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Uncertain Risk Assessment and Management: Case Studies of the Application of the Precautionary Principle in Portugal

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This study intends to clarify how the precautionary principle (PP) has been interpreted and applied by the courts in Portugal in the analysis of conflicts associated with uncertain and serious potential risks to human health and the environment. It also aims to contribute to the debate of when and how to apply precautionary measures. To this end, recent court cases in the areas of waste incineration, high-voltage power lines, as well as dam and wind farm construction were considered. The degree of consistency in the courts' decisions and their reasons in the different judicial bodies was analyzed with the support of a theoretical framework based on three attributes: the level of seriousness of potential hazards, level of evidence required, and the severity of precautionary actions taken. Different positions among courts were observed, with contradictory arguments in the same case or in similar cases. A greater propensity for favorable decisions in the acceptance of restraining orders was verified in the courts of lower instances, where human health could be threatened. However, the decisions of the Supreme Administrative Court, which were always unfavorable to the restraining orders, seem to reflect the priority given to national economic and political interests over local or regional environmental interests. They may also reflect the Supreme Court's reluctancy to apply the PP in the absence of a firm legally binding PP in national legislation. To address this situation, more explicit legal requirements and criteria for the analysis of uncertain risks and the weighting of interests by area of activity are needed.

KEY WORDS: Assessment and management of human health and environmental risks; judicial cases; precautionary principle

1. INTRODUCTION

The application of the precautionary principle (PP) in the assessment and management of uncertain and potentially serious risks to human health and to the environment has shown ambiguity in the interpretation of the concept of precaution, insufficient characterization of potential impacts and lack of mechanisms and operational frameworks to support decision making. It has therefore been largely conditioned by factors such as the decisionmakers' goals, their attitudes toward risk and rules and the decision criteria they use, hindering the functioning of administrative justice and generating discretion, ambiguity and unpredictability of precautionary decisions.

The diversity of situations, the absence of precise regulations, and the multiple interests (environmental, economic, and social) involved hinder the role of the decisionmaker, especially in a context of uncertainty. In court disputes, in particular, it is difficult for judges to assess facts that are presented from the perspective of branches of science and technology other than law, such as the environment and economics. This article aims to clarify the way the PP has been interpreted and applied by courts in Portugal in the analysis of conflicts associated with uncertain risks to human health or to the environment. To this end, a recent set of relevant

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court cases in which the PP was applied were analyzed as they moved through the different judicial instances.

To evaluate the degree of consistency of the application of precaution in the analysis of comparable risks and the proportionality of decisions in relation to the seriousness of the hazards, a theoretical framework was developed based on three attributes: the seriousness of the potential hazards, evidence required, and the severity of the actions taken. Finally, this article aims to contribute to the debate of when to apply precautionary measures and how to improve the conditions of application of the PP in the assessment and management of human health and environmental risks.

2. METHODOLOGY

This article presents an empirical study of qualitative nature including the following methodological steps:

- Initial presentation of the PP, referring to its concept, main elements, recent trends, and future perspectives for application (chapter 3).
- Presentation of the theoretical framework based on three attributes of the PP: seriousness of hazards, evidence required, and severity of the actions taken. The objective is to allow a systematic analysis of the selected case studies regarding the consistency of the interpretation and application of the PP by the courts and the proportionality of the courts' decisions in relation to the seriousness of the hazards (chapter 4).
- Selection of case studies from the Portuguese Ministry of Justice database. Recent relevant judicial proceedings involving risks to human health and the environment were considered. They are presented in chapter 5.
- Analysis of the reasons for the positions of the parties involved in the different cases and the courts' decisions and outcomes. The assessment of the extent to which precautionary measures have been applied in the decision processes is explored with the support of the framework of analysis (chapter 5).
- Recommendation of regulatory measures to improve the conditions of application of the PP in the assessment and management of human health and environmental risks (chapter 6).

3. THE PRECAUTIONARY PRINCIPLE

The PP is presently a fundamental principle of environmental regulation in many countries. It appeared in the context of risk management strategies in areas where measures to achieve a high level of protection, in particular in relation to human health and the environment, cannot be determined on the basis of scientific certainty and when there may be a threat of irreversible damage (EEA, 2013; OECD, 2003; Renn, 2008; Stirling, 2007). These situations include areas such as radiological exposures (mobile phones and antennas), genetically modified organisms (GMO) crops, nanotechnologies, or chemicals that entail potential risks to human health and the environment (CPP, 2010; Rogers, 2011).

