Beck's positioning of modern societies as observing, systematizing and managing the risks they face.[36] In fact, the concept of risk has a significant effect on the scale of freedom and security, which expresses a socially authentic dichotomy. Douglas argued that the institutionally embedded cultural biases that shape the social construction of risks also establish references to responsibility and condemnation.[37] Thus, an interactive relationship is established between the applied law and society and risks. This relationship has a contentious character between the environment, state,

[29] Normative restrictions are the first tools that come to mind for environmental protection. However, when the environment is mentioned, it is necessary to apply a methodology suitable for natural sciences in the field of law, in which observation, not deductive norms, comes to the fore. Once the norms are in effect, the possibility of testing that environmental protection is too flexible or stringent is limited. Because the normative responsibility envisages categorical sanctions for categorical acts. Additionally, amendments can get caught up in cumbersome bureaucratic processes. In this respect, our work aims to develop nuisance-based facilities in environmental precaution.

[30] Ülker Gürkan, *Hukuki Realizm Akımı* (Sevinç Matbaası 1967) 2.

[31] On the fact that the event-specific character of realism came to the fore in the US and the exclusion of morality was emphasized in Sweden, see. Ibid 3.

[32] Anne van Aaken, 'Behavioral International Law and Economics' 55 Harvard International Law Journal 421; Tomer Broude, 'Behavioral International Law ' [The University of Pennsylvania Law Review] 163 University of Pennsylvania Law Review 1099

[33] Gürkan (n 30) 3.

[34] Rudolf von Jhering, *Geist des römischen Rechts auf den verschiedenen Stufen seiner Entwicklung*, vol 3 (Breitkopf und Härtel 1865) 302.; Gürkan (n 30) 7.

[35] While the realist legal movement emphasized the judicial practice, it did not completely reject the rational ground. See. Hessel E. Yntema, 'Rational Basis of Legal Science' 31 Columbia Law Review 925 Indeed, Spinoza stated that knowledge is possible with an axiomatic basis. See. Baruch Spinoza, *The Ethics* (R.H.M. Elwes tr, Blackmask 2001) In contrast, the topical approach focuses on the dialectic and consensus, not positive norms. It deals with the *sui generis* logic of law on the basis of persuasion. See. Yasemin Işıktaç and Sevtap Metin, *Hukuk Metodolojisi* (Filiz 2003) 74-77. Similarly, for the concept of *ex aequo et bono*, which finds its place in international legal sources with references to "good", "just" see. Leon Trakman, 'Ex Aequo et Bono: De-mystifying an Ancient Concept ' 8 Chicago Journal of International Law 621

[36] Ulrich Beck, *Risk Society : Towards a New Modernity* (Sage Publications 1992) For the criticism that Beck does not fully understand the concepts of risk analysis and probability in his work, see. Scott Campbell and Greg Currie, 'Against Beck:In Defence of Risk Analysis' 36 Philosophy of the Social Sciences 149 However, Beck focuses on responses to risk, not on the nature of risk. See. Hauke Riesch, 'Levels of Uncertainty' in Sabine Roeser and others (eds), *Handbook of Risk Theory: Epistemology, Decision Theory, Ethics, and Social Implications of Risk* (Springer Netherlands 2012) <https://doi.org/10.1007/978-94-007-1433-5_4> 100. For cultural theory, which is the other of the two influential social risk theories, see. Douglas and Wildavsky While Douglas and Wildavsky focus on the cultural construction of risks, Beck defines risk as a way of dealing with hazards in a systematic way. See. van de Poel and Fahlquist (n 7) 881. For the relationship between the concept of risk and risk-based policy processes, see. Bradbury On the concept of risk in social sciences, see. Ortwin Renn, *Concepts of Risk : A Classification* (Universitätsbibliothek der Universität Stuttgart 2010) Rolf Lidskog and Göran Sundqvist, 'Sociology of Risk' in Sabine Roeser and others (eds), *Handbook of Risk Theory: Epistemology, Decision Theory, Ethics, and Social Implications of Risk* (Springer Netherlands 2012) <https://doi.org/10.1007/978-94-007-1433-5_40> On the idea of collective responsibility for risks, see. van de Poel and Fahlquist (n 7) 890-895.

[37] Mary Douglas, *Risk Acceptability According to the Social Sciences* (Russell Sage Foundation 1985); van de Poel and Fahlquist (n 7) 885.

society, individuals and future generations for risks. Therefore, judicial practice on environmental problems means the judgment of contentious rights.

In the article "*The Problem of Social Cost*" written by Ronald Coase, the contentious aspect of environmental damage was emphasized. Accordingly, although environmental lawyers have a one-sided view of the source of pollution in environmental damage, it is actually the victims who are exposed to and claim that environmental activities cause damage. In other words, our acquis on environmental damage stems from the contentious rights that arose in this area.[38] In fact, our study has a parallel attitude while presenting the definition of damage on the condition that it is directed to the legally recognized person. The mechanism of "*ground and eliminate conflict*", known as the Coase theorem, focuses on the right to property to internalize environmental changes in the legal system.[39] Indeed, as long as activities that threaten environmental sustainability violate the property rights granted to individuals, contentious ground is set in the legal system. In our opinion, however, the environment and human dialectic are not suitable relationships for the environment to handle only in the context of human rights. The system, which the European Court of Human Rights generally considers in the context of the right to respect for private and family life and references property and life rights, is reasoning devoid of "*grounding conflict*", as Coase puts it. Additionally, relying on property rights, which give the highest rights over the things with *usus*, *fructus* and *abusus* powers beyond the sovereign authority of the state, neglects the mechanism of nature.[40] Environmental sustainability has variables in the field of study of natural sciences, unlike the parameters in which the property right is limited. Another issue that Coase neglects the functioning of the environment is the view that conflicting parties with bargaining power will always find the optimal solution under the right economic conditions where the transaction cost is zero, regardless of the legal liability system and predetermined property relations.[41] For example, if installing a filter in a factory chimney is the optimal solution, this will be the result. However, we cannot guarantee that the "optimal" solution mentioned here will always be the most suitable option for the environment.[42] In our opinion, human needs for law, responsibility, and justice are the reflection of sustainability or, in Spinoza's words, the *conatus* motive. This motive, which stems from its own existence, requires that its environment be sustainable when it is externalized. Being the starting point of human sustainability indicates that they adopt a precautionary pragmatism that is not entirely objective in terms of reference value to maintain but is not content with proximate causation. This precaution requires not only environmental damage but also making the risks of damage contentious. For example, depending on the case under investigation, the magnitude of risk may lower the standards of evidence, and the burden of proof may be shifted.[43] Therefore, the correct grounding of conflict can be built on the conflict of risk in environmental precaution. In this respect, it is important for Coase's theory to emphasize the contentious nature of environmental disputes. Our work aims to provide people whose rights are at risk before damage occurs with innovative legal tools that they can use.

[38] Ronald H. Coase, 'The Problem of Social Cost' [[University of Chicago Press, Booth School of Business, University of Chicago, University of Chicago Law School]] 3 The Journal of Law & Economics 1; Michael G. Faure and Roy A. Partain, *Environmental Law and Economics: Theory and Practice* (Cambridge University Press 2019) 19.

[39] Faure and Partain (n 38) 19 ff.

[40] The inherent interconnectedness of life can be observed and studied through the mathematical and analytical tools of modern science. This "mathematical connectivity" allows us to model complex systems, understand interactions, and predict potential outcomes. For a discussion on the need to prioritize a connective life culture over a culture of possession, and how this cultural shift might be related to the concept of mathematical connectivity in modern scientific methodology, see. Türker Kılıç, *Yeni Bilim Bağlantısallık Yeni Kültür Yaşamdaşlık* (Ayrıntı 2023)

[41] Faure and Partain. (n 38) 20-21.