The PP is embedded in the European legislation (in Action Programs, directives, declarations, and recommendations) as a general principle to apply in particular legal settings. It is explicitly mentioned in many international conferences and treaties and in international trade legislation. There are a variety of formulations for the PP with different levels of intervention and the imposition of obligations in some cases (as in the Wingspread Declaration) (SEHN, 1998) granting the decisionmaker the possibility to act with caution in others (as in the Rio Summit Declaration and in the European Commission Communication of 2000) (EC, 2000). One of the most representative definitions is proclaimed in principle 15 in the Declaration of the Rio Summit on Environment and Development of 1992: "When there is a threat of serious or irreversible damage to the environment, the absence of absolute scientific certainty should not be used as a reason to postpone cost-effective measures to prevent environmental degradation" (UNCED, 1992).

The critics of the PP have claimed that it is vague and lacks a single accepted formulation, resulting in inconsistency in its application (Majone, 2002; Sunstein, 2005). However, most formulations have common key elements associated with the main issues to be considered in the practical implementation of precaution.

- The level of seriousness of potential hazards required to invoke the PP.
- The Risk Assessment and Management potential consequences of the activity with risk.
- The level of severity of the precautionary actions.

The issue of the level of severity of the precautionary actions reflects the difficulty in selecting the results required for the precautionary decision. These may range from simple studies to deepen scientific knowledge of risks or adaptive strategies such as the implementation of measures to minimize negative impacts, monitoring or surveillance, to the prohibition of risky activities until uncertainties are clarified (Peel, 2009; Stirling, 2017).

In spite of being increasingly accepted as a general principle of policy, law, and environmental management[1], the practical implementation of the PP has been the subject of controversy and discussion, particularly in situations where it may be considered as a restriction on economic activity and trade (as in the context of the WTO or biosecurity). More generally, divergences may be explained by the fact that the PP operates in a number of different contexts. According to De Sadeleer, within the EC jurisdiction, the development of clear and consistent jurisprudence is made difficult by the complexity of regulatory regimes and by the broad discretion in the application of the PP by decisionmakers (De Sadeleer, 2006). Some authors compared the approaches to risk regulation in the EU and in the United States and verified, that both jurisdictions partake in "occasional and selective application of precaution to different risks in different places and time" (Wiener, Rogers, Hammitt, & Sand, 2011).

De Sadeleer also studied regulatory standards in the United States and concluded that differences between the EU and United States are often not grounded in risk analysis procedures and science but rather based on economic, political, and normative dimensions (De Sadeleer, 2010). Or, as another author states (Scotford, 2017), they reflect changing policy priorities and make environmental principles look very different in different jurisdictions.

A current trend in international jurisprudence seems to be to focus attention on the process of decision making, possibly reflecting an effort to develop more concrete elements of operation. This may help to overcome the problem of assessing the suitability of precautionary interventions due to the difficulty in judging the likely outcome of events. This process should consider several methodological steps including risk analysis and the assessment of impacts by weighing the interests involved—technical, economic, social, and political. The scientific evidence of the hazards should be convincing and as comprehensive as the available information allows. And precautionary actions should be proportionate to the hazards and their potential consequences (Bocchi, 2016; De Sadeleer, 2009; Noiville, 2015; Peel, 2009; Stokes, 2008).[2]

Despite the progress made and the proposal of certain methodological frameworks for the practical implementation of the PP issued in reports by public entities and scientific publications[3], several authors in Europe and in the United States consider that appropriate instruments and procedures that allow a more effective contribution of the PP in the assessment and management of human health and environmental risks are still lacking. These include careful risk analysis (Noiville, 2015; Sachs, 2011), the analysis of the level of evidence required for applying the PP (Zander, 2010), being explicit about the role of politics, economics and social reasons (Lofstedt, 2014; Tosun, 2013; Zander, 2010), and the analysis of proportionality of decisions (Tosun, 2013; Zander, 2010).