[42] Ibid 21 ff.

[43] Hopster (n 9) 7.

III. Risk Attribution

Regarding risk attribution, Leibniz's methodology can be followed. Courts may acknowledge changes in risk values as factual and impose specific proof requirements based on the principle of sufficient reason. The attribution of the proven change to the defendants can be established by subjecting the relevant activity to the *conditio sine qua non* test,[44] grounded in rational principles. This distinction, grounded in Leibniz's classification, implies that the judge should initially rely on the causality supported by data demonstrating that risk values have changed. At this stage, the defendant is expected to provide evidence to refute the presumption of causality. In the second stage, the judge should examine, *ex officio*, whether the risk values could have changed without the defendant's activity. This method ensures that the burden of proof is managed in a balanced manner, allowing for an objective evaluation of causality based on both presented evidence and the principle of sufficient reason. By integrating philosophical rigor into legal reasoning, this approach strengthens the foundation for liability, providing a more comprehensive and rational basis for attributing responsibility. It not only supports fair adjudication but also aligns with a broader framework of justice that incorporates logical consistency into legal processes.

When environmental damage occurs, the perpetrator's active and the victim's passive roles, depending upon the activity, allow the establishment of the attribution necessary for the responsibility. The idea of dealing with responsibility as probabilistic rather than deterministic, as required by the scientific paradigm, reveals that responsibility can be realized not only with determined damage but also with the risks we can predict. It is both economically and legally inconvenient not to envisage normative responsibility unless a threshold determined by the public authority is exceeded and to impose the entire responsibility when the threshold is exceeded.[45] In this way, the causal link established by assigning only nominal values will reveal a punitive character by ignoring the real components of the responsibility concept. Because risks are not just assumptions, they are factual phenomena inherent in the workings of nature. Landes and Posner provide an example in which the number of cases became 111 after a nuclear facility was established in an area where cancer cases were limited to an average of 100 people per year.[46] This means that when the installation of a nuclear power plant causes 11 additional incidents, causality corresponds to the objective marginal product of an activity, i.e., the amount that the activity contributes to the increase in accident risk.[47] However, it is difficult to determine which case is caused by the effect originating from the power plant. Landes and Posner stated that this power plant, which causes an approximately 10% change in cases, should cover 10% of the damage of each victim.[48] The general trend in the literature is that polluters should not be responsible for background risk according to statistical calculations but rather should be responsible for the extent to which they contribute to risk.[49] In our opinion, public regulations

[44] Regarding Belgium and Austria's acceptance of causation in tort as pure *conditio sine qua non*, see. Francesco D. Busnelli and others, *Principles of European Tort Law: Text and Commentary* (Tuğçe Oral, M. Emir Göka and Erhan Gündüz trs, Oniki Levha 2021) 55-66. This theory, called natural cause theory, is criticized for confusing the concepts of cause and condition, see. Fikret Eren, *Borçlar Hukuku Genel Hükümler* (Yetkin 2021) 621. On the other hand, the dominant view in Swiss and German law is the adequate causal link theory, see. Karl Oftinger, *Schweizerisches Haftpflichtrecht-I* (Polygraphischer Verlag 1975)at 110; Eren (n 44) 621. For criticisms of the adequate causation approach, see. Henri Deschenaux and Pierre Tercier, *La responsabilité civile* (Salim Özdemir tr, Kadıoğlu 1983); Eren (n 44) 622.

[45] Faure and Partain (n 38) 164.

[46] William M. Landes and Richard A. Posner, 'Causation in Tort Law: An Economic Approach' [[University of Chicago Press, University of Chicago Law School]] 12 The Journal of Legal Studies 109 123-124.; Faure and Partain (n 38) 162.

[47] Mario J. Rizzo and Frank S. Arnold, 'Causal Apportionment in the Law of Torts: An Economic Theory' 80 Columbia Law Review 1399; Faure and Partain (n 38) 162.

[48] Landes and Posner (n 46) 124; Faure and Partain (n 38) 163.

[49] Steve Gold, 'Causation in Toxic Torts: Burdens of Proof, Standards of Persuasion, and Statistical Evidence' [The Yale Law Journal Company, Inc.] 96 The Yale Law Journal 376, 376-402; David Rosenberg, 'The Causal Connection in Mass Exposure Cases: A "Public Law" Vision of the Tort System' 97 Harvard Law Review 851, 851-929.; Faure and Partain (n 38) 163.

should focus on practices such as carbon and water footprints, which allow us to establish causal links with responsibility rather than categorical crimes and penalties. Compared to the "responsibility according to market share" formula,[50] which we criticize for not having a direct context with tort activity, Landes and Posner's proposal is more in line with the *sine qua non* condition of causality. Additionally, the *American National Council on Radiation Protection and Measurements* announced in a statement dated September 30, 1992, that this probabilistic causality method is acceptable for determining whether a particular radiation is causing a particular disease.[51] Eventually, probabilistic causation is scientifically possible provided that the contexts are testable.[52] Our study proposes the *ex-ante* applicability of probabilistic causation in the context of judicial attribution. Probabilistic causality can be modeled not only by determining responsibility after damage but also before damage by experts in the field.[53] van de Poel interpreted why the *ex-ante* practices developed in the literature to mitigate, manage and prevent the expected risks do not address the attribution of risk, as the focus of this field is not on the attribution of responsibility.[54] van de Poel touched upon the existing practices of the courts, such as the decisive role of the courts in liability arising from technological risks. or social insurance.[55] Here, the equation changes when we evaluate responsibility not limited to the classical damage-compensation mechanism but also to the risk-insurance paradigm. This approach involves creating a synthesis that provides the possibility of charging liability to the party, causing the risk and creating a judicial sanction for insuring the related risks. This liability mechanism includes risks caused only by will (*intent/negligence*).

Hart points to four main types of responsibilities: role responsibility, causal responsibility, liability responsibility and capacity responsibility.[56] In the taxonomies[57] that were expanded and developed later, descriptive (*reason, role, authority, capacity*) and normative (*virtue, debt, accountability, guilt and obligation*) elements were emphasized.[58] According to van de Poel, virtue and obligation are prospective in nature, while accountability and liability are retrospective.[59] Some authors argue that individuals can only be responsible retrospectively.[60] While forward-looking responsibility applies to states, not individuals, for some authors,[61] there are also writers who accept the forward-looking responsibility of individuals and claim that they are not responsible for how environmental problems will be shaped.[62] In the responsibility

[50] Busnelli and others (n 44) 64-65.

[51] NCRP, *Statement No. 7* (1992); V. P. Bond, 'The Cancer Risk Attributable to Radiation Exposure: Some Practical Problems' 40 Health Phys 108; Faure and Partain (n 38) 163.

[52] Samuel D. Estep, 'Radiation Injuries and Statistics: The Need for a New Approach to Injury Litigation' [The Michigan Law Review Association] 59 Michigan Law Review 259, 259-304; Fred A. Mettler and R. Moseley, *Medical Effects of Ionizing Radiation* (Grune and Stratton 1985); Faure and Partain (n 38) 163.

[53] For statistically undetectable risks, see. Sven Ove Hansson, 'Risk and safety in technology' in D.M. Gabbay and others (eds), *Philosophy of Technology and Engineering Sciences* (Elsevier Science 2009) <https://books.google.com.tr/books?id=prvCTW4V7jEC> 1084-1086.

[54] van de Poel and Fahlquist (n 7) 884.

[55] Ibid 884.

[56] Herbert Lionel Adolphus Hart, *Punishment and Responsibility: Essays in the Philosophy of Law* (Oxford University Press 1968) 210-237.; van de Poel and Fahlquist (n 7) 882.

[57] Ibo van de Poel, *The Relation Between Forward-Looking and Backward-Looking Responsibility* (2011)

[58] van de Poel and Fahlquist (n 7) 883.

[59] Ibid 883. See also. Poel (n 57)

[60] M. Braham and M. van Hees, 'An Anatomy of Moral Responsibility' 121 Mind 601, 91.

[61] Walter Sinnott-Armstrong, 'It's Not My Fault: Global Warming and Individual Moral Obligations' in Walter Sinnott-Armstrong and Richard Howarth (eds), *Perspectives on Climate Change* (Elsevier 2005); van de Poel and Fahlquist (n 7) 901. We dissent from this thought. Conceptually, the idea of liability established by the insurance provision for the risks caused can be applied to both national legal proceedings and international courts. Individuals can be subject to risk liability just like states, as long as the proof and attribution requirements for risk are met. Because individuals and states do not differ in terms of their ability to act in the context of causing risk. Therefore, the provision of insurance is not a proposal specific to the discipline of public international law.

[62] Jessica Nihlén Fahlquist, 'Moral responsibility for environmental problems—individual or institutional?' 22 Journal of Agricultural and Environmental Ethics 109; van de Poel and Fahlquist (n 7) 901.

terminology that allows the idea of forward-looking liability, it is necessary to start talking about risks rather than damage.[63] In retrospective liability, damage is judged by mechanisms such as attribution, proof, compensation, and sanction. For the pre-damage regime, the current legal system envisages mechanisms such as risk assessment, risk management, risk mitigation, and prevention[64] principles.[65] The distinction between responsibility before and after the damage we have emphasized is based on the possibility that the will on the basis[66] of responsibility can both result in damage and cause risk. Frankfurt, who evaluated freedom, which is the source of responsibility, as a *possibility* for the perpetrator to act differently, revealed a close relationship with risk terminology.[67]

Discussions that followed John Rawls' theory of justice have revealed that there is no single decision rule to be complied with by all parties regarding uncertainty or risks.[68] According to Giddens risks exist when decisions are made, and responsibility exists when decisions with noticeable consequences are made.[69] Our study considers the area of risk as contentious as the area of responsibility. It envisages a liability mechanism against the perpetrators whose activities do not reach the level of legally acceptable damage and pose real possible risks for the future. The sanction of this mechanism should be the insurance institution, which is the most established practice of risk. Accordingly, the attribution of risk operates as a liability law institution for more effective environmental protection before damage. The judicial provision of insurance established after the attribution of risk will be discussed in the next chapter.

IV. Judicial Practice of Risk: Insurance Provision

Tolerable, measurable, predictable, and attributable risks have a wide range of applications in light of the risk studies. The reality of risk and its applicability to the nuisance-based precaution regime allows probabilistic causality and risk attribution. This brings the insurance provision to the agenda as a final step. This theoretical possibility offered by the literature has not yet been mentioned in nuisance-based precautionary practice. On the one hand, the difficulties in attributing and proving damage and, on the other hand, the cumbersomeness of the *res ipsa loquitur* restrictions do not provide sufficient opportunities for solving environmental problems. In cases where the damage is not yet acceptable by legal standards, there is an implementation gap regarding the risks caused by certain activities in the environment.[70] The gap is valid for the risks that arise provided that they comply with the minimum safety standards in the sectors. In such cases, the sanctions envisaged by the prevention principle are of an "*all or none*" nature and do not reflect the contentious nature of the risk. Although the precautionary principle puts forward a principled stance that uncertainty cannot be a reason for inaction, our developing techniques for risk measurement and probabilistic attribution indicate that an effective insurance mechanism can be combined with liability

[63] van de Poel and Fahlquist (n 7) 901.

[64] For the concept of technical risk to imply a liability to avoid risks, see. Ibid 885.

[65] Ibid 883.

[66] On the elements of free will and knowing as the terms of responsibility, see. R. Jay Wallace, *Responsibility and the Moral Sentiments* (Harvard University Press 1994) John Martin Fischer and Mark Ravizza, *Responsibility and Control: A Theory of Moral Responsibility* (Cambridge University Press 1998) Aristotle, W. D. Ross and J. O. Urmson, *The Nicomachean ethics* (Oxford University Press 1980) Book III, (1-5).; van de Poel and Fahlquist (n 7) 884.

[67] Harry G. Frankfurt, 'Alternate Possibilities and Moral Responsibility' 66 Journal of Philosophy 829; van de Poel and Fahlquist (n 7) 884.

[68] R. M. Hare, 'Rawls' "a theory of justice" - I' 23 Philosophical Quarterly; John C. Harsanyi, 'Can the Maximin Principle Serve as a Basis for Morality? A Critique of John Rawls's Theory' [Cambridge University Press] 69 American Political Science Review 594; Hansson (n 16) 46.

[69] Anthony Giddens, 'Risk and Responsibility' [[Modern Law Review, Wiley]] 62 The Modern Law Review 1, 8; van de Poel and Fahlquist (n 7) 886.

[70] In private insurance contract applications, the deficiencies in the context of *ex-ante* tort proceedings in terms of risk-related regulations and disputes arising from claims are expressed in the doctrine. See. Rob Merkin and Jenny Steele, *Insurance and the Law of Obligations* (Oxford University Press 2013) 204. Our study proposes a constructive judgment for the establishment of an insurance contract apart from the private insurance discipline provided that risk attribution.

law. This idea implies a more dynamic practice than private insurance or categorical compulsory insurance institutions and does not consider *ex-ante* environmental protection in the context of mere normative responsibility. Because risk is stochastic, it cannot be handled deterministically with purely nominal and punitive categories. Environmental risks are a contentious topic on a global and local scale. At this point, dispute resolutions involving case-specific risk judgments should be highlighted. The elasticity of the rules according to the data are not as dynamic or testable as the reasoning of the event according to the rules. Of course, public restrictions, precautionary principles and norms should come into play, especially in regard to hazardous activities and intolerable or irreversible environmental damage. The risk attribution and insurance provision that we propose in our study diversify our legal instruments. When the conditions detailed below for environmental damage risks are met, the legal basis for envisaging an insurance obligation is that the no-harm obligation (*sic utere tuo ut alienum non laedas*), which is accepted as a rule of customary law,[71] also includes the risk of damage.[72] In fact, judicial procedures also need an axiomatic basis as an information processing method. The broad area of conflict where we face environmental risks must be addressed in accordance with scientific methodology. The dynamism of institutions, such as presumption and burden of proof in judicial practice, in a case-specific and transparent manner is more resistant to normative dogmas. While changes in the environment involve factual and legal uncertainties in terms of damage, precautionary and prevention principles envisage sanctions such as decommissioning or not decommissioning an activity. When trying to manage the wide scale of uncertainties with the narrow scale of sanctions, the nuances in the way of sustainability goals are ignored. In addition, judicial practice has mostly found applications after damage or violation (*ex-post*). Our study aims to overcome this limitation with consistent and necessary grounds.