On the one hand, it is desirable to preserve flexibility in decision making in various sectoral contexts, with risk assessments and precautionary measures defined on a case-by-case basis; on the other hand, it is important to balance this flexibility with consistency and predictability, especially in legal disputes. For this to happen, the courts must overcome interpretations with different evidence

[1]Many studies of a conceptual or empirical nature have been dedicated to the PP and related issues in various scientific domains, such as international law, political science, ecological economics, and environmental governance (Myers & Raffensperger, 2005; De Sadeleer, 2006; Iverson & Perrings, 2012).

[2]Such evidence does not fully address the uncertainties, since it would then be outside the scope of precaution, but is obtained from documentation regarded as satisfactory about the relevant hazards. On the other hand, scientific uncertainty is rarely considered (by the European Court of Justice and the World Trade Organization) as too high to prevent risk analysis and to affect the ability to take concrete action, especially given that it is always possible to adopt provisional and revisable measures (Noiville, 2015). This was the case of the banning by the EU of all imports on beef export from the United Kingdom (Wiener et al., 2011). However, revision of precautionary actions in light of new scientific data does not appear to have been reflected in European court cases involving the PP (Rogers, 2011).

[3]Some frameworks are more focused on general objectives and guidelines, others are more operational and describe the process of analysis and decision as a set of successive stages (IRGC, 2008; CPP, 2010; EC, 2011; Klinke & Renn, 2012). Their most relevant elements are the analysis of the potential seriousness of impact on human health and the environment, the levels of evidence, and the degree of precaution required.

requirements, current ambiguities and arbitrariness in the practical implementation of the PP.

In Portugal, the Constitution recognizes fundamental rights to human health and the environment yet the PP is not included contrasting with the principle of prevention (Article 66, paragraph 1). The PP is, however, enshrined in the transposition of European directives into national legislation: the Environmental Licensing (2008), Water Law (2005), the Civil Protection Law (2006), and the Nature Conservation & Biodiversity Law (2008).

4. FRAMEWORK OF ANALYSIS

An analytical framework was developed in order to analyze the consistency in the interpretation and application of precaution in practice by the parties involved and by the courts in the cases selected for review. This framework was also applied to analyze the proportionality of the courts' decisions in relation to the level of seriousness of the hazards. It is based on three attributes that are considered key elements of the application of the PP (EC, 2000; Garnett & Parsons, 2017; Sachs, 2011; SEHN, 1998; Stirling, 2017; UNCED, 1992).[4]

- Level of seriousness of potential hazards.
- Level of evidence required.
- Severity of precautionary actions taken.

The analysis of consistency is based on the severity of the precautionary measures in the cases reviewed and the corresponding levels of evidence required. Both of these levels emerge from the courts' outcomes and the language expressed in the judgments. It is assumed that they implicitly reflect the levels of uncertainty and/or seriousness of the hazards as perceived by the courts, which are not explicitly characterized in the judgments.

A hypothetical scenario for the seriousness of the hazards in the cases reviewed is considered when analyzing the court decisions' proportionality to counter the data limitations (Stirling, 2017). The level of seriousness of the hazards in the different activity areas is established from the assessment of criteria based on the information on the hazards and their contexts available in the courts' judgments. Uncertainty (Aven, 2011) is also assumed in all the cases but, due to the data limitations, the levels of uncertainty in the different areas are not considered for the analysis of the proportionality of precautionary measures.

To support the case analysis, the three attributes mentioned above are characterized by the categories presented in the following sections.

4.1. Analysis of the Seriousness of the Hazards

The severity of the precautionary measures is dependent on the seriousness of the hazards. Thus, in order to analyze the decisions' proportionality, the level of seriousness for each risk situation must be known, yet the level of seriousness perceived by the courts for the hazards is not explicitly referred in the courts' judgments. To overcome this limitation and characterize the potential seriousness of the hazards in the different activity areas, the following criteria are considered (Bevan, 2009; Klinke & Renn, 2010; WBGU, 2000):

- Relevance of potential danger
- Irreversibility
- Geographical dispersion
- Relevance of the interests involved