The MOX case is an important example of the situation in which we drew attention to environmental risks. The facility, which was authorized to be built in Sellafield, England, dumps its nuclear waste into the Irish Sea, one of the marginal seas that separates from the Atlantic Ocean. Although the MOX (*mixed-oxide*) fuel produced by this facility, 112 miles from the Irish coast, reduces the need for natural uranium in nuclear power plants, large amounts of nuclear waste are generated when plutonium is separated from spent fuel rods. Ireland has emphasized activities affecting tourism, the population, and the entire fishing area of the region.[73] According to the STOA (*Scientific and Technological Options Assessment*) Report submitted to the European Parliament in August 2001, the Irish Sea has reached the most advanced level of radioactive contamination.[74] The report also stated that there is a hazard—not damage—far beyond the emission in Chornobyl.[75] It has been argued that a necessary and sufficient environmental impact assessment was not carried out during the authorization process.[76] The International Court of Law of the Sea ruled its jurisdiction over Ireland's requests for provisional measures. Its decision was to exchange information, monitor risks and impacts, and increase cooperation.[77] In practice, this facility is expected to be completely decommissioned by 2120.[78] This case shows that we need to reconsider our nuisance-based approach

[71] *Legality of the Threat or Use of Nuclear Weapons* International Court of Justice para. 29; *Pulp Mills on the River Uruguay (Argentina v. Uruguay)* International Court of Justice para. 101.

[72] Nedeski and Nollkaemper (n 4)

[73] *Request for provisional measures and statement of case submitted on behalf of Ireland* ITLOS para. 5.

[74] Ibid para. 10.

[75] Ibid para. 11.

[76] Ibid paras. 19-23.

[77] *The Mox Plant Case (Ireland v. United Kingdom)* ITLOS para. 89.

[78] Harry Cockburn, 'Sellafield nuclear decommissioning work 'significantly' delayed and nearly £1bn over budget, report reveals' The Independent <https://www.independent.co.uk/climate-change/news/sellafield-nuclear-power-plant-decommission-overspend-delays-budget-report-a8609671.html> accessed 03/06/2023

toward environmental risks and question the adequacy of our judicial instruments. In such situations, issues such as the determination of environmental risks, the probability and possibility of directing to the plaintiff, the conditions of attributing the risks to the defendant, the adequacy of the hazard assurances for the activity, and the priority of the guarantees of risks directed to plaintiffs should be discussed. Our proposal is that the courts order an insurance provision that envisages the defendants to insure the risk they cause. This process is described in detail in the following subheadings.

A. Jurisdiction

Insurance provision is relevant to procedural jurisdiction, as it is a new type of judgment that courts can make. Therefore, it does not have a distinctive feature related to jurisdiction in terms of territory and person. Envisaging the insurance obligation before environmental damage occurs can, in a sense, create a reserve of jurisdiction in terms of time. Additionally, bringing the risk of damage into litigation and imposing insurance obligations can be considered an innovation in jurisdiction *ratione materiae*. Here, the activity causing environmental risk should arise from the territorial sovereignty of the defendant state or allow a functional causality arising from the execution of the instruments of sovereignty. In fact, our proposal offers a solution appropriate to the character of environmental risks by addressing situations where an activity can be clearly attributed, but it is unclear whether the results of the activity can be legally accepted as damage. The attribution of the activity, which is relatively easy, does not entail a problem in jurisdiction issues. Since our proposal is applicable in the context of both international law and domestic law, as will be detailed below, courts can determine their jurisdiction based on the source of an activity that is claimed to pose a risk. Pure environmental risks are not currently acknowledged as facts that give rise to legal claims in cases of unrealized damage.[79] Our proposal aims at formulating the judicial practice of environmental risks. Naturally, guaranteeing individuals exposed to environmental risks can be discussed in the field of human rights and within the context of the jurisdiction of human rights courts. However, the argument that the customary international rule of no-harm obligation includes the risk of damage should work here. This requires that the no-harm rule, which is considered in the context of international environmental law, be regulated separately as a negative environmental human right obligation of states toward individuals. Our study proposes that insurance provisions be provided primarily for international courts with the jurisdiction rules stipulated by public international law and for arbitration as well as for domestic courts based on the jurisdiction granted by the domestic law of the states.

B. The Nature of Insurance Provision

The phenomenon of causing risk indicates the need for a liability mechanism based on probabilistic causation. Risk, which functions positively in the capitalist economy,[80] can thus be dynamically limited by an accidental (judicial) mechanism. The decision that envisages a binding insurance contract given by

[79] Regarding the distinction between peril and material damage, see. *Case Concerning Gabčíkovo- Nagymaros Project (Hungary/Slovakia)* İnternational Jourt of Justice para. 54; Nicolas de Sadeleer and others, 'The UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes: Its Contribution to International Water Cooperation' in *The Role of the Precautionary Principle in the Convention on the Protection and Use of Transboundary Watercourses and International Lakes* (Brill | Nijhoff 2015) <https://brill.com/view/book/edcoll/9789004291584/B9789004291584-s013.xml> 169; Malgosia Fitzmaurice, 'Due Diligence in the Use of International Watercourses' in Heike Krieger, Anne Peters and Leonhard Kreuzer (eds), *Due Diligence in the International Legal Order* (Oxford University Press 2020) 143. The ECtHR's Grand Chamber has been reluctant to directly link obligations under the Paris Agreement with Articles 2 and 8 of the ECHR. In the decision rendered on April 9, 2024, the Grand Chamber modified this approach to some extent and concluded that there was a violation of Article 8, which did not encompass compensation for damages resulting from climate change risks. See. *Case of Verein Klimaseniorinnen Schweiz and Others v. Switzerland* The Grand Chamber cited the United Nations Special Rapporteurs and stressed that the issue was no longer whether climate change should be addressed within the framework of human rights, but rather how it should be addressed. See. Ibid para. 541. Addressing environmental risks based on probabilistic liability, judicial determination of the coverage gap resulting from state activities, and considering environmental assurance as a human right constitute the response to the "how" question posed in our study.

[80] Adam Smith, *An inquiry into the nature and causes of the wealth of nations (ed. R.H. Campbell, A.S. Skinner, and W. B. Todd)* (Oxford University Press 1976) 1:66.

local or international courts against the perpetrator causing the risk will have a quality that creates a new legal situation and changes the content of the current legal situation. In this respect, imposing an insurance obligation on the party causing an environmental risk is a constitutive provision. Adjudicating such a provision requires going into the merits of the case, as it includes following the procedures of proof and attribution of the risk and appraisal of the coverage by the court. Therefore, an insurance provision cannot be established with a *prima facie* investigation. This means that the insurance provision cannot be considered a provisional measure or an injunction. This proposal, which was put forward as a result of the discussions on the terms of liability, risk, and insurance above, is a synthesis at the conceptual level, so it does not have to be limited only to public international law.[81] Based on the idea of attributing environmental risks, there is no paradox to establishing an insurance provision before national courts. This new paradigm, developed in terms of insurance and liability law, allows individuals and states to take responsibility for risks dynamically.[82] To implement this proposal, an amendment requires that includes an insurance provision in the statutes of the ICJ and the ITLOS in a way that does not imply a *prima facie* provision.[83] The conditions of the provision can be described in detail in the procedural rules of these courts. A similar procedure can be employed in arbitration and mediation systems.[84] By incorporating probabilistic liability principles, our proposal could be integrated into the UNIDROIT Principles of Transnational Civil Procedure. These principles, adopted by over 60 countries, aim to harmonize civil procedures across borders. Here, the inclusion of probabilistic liability, which considers the likelihood of damage occurring, would be particularly relevant. There are already probabilistic liability studies on the acceptability of future damages in tort.[85] However, these studies proposed traditional compensation instead of an *ex-ante* insurance obligation. The Bhopal disaster in India offers a similar example where victims received financial compensation. However, unlike our proposed method with its robust theoretical and practical foundation, the Bhopal case lacked a clear technical framework. The Supreme Court of India awarded compensation without establishing a defined limit on individual claims or a structured insurance mechanism.[86] This approach, while acknowledging the long-term health uncertainties faced by victims, presented challenges in terms of traditional insurance principles. In this respect, the Bhopal decision is an *ex-post* compensation approach, interpreting tort law to hold the responsible company liable for continuous health damages. While this approach aimed

[81] Risk attribution and insurance provision is a new paradigm for post-damage operative tort law. As for public international law, a breach of an obligation, not damage, is negated. See. International Law Commission, *Draft Articles on Responsibility of States for Internationally Wrongful Acts* (Yearbook of International Law Commission 2001) Article 2. Considering that the customary "*No-harm*" obligation includes the risk of damage, the legal basis for the insurance provision is established.

[82] Dynamic responsibility refers to an *ex-ante* risk liability, which is an alternative to the categorical hazard liability applied *ex-post*.

[83] Amendments to the Statute of the International Court of Justice are subject to the same procedure as the United Nations Charter, in accordance with Article 69 of the Statute. Therefore, they must be accepted by a 2/3 majority in the United Nations General Assembly, including the permanent members of the Security Council, and undergo the constitutional approval process by the same majority. The Court has the authority to propose the changes in question. Changes to the Court Rules are made by decision of the member judges. In accordance with Article 41/1 of the Statute of the International Tribunal for the Law of the Sea, the simple amendment procedure can be applied, except for changes in the region and sea bed sections. According to Article 313 of the United Nations Convention on the Law of the Sea, a change is deemed to have taken place if no objection is received from any party state within 12 months after a party state notifies the relevant proposal in writing to the United Nations Secretary-General.

[84] For optional rules, see. PCA, *Permanent Court of Arbitration Optional Rules for Arbitration of Disputes Relating to Natural Resources and/or the Environment* (2001)

[85] 'Probabilistic liability' in Sandy Steel (ed), *Proof of Causation in Tort Law* (Cambridge University Press 2015). Regarding the continuous damage in tort, see. Busnelli and others (n 44) 69-71.

[86] "*... Contingencies such as payment of compensation to the persons who were exposed to the Bhopal gas disaster, who though presently asymptomatic and filed no claim for compensation but might become symptomatic in future and the yet unborn children of mothers exposed to MIC toxicity, who may develop congenital defects, shall be taken care of by obtaining an appropriate medical group insurance cover from the General Insurance Corporation of India or the Life Insurance Corporation of India. There shall be no individual upper monetary limit for the insurance liability. The period of insurance cover should be a period of eight years in the future. The number of persons to be covered by this Group Insurance Scheme should be about and not less than one lakh of persons.*" In addition, the premiums for the insurance coverage awarded in the Bhopal case were paid by the Union of India representing the victims, not by the company that caused the damage: "*... The premia for the insurance shall be paid by the Union of India out of the settlement fund.*" See. *Union Carbide Corporation & Others v. Union of India & Others* Supreme Court of India para. 270.

to provide some relief to victims, it lacked a proactive framework for preventing environmental risks or establishing a clear financial mechanism for handling potential future claims. The trigger for risk responsibility that we propose in our study is not the continuous damages following a disaster, but simply environmental risk changes. Unlike traditional tort liability, our study deals with the legal consequences of risk liability probabilistically with the concept of judicial insurance in this liability mechanism where causality is established probabilistically. It aligns with the forward-looking approach of the UNIDROIT principles by incentivizing parties to consider and mitigate potential environmental risks before they cause damage. This integration could facilitate cross-border environmental claims by providing a framework for establishing financial responsibility based on the probability of damage. Our proposal is also compatible with the environmental and social sustainability principles promoted by the World Bank's MIGA. This agency offers political risk insurance to foreign investors in developing countries. MIGA's existing framework, which offers political risk insurance to companies and governments, can be expanded to encompass environmental considerations. Upon meeting the judicial conditions outlined below, MIGA can directly provide environmental risk assurance for investment activities. Should an international environmental court be established in the future; specialization can be provided on the case law on insurance provision. At the domestic level, civil procedure codes can be used to establish regulations allowing insurance provision. Environmental courts can be established at the domestic level to ensure specialization. After the court determines the coverage, the file can be referred to the enforcement offices and courts for the implementation of open tender to take into account the market conditions and competition in determining the premiums and other conditions related to the insurance contract. Finally, the insurance provision is not an alternative to minimum safety standards in risky activities but is complementary.[87]

C. The Conditions of Insurance Provision

The insurance business operates by quantifying and distributing risks. In the case of environmental risk, approaches related to ecosystem services have been developed to determine the criteria by which environmental values and environmental order are established after damage has occurred.[88] Quantification of the current environmental damage therefore presents a unique challenge. To quantify environmental risks in environmental damage insurance, it would be appropriate to first refer to the economic principles related to the pricing of environmental damage. The main issue is the internalization of environmental damage that manifests as a negative externality.[89] In fact, the pricing of environmental damage provides important insight into the analysis of the cost of precautionary measures.[90] Therefore, the economic optimization of policies adopted before environmental risk materializes is closely related to the pricing of environmental damage.[91] Oates introduced four basic steps for cost benefit analysis: listing the costs and benefits of the activity under consideration, assigning monetary values to them, assessing the benefits and costs expected to accrue in future years, and finally calculating the discounted present sum of all expected future benefits and costs.[92] When each of the options in the decision process has more than one feature, a rational basis

[87] Minimum safety standards need to be complemented by nuisance-based policies, not categorical *res ipsa loquitur* restrictions, and police-dominated policies. Thus, event-specific conditions and developments can be considered dynamically.

[88] *Certain Activities Carried Out by Nicaragua in the Border Area (Costa Rica v. Nicaragua)* International Court of Justice para. 45-53.

[89] Faure and Partain (n 38) 106.

[90] Ibid 106 ff. Also see. Jason Rudall, *Compensation for Environmental Damage Under International Law* (Routledge 2021) 95 ff.

[91] Arden Rowell, 'Time in Cost-Benefit Analysis' 4 UC Irvine Law Review 1215, 1218.; Faure and Partain (n 38) 107.

[92] Wallace E. Oates, 'Book Review: The Uncertain Search for Environmental Quality' 124 University of Pennsylvania Law Review 864; Faure and Partain (n 38) 108.

is established by assigning benefits.[93] Hsu draws attention to the economics literature that emphasizes scientific precision for the operation of the cost–benefit analysis stages. Referring to Kuhn's paradigmatic understanding of science, he focuses on the necessity of postmodern science and the incompatibility of environmental degradation with cost–benefit analysis.[94] Is the cost–benefit analysis a basis for setting environmental standards, or is it the function of updating the determined standards? Baumol and Oates suggested pricing based on predetermined environmental standards.[95] When the principle of marginal costs equals marginal benefits, which has been adopted in public finance for years,[96] is applied to an environmental incident, the marginal cost of reducing pollution or value change is compared with the marginal benefits of reducing environmental damage.[97] Here, issues such as "pollution" are not *ipso facto* "damage",[98] and the legal acceptability of future damage and the reliability of future projections should be considered in addition to the measurement problem of environmental values. The ecological sustainability perspective comes to the fore, especially in terms of long-term environmental problems. The effect of this long-term period on the willingness to pay in the market limits the cost–benefit analysis.[99] Indeed, the enormous time gap between environmental processes that have been ongoing for billions of years and practical expectations for people's lives impacts the degree to which future risks should be considered today.[100] Huber stated that time-related problems are reduced by fee simple.[101] However, as mentioned above, a sustainability-based policy should be developed rather than a property-based policy. On the other hand, Revesz and Livermore emphasized the establishment of opportunities where all parties have simultaneous bargaining power.[102]

When an environmental risk is caused, the extent to which the court will find that risk acceptable is a separate issue.[103] In addition to probability and magnitude, Wolff suggested adding the cause influencing moral[104] acceptability, emphasizing human influence as the primary variable in the concept of risk.[105] These discussions, which develop in the context of acceptability and reprehensibility in the context of risk, lay the

[93] Paul Weirich, 'Multi-Attribute Approaches to Risk' in Sabine Roeser and others (eds), *Handbook of Risk Theory: Epistemology, Decision Theory, Ethics, and Social Implications of Risk* (Springer Netherlands 2012) <https://doi.org/10.1007/978-94-007-1433-5_20>

[94] Shi-Ling Hsu, 'The Accidental Postmodernists: A New Era of Skepticism in Environmental Policy' 3 Vermont Law Review 67.; Faure and Partain (n 38) 108.