The relevance of the potential danger inherent in the risk agent is considered as *high* in cases where there is potential damage to health and human life and *moderate* in cases where damages threaten the natural world (Garnett et al., 2017).[5] This two-level classification is sufficient to apply to the selected cases as they already involve risks considered potentially serious by the plaintiff parties. In addition, the courts' judgments do not include any detailed expert judgments on the significance of the impacts that could allow a wider range of classification levels for potential danger. It is also accepted that the other criteria for the severity of the hazards will allow a better contextualization of the assessment. Situations

[4]Garnett and Parsons (2017) use these attributes to examine a set of EU pieces of legislation and judicial decisions. Their aim is to conclude on whether the applications of the PP were consistent and followed the European Commission's guidance for invoking the PP. They also analyze the strength of the PP in different cases. In this article, a new framework of analysis is devised where these same attributes are categorized in order to analyze the consistency in the application of precaution by the courts in Portugal and the proportionality of the courts' decisions.

[5]This classification is based on the distinction between technological risks (including problems such as pollution in general, the accumulation of toxic waste, and global warming) and risks of natural resource management, disappearance of natural habitats, and loss of biodiversity (OCDE, 1997; O' Connor & Spash, 2001; Harremoes et al., 2002). Here, we associate the potential damage to health and human life to technological risks and damages threatening the natural world to the other risks.

of reversibility of potential risk damages are associated with a *low* level of seriousness of hazards and situations of irreversibility with a *high* level of seriousness of hazards.

The geographical dispersion of hazards is considered as *high*, *moderate*, or *low* in different cases depending on the respective area of influence (national, regional, or local). Finally, the relevance of interests involved is considered as *low, moderate*, or *high* depending on the weighting of environmental interests by the courts in relation to economic and social interests.

Overall, the hazard level is considered *high* when all criteria are at the highest and *moderate* when potential damage is not *high* or when the assessment is not at the highest level in more than one criterion. Similar nature hazards are assumed to belong to the same activity area in different cases.

4.2. Analysis of the Level of Evidence Required

In view of the uncertainties, the necessary basis for determining the degree of concern with a risk is founded on the robustness of the scientific evidence relating to the potential existence or absence of serious hazards and the weighting of all the costs and benefits involved. These factors help to determine whether or not to apply the PP as well as determine the proposed measures.

A simple risk suspicion or a theoretically and empirically justified strong risk presumption may constitute as an evidence requirement for decision making. Three levels of required evidence are considered in the framework, corresponding to risk situations that decisionmakers consider intolerable, tolerable, or acceptable according to what they believe is the needed level of protection against the potential hazard.[6] It is assumed that weaker evidence may be acceptable when recommending action against highly hazardous exposures to damage while less harmful exposures require stronger evidence (Weed, 2004).

These levels may be characterized as follows:

- *Low level*: This level requires less evidence for the risk situation to be considered potentially serious. The decisionmaker assumes no additional scientific evidence is available on the hazard at that moment in time but accepts the seriousness of the hazard. The risk situation is considered intolerable. The decisionmaker often also believes that the burden of proof should lie with the entity responsible for the activity and not with its beneficiaries.[7]
- *Moderate level*: Evidence about the hazard is in greater quantity than in the previous level (there is less uncertainty). However, existing uncertainty still justifies action when it is possible to establish that the potential hazard is serious. That is why safety margins (legal risk thresholds) or adaptive strategies such as measures to minimize negative impacts may be justified. The risk situation is then considered tolerable.
- *High level*: There is sound scientifically up-to-date evidence and comprehensive risk analysis, so that uncertainty is considered solved.[8] The risk situation is considered acceptable and restrictive measures are prescribed on a preventive basis.

Different parties and different courts may have divergent opinions on the type of evidence required and their standard of proof for invoking the PP may also differ.

4.3. Analysis of the Severity of Precautionary Measures

Taking into account the diversity of measures and possible outcomes required for precautionary decisions and the variability in the formulation and interpretation of the PP, and following the suggestion of certain authors (Garnett et al., 2017; Lofstedt, 2014; Sachs, 2011), two levels of application of the PP are considered, which will find expression in different types of actions to be proposed:

- "Weak" application
- "Strong" application

[6]The definition of these levels of evidence should ideally reflect the social acceptability of risks. These three levels of risk tolerability or acceptability are considered in the IRGC Risk Governance Framework (Klinke & Renn, 2010).

[7]With this level of evidence, the fulfillment of safety margins is not sufficient since it is not possible to be certain about the effectiveness of these measures (Wiener & Rogers, 2002).

[8]The cause–effect relationship of the hazard and the statistical behavior of the phenomenon are scientifically known. In these situations, prevention (understood in this study to mean actions taken to reduce well-known or verified risks) and not precaution (deals with suspect risks) is at stake (Renn, Klinke, & Van Asselt, 2011).

The first level includes a wide spectrum of precautionary measures; less restrictive actions such as minimization, compensation of negative impacts, compliance with risk thresholds; simple measures of observation and surveillance; or measures to support the development of scientific knowledge about risks.

The second level considers more restrictive measures, such as prohibition/suspension of risky activities until existing uncertainties are better clarified. Thus, the "weak" application of precaution may be associated with situations assessed as tolerable risks and risk reduction options while the "strong" application may be associated with intolerable risks or risk situations with consequences considered as too serious and with options of risk avoidance. Risks that are considered acceptable do not require precautionary actions.

According to the characterization of required levels of evidence (see Section 4.2), the "weak" application of the PP should be associated with the requirement for *moderate* evidence, while the "strong" application should be associated with the *low* evidence requirement. The *high* level of evidence should correspond to situations where restrictive measures are taken to reduce well-known risks. What is more, from the analysis of the multiple cases of the application of the PP, this correlation between levels of evidence and the severity of the precautionary actions seems to be the trend observed in European jurisprudence (Garnett et al., 2017).

4.4. Analysis of the Proportionality of Precautionary Measures

Finally, the framework includes a study of the proportionality of the precautionary measures in relation to the seriousness of the hazards. This is an important criterion of good governance in assessing risk management options. The analysis of costs and benefits associated with precautionary decisions is a particular expression of the principle of proportionality (De Sadeleer, 2009). It is reflected in the assessment criteria for the seriousness of the hazards (see Section 4.1).

Precautionary measures will be considered proportionate to the seriousness of the hazards if the severity increases according to seriousness of the potential hazards.[9] Thus, more restrictive precautionary actions ("strong" application) should be applied in cases with more serious hazards (*high* seriousness) while less restrictive actions ("weak" application) should be applied in cases with less serious hazards (*moderate* seriousness).

Fig. 1 summarizes the framework of analysis, which represents the integration of uncertain risk analysis, assessment, and management.[10]

5. CASE ANALYSIS

A number of judicial proceeding related to uncertain risks to public health and to the environment were selected upon examination of the Legal and Documentary Database of the Portuguese Ministry of Justice. In these proceedings, the plaintiff parties seek restraining orders in court and apply the PP.[11] The search was carried out in the database (http://www.dgsi.pt/) to identify relevant cases for review. Documents dated between 2002 and 2018 containing the words "precautionary principle" filed in the Supreme Administrative Court (SAC) and the North and South Administrative Central Courts (NACC and SACC) were selected. Note that 65, 61, and 28 judgments were identified in the three courts, respectively. However, in most of these judgments, the PP was only mentioned in passing without any relevance for the case analysis or the two words were mentioned separately changing their combined meaning. The selection took into account the number of references made to the PP and whether or not it was important to the case. It should also be

[9]The seriousness of potential hazards is considered here as a single variable of proportionality. Uncertainty, the other key variable for the invocation of the PP, was not considered, as mentioned before, because it could not be characterized in the cases reviewed due to data limitations.

[10]The seriousness of the hazards is not clearly characterized in the judgments of the cases reviewed. Thus, a direct relation to the two boxes on the right of Fig. 1 cannot be established as they are not an explicit consequence of the level of seriousness of the hazards. To analyze the proportionality of the precautionary measures taken by the courts, a hypothetical scenario for the seriousness of the hazards in the different areas of activity had to be considered (see Section 5.4.1).

[11]According to the Code of Procedure in the Administrative Courts, in order to justify the acceptance of a restraining order, an irreversible or hard-to-repair damage and a balance of interests favorable to the acceptance of that order should be verified (CPTA, 2002). The invocation of the precautionary principle in the restraining orders arises naturally because the two required conditions for the acceptance of these orders correspond to key requisites for the invocation of the PP. The acceptance of a restraining order will be associated with the application of the PP at its "strong" level, while the rejection of a restraining