[95] William J. Baumol and Wallace E. Oates, 'The Use of Standards and Prices for Protection of the Environment' [Scandinavian Journal of Economics, Wiley] 73 The Swedish Journal of Economics 42, 42-54.; Faure and Partain (n 38) 107.

[96] Lee S. Friedman, *Microeconomic policy analysis / Lee S. Friedman* (McGraw-Hill 1984); Faure and Partain (n 38) 109.

[97] Faure and Partain (n 38) 109.

[98] A legally acceptable personality requires taking responsibility. The sine qua non component of responsibility is to have willpower. It is problematic in this respect that the legal personality of the environment becomes an established legal practice. For local examples of the legal personality of the environment, see. Hakkı Hakan Erkiner and Abdulkadir Nacar, 'Strengthening Environmental Soft Law Commitments with the Principle of Pacta Sunt Servanda' 21 Galatasaray Üniversitesi Hukuk Fakültesi Dergisi 234.

[99] Faure and Partain (n 38) 109 ff.

[100] For problems of applying intertemporal cost–benefit analysis, see. Rowell 1217.; Faure and Partain (n 38) 111. On the long-term risks posed by nuclear waste to future generations, see. Behnam Taebi, 'Intergenerational Risks of Nuclear Energy' in Sabine Roeser and others (eds), *Handbook of Risk Theory: Epistemology, Decision Theory, Ethics, and Social Implications of Risk* (Springer 2012)

[101] Bruce R. Huber, 'Temporal Spillovers' in Bruce R. Huber and Klaus Mathis (eds), *Environmental Law and Economics* (Springer 2017) 45; Faure and Partain (n 38) 112.

[102] Richard L. Revesz and Michael A. Livermore, *Retaking Rationality: How Cost Benefit Analysis Can Better Protect the Environment and Our Health* (Oxford University Press 2008); Faure and Partain (n 38) 112. Regarding the "*pollicitatio*" nature of environmental soft law commitments in favor of future generations, see. Erkiner and Nacar 251.

[103] For sense of risk and acceptable risk, see. Sabine Roeser, 'Moral Emotions as Guide to Acceptable Risk' in Sabine Roeser and others (eds), *Handbook of Risk Theory: Epistemology, Decision Theory, Ethics, and Social Implications of Risk* (Springer Netherlands 2012) <https://doi.org/10.1007/978-94-007-1433-5_32>

[104] The management of the risks posed by climate change in linear time is closely related to the concepts of "good", "morality" and "virtue" on the basis of sustainability. In our opinion, the ground that establishes this relationship is the temporality of the concept of *phronesis*, its dependence on movement and will, unlike the term *Sophia*. Therefore, the sustainability of the values assigned to certain elements can be accepted as a basis of secular ethics. The relative construction of the concepts of value assignment and sustainability shows that ethics should be considered on the basis of a relational and elastic *quid juris*, not individual, objective, or absolute.

groundwork for the possibility of foreseeing a legal sanction for those who cause environmental risk. Here, the establishment of a fixed acceptable level of risk should be viewed with suspicion.[106] It is essential not to make an inconvenient and disproportionate assignment of responsibility, especially in terms of cumulative risk. This is the main reason why our study opposes a purely normative environmental responsibility idea. In regard to values that should be considered in environmental policies such as irreversible environmental damage, it is inconvenient to determine the risk threshold with cost–benefit analysis, which is evaluated only in monetary terms.[107] Here, the concepts of security and sustainability are evaluated. Security can be achieved by reducing risk to a tolerable level.[108] Eventually, security does not mean a risk-free situation.[109] In our opinion, the tolerable level refers to the sustainability of the values assigned to the relevant activities.

The first fundamental question about sustainability is what is intended to be sustainable. This question refers to assigning and maintaining values to variables and states in chaotic systems. Notably, sustainability goals include not only the preservation of existing values but also the reduction of harmful actions by taking preindustrial values as a reference, as in the example of the Paris Agreement. The operation of this mechanism depends on the adequacy of the data provided by the monitoring processes. Reporting standards (*Task Force for Climate Financial Disclosures-TCFD*) should also be considered in the assessment of risks related to climate change.[110] Sustaining the values aimed at the mechanism necessitates policy-making and decision processes. Today, various decision analytics methods related to sustainability are applied.[111] The legal term environment is not a "*Ding an Sich*" element since value assignment is clearly a human activity. However, the link between the environment and humans should not be handled with proximate causality. The Nationally Determined Contributions[112] (*NDCs*) and World Business Council for Sustainable Development (*WBCSD*) standards on climate change are used as important implementation tools. The System of Environmental-Economic Accounting-Ecosystem Accounting (S*EEA*), adopted by the United Nations Statistical Commission in 2021, provides an important statistical framework for the integration of the environment, society and economy. In addition, there are criteria that can be used as a basis for disputes regarding water and air quality.[113] All the mentioned tools reveal how sustainability, which is the master key of the environmental risk and responsibility equation, should be comprehended. Our proposal is for the courts to establish an insurance contract by estimating coverage for activities that are risky in terms of sustainability.

The courts thus impose an insurance obligation on the perpetrator while environmental risks are still at a tolerable level; that is, they can be predicted and modeled scientifically and calculated and distributed

[105] Jonathan Wolff, 'Risk, Fear, Blame, Shame and the Regulation of Public Safety' [Cambridge University Press] 22 Economics & Philosophy 409 For the risk equation with an acceptability variable, see also. Steve Rayner, 'Cultural theory and risk analysis' in S. Krimsky and D. Golding (eds), *Social Theories of Risk* (Praeger 1992); van de Poel and Fahlquist (n 7) 882.

[106] Martin Peterson, 'What Is a de Minimis Risk?' [Palgrave Macmillan Journals] 4 Risk Management 47; Möller (n 23) 60.

[107] For critiques of cost–benefit analysis, see. Julian Le Grand, *Equity and Choice: an Essay in Economics and Applied Philosophy* (Harper Collins 1991); Amartya Sen, *On Ethics and Economics* (Basil Blackwell 1987); Sven Ove hansson, 'Weighing Risks and Benefits' 23 Topoi 145; Baruch Fischhoff and others, 'How Safe Is Safe Enough? A Psychometric Study of Attitudes Toward Technological Risks and Benefits' 9 Policy Sciences 127 For the evaluation of the risks arising from methane gas in terms of moral obligations apart from the welfare economy model, see also Christoph Lumer, *The Greenhouse: A Welfare Assessment and Some Morals* (University Press of America 2002)

[108] Y. Misumi and Y. Sato, 'Estimation of average hazardous-event-frequency for allocation of safety-integrity levels' 66 Reliability Engineering & System Safety 135; Möller (n 23) 61.

[109] Möller (n 23) 61.

[110] Renard Siew, 'Analytics for Sustainability Issues' in *Sustainability Analytics Toolkit for Practitioners: Creating Value in the 21st Century* (Springer Nature Singapore 2023) <https://doi.org/10.1007/978-981-19-8237-8_9>

[111] Siew, 'Sustainability Decision Analytics' (n 110)

[112] For current methodological debates on determining national carbon budgets, see: Stephen Humphreys, 'A Swiss human rights budget?' EJIL Talk <https://www.ejiltalk.org/a-swiss-human-rights-budget/> accessed 22/04/2024

[113] Siew, 'Analytics for Sustainability Issues'. See also OECD, *Guidance on Sustainability Impact Assessment* (2010)

economically and attributed legally.[114] Judicial insurance provides an effective *ex-ante* practice of the probabilistic causality expressed by Landes and Posner. Contentious risk judgment is focused on process and risk management, not just reparation. The new paradigm of responsibility is necessary, as tolerable, predictable, and attributable risks are expanding with scientific, technological, and actuarial advances. Because hazard categories, compulsory (*regulative*) or private insurance, and normative responsibility are limitedly efficient but are not the best options for the stochastic nature of environmental risks.[115] Environmental risks do not necessarily arise from categories considered hazardous activities and must be addressed with a dynamic paradigm. Priority should be given to case-specific approaches and judicial practices related to environmental risks. In fact, the normative architecture of these risks is elastic under the due diligence concept.[116] Additionally, environmental risks are a contentious area. Indeed, the beneficiaries of judicial insurance provisions are plaintiffs who are specifically at risk of being exposed to damage. If these persons are able to document the environmental changes caused by an activity but cannot yet prove legally acceptable damage,[117] an alternative legal opportunity will be established with proof of risk. Through this opportunity, which promises a separate guarantee to the plaintiffs, the perpetrators will also not be subject to the strict prevention principle and *res ipsa loquitur* restrictions that should be applied as an *ultima ratio*. Although hazard has an *ex-ante* connotation, it assumes a function in the post-damage attribution mechanism in the application of liability law.[118] Since our proposal establishes an attribution relationship over "causing environmental risk", it represents an alternative to hazard policy and strict liability practice.[119] Basing responsibility primarily on will rather than norms will provide realistic, competitive, and contentious ground. The *learned hand* formula can be evaluated here in the implementation of *ex-ante* conditions based on will.[120] This formula shows the fault measure as follows.[121]

i. Probability X Loss > Burden of care → Faulty

ii. Probability X Loss < Burden of care → Not Faulty

The judge who applied this formula to his/her decision actually made an *ex-post* evaluation by considering the *ex-ante* conditions. However, the tendency to view probabilistic causation as merely solving a problem of attribution would have thus been continued. The idea of imposing insurance coverage as a sanction due to probability attribution is an innovative approach in this regard. Addressing coverage gaps in environmental insurance requires accurate assessments of potential damage. This is where damage estimation methods come into play, relying on expert support. Two key approaches are Life Cycle Impact Assessment (LCIA) and Impact Pathway Analysis (IPA). These methods use scientific principles to model the

[114] Insurance provision requires the impact of the relevant activity on the sustainability and the possible risk of damage to a legally recognized person. The European tort law acquis can be taken as a basis in the classification of the damages whose possibility will be examined. For the insurance approach in loss classification and comparative analysis, see. Christian Lahnstein, 'Aggregation and Divisibility of Damage: Insurance Aspects' in Ken Oliphant (ed), *Aggregation and Divisibility of Damage* (Springer Vienna 2009) <https://doi.org/10.1007/978-3-211-92209-5_17> ; Ken Oliphant and Marlene Steininger, 'Aggregation and Divisibility of Damage in Tort Law and Insurance: Comparative Summary' in Ken Oliphant (ed), *Aggregation and Divisibility of Damage* (Springer Vienna 2009) <https://doi.org/10.1007/978-3-211-92209-5_18>

[115] Implementations of the hazard regime in the fields of marine pollution and nuclear energy have facilitated precaution to some extent. See. Jorge E. Viñuales, 'Legal Techniques for Dealing with Scientific Uncertainty in Environmental Law' 43 Vanderbilt Law Review 437 However, environmental risks should be addressed not with categorical and mandatory practices, but with a dynamic risk-responsibility paradigm.

[116] Isaac Ehrlich and Richard A. Posner, 'An Economic Analysis of Legal Rulemaking' 3 The Journal of Legal Studies 257; Anthony Ogus, *Regulation: Legal Form and Economic Theory* (Clarendon Press 1997) 168-170.; Faure and Partain (n 38) 69.

[117] For complex evidence procedures in proving environmental damage, see. Viñuales, 'Legal Techniques for Dealing with Scientific Uncertainty in Environmental Law'

[118] *Türk Borçlar Kanunu* (2011) Article 71.

[119] For a comparative analysis of environmental regulations and practices for fault liability, see. Willem H. van Boom, Meinhard Lukas and Christa Kissling, *Tort and Regulatory Law* (Springer Vienna 2007)

[120] Michael Faure, 'Economic Analysis' in Pierre Widmer and Christa Kissling (eds), *Unification of Tort Law: Fault* (Kluwer Law International 2005)

[121] Kerem Cem Sanlı, *Haksız Fiil Hukukunun Ekonomik Analizi* (Arıkan 2007) 205 ff.

severity of future environmental consequences, considering factors like the activity's impact pathway and potential exposure. Crucial to these models are dose-response and exposure-response functions which estimate the likelihood and severity of damage.[122] With advancements in damage estimation,[123] courts can now gain accurate reports of potential environmental impacts associated with specific activities. Based on these reports, they can tailor insurance provisions to address the specific coverage gaps arising from those activities. For example, if 25 percent of an environmental value change—potentially costing 1 unit for environmental sustainability—can be attributed to a specific activity, those responsible for the activity would need to insure a coverage gap of 0.25 units.

We can eventually list the conditions required for insurance provision as follows: i- There is a possible risk against environmental sustainability; ii- This risk should be attributed to the defendants and directed to the plaintiffs; and iii- The risk should not create irreversible environmental pollution and should not violate minimum safety standards. In fact, our proposal for risk attribution and insurance provision can be adapted *mutatis mutandis* to disciplines that use the concepts of sustainability and risk, such as economics, finance, and construction. In the next chapter, the rights and obligations of the parties in the legal situation established by the insurance provision will be discussed.

D. The Rights and Obligations of the Parties

Considering the legal uncertainties of liability insurance,[124] our proposal on judicial insurance establishes an environmental damage insurance policy. This will provide a direct guarantee to the beneficiaries. The insurer has obligations arising from the insurance policy to bear the risk, to disclose, to issue an insurance policy and to cover expenses and indemnities. Providing information and premium payment obligations come to the fore in terms of the insured (*defendant*). The beneficiaries are the plaintiffs who prove the environmental risks facing them and attribute them to the defendant. The determination of the terms of the insurance contract should primarily be shaped in line with the claims of the plaintiffs and defendants, who represent the contentious rights regarding the relevant risk. The court will decide whether to add the requested additional clauses to the contract, taking into account the legal and minimum safety standards for the relevant activity. Here, it is important for risk governance to allow insurers to request a guarantee clause in their tender applications rather than presenting a tender for prospective insurers to be a party to a determined contract. Courts should consider the claims made by contentious rights and case law regarding guarantee clauses when establishing the terms of the contract.[125] Regardless of whether the activity is in the normatively hazardous category, the established insurance policy will provide effective protection to those exposed to risk while also guaranteeing environmental sustainability. Even if the activity subject to the case is considered hazardous activity and is subject to compulsory insurance

[122] For detailed information on environmental damage estimation, see. Guido W. Sonnemann, 'Environmental Damage Estimations in Industrial Process Chain' (Universitat Rovira i Virgili 2002)

[123] James E. Neumann and others, 'Climate Damage Functions for Estimating the Economic Impacts of Climate Change in the United States' 14 Review of Environmental Economics and Policy 25

[124] OECD, *Environmental Risks and Insurance* (2003) 42.; Michael G. Faure and Albert Verheij, *Shifts in Compensation for Environmental Damage*, vol 21 (Springer 2007) 76 ff.

[125] For sample case-law on guarantee clauses, see. Alastair Owen, *The Law of Insurance Warranties: Flawed Reform and a New Perspective* (Taylor & Francis 2021) 191-194. Alleviating the negative effects of predetermined insurance guarantees in private insurance contracts by the courts may have negative effects on the certainty of law. see. *Insurance Contract Law Issues Paper 2 Warranties* (2006) para. 4.18.; Owen (n 125) 193. Since the proposal of our study requires judicial intervention in the establishment of the contract, it is not expected to have a negative effect on the certainty of law. Future disputes that may arise in breach of the contract and uncertainties regarding interpretation will be adjudicated by considering the certainty of law. On the distinction between legal formalism and legal functionalism in insurance contract interpretation, see. Jeffrey W. Stempel, Peter N. Swisher and Erik S. Knutsen, *Principles of Insurance Law* (LexisNexis 2012) 178-181. On the issue of courts requiring *ex-post* applications to pay damages arising from environmental risks that the insurer does not even intend to cover, see. Paul K. Freeman and Howard Kunreuther, *Managing Environmental Risk through Insurance* (Kluwer 1997) 35. Smart contract-based technological tools can be used to minimize the uncertainties regarding the contract language with DRY (*Do not Repeat Yourself*) codes.

regulation, the adequacy of the coverage will be discussed through judicial judgment. In addition, the payment priority can be established in favor of the plaintiffs. A critical challenge in applying our judicial insurance proposal to international environmental risks is the limited ability of claimants[126] (*e.g., affected communities*) to bring claims against corporations or states that cause transboundary environmental risks. This insufficiency hinders effective management of environmental risks, as those responsible might face fewer consequences. Our proposal can be a valuable tool to address this gap. By providing financial resources and legal support through judicial insurance, civil enterprises (*e.g., NGOs*) could have greater opportunities to pursue claims in international courts or through diplomatic channels. This aligns with the concept of human rights jurisdiction and the idea of holding corporations directly accountable for their environmental impact. An alternative legal opportunity will be provided to those who are exposed to risk, who cannot prove and attribute the damage by proving and attributing the risk. Should an activity cause proven damage but also cause environmental risks, both compensation[127] and insurance provisions may be possible. The other benefit of our proposal is to establish compulsory sustainability expertise in the management of environmental risks. Here, the importance of the joint relationship between insurance experts and perpetrators comes to the fore. As a requirement of this dynamic relationship, perpetrators should be able to request premium updates from the insurer and coverage updates from the court in their attempts to mitigate risk. The court should consider these claims, taking into account market conditions and expert opinions. Innovative solutions can be considered, such as the allocation of existing funds to environmental protection through peer-to-peer insurance practices.[128] However, the important thing is to recognize judicial insurance as environmental damage insurance and not exclude it from standard insurance regulations. Bridging the court-determined environmental coverage gap with credit default swaps may pose a problem, especially in terms of meeting capital reserve standards. Finally, fund management should be open to financial support for projects aimed at eliminating or significantly mitigating the risks that are the subject of the case.

Conclusion

The concept of precaution has a dialectic in the context of the police and the nuisance. This dialectic should allow for a dynamic discussion to come up with optimal synthesis. Distinctions between real/nominal and private/public enrich the dialectic of environmental precaution. There are fundamental differences in how national and international judicial bodies address environmental risks. However, our study, based on the reality and attributability of the concept of risk, contributes to the literature in terms of the types of provisions, not in terms of territorial authority. Therefore, this study provides a proposal that can be applied at the national and international levels.

The judicial insurance proposal offers a solution by facilitating risk-sharing. This means the financial responsibility wouldn't solely fall on the shoulders of those seeking compensation. Instead, the proposal spreads the burden across insurance companies and potentially even polluters. This not only alleviates the pressure of large upfront costs but also has a more significant impact: it fosters proactive (*ex-ante*) accountability rather than determined normative responsibility. By requiring insurance coverage, companies have a stronger incentive to prioritize environmental responsibility and mitigate risks before damage occurs. This shift in focus, from normative and *ex-post* damage liability to contentious probabilistic risk liability

[126] Katja Creutz, *State Responsibility in the International Legal Order: A Critical Appraisal* (Cambridge University Press 2020) 174-180.

[127] For compensations paid in the form of income in some legal systems, see. Ulrich Magnus, *Unification of Tort Law: Damages* (Kluwer Law International 2001) 185.

[128] NAIC, 'Peer-To-Peer (P2P) Insurance ' <https://content.naic.org/cipr-topics/peer-peer-p2p-insurance> accessed 04/05/2022

is a key strength of our proposal. In fact, environmental precaution requires case-specific investigation both in the normative domain of due diligence and in nuisance practices. Our study has concluded that nuisance-based precaution practices should not consider only norm violations. The reality and attribution of risk provide the theoretical coherence of this new paradigm. The practical necessity of our proposal is based on the *ultima ratio* character of *res ipsa loquitur* restrictions, more contentious and competitive risk management, providing a legal remedy other than proof of damage to the people exposed to the risk, and the need for a dynamic guarantee for *ex-ante* environmental protection. Thus, insurance will not be seen as a polluting license and will be dynamically incorporated into liability law. Our proposal will provide convenience in terms of compensation when environmental damage occurs, but it will have a main effect on diversifying *ex-ante* sanctions. How will courts decide whether to provide environmental coverage in favor of those exposed to risk in a case? It must first be attributed and proven that the action in question poses an environmental risk to the plaintiffs. The court can determine that this risk is a "possible" risk by assigning values to the probability ranges as applied by the IPCC. In addition, whether the action in question affects environmental sustainability should be examined. The courts may obtain opinions from ecosystem models and experts. Finally, the coverage amount of the policy should be determined by calculating the coverage gap caused by the relevant risk(s). Insurance premiums should be determined by an open tender in which insurers can participate under market conditions. Competition in open tender and risk distribution appeals to the market economy aspect of insurance, while the court's jurisdiction over defining coverage and policy updates appeals to the public aspect of environmental sustainability. Compared to the *jus cogens* environmental norms suggested by some scholars or administrative and penal restrictions as the public aspect of environmental protection, judicial insurance offers optimal public intervention. Thus, the marketability of environmental risks will increase on dynamic contentious ground instead of categorical norms. Proposed dynamic risk responsibility promises a legal solution to the moral hazard issue, which expresses the behavior change that occurs with insured risks. In addition, the role of the "*environmental commissar*" assigned by compulsory insurance practices to insurance companies will be balanced with a dynamic and transparent judicial authority. Finally, our study contributes to the discipline covering tort theory, environmental protection, liability law, and the international responsibility of states.

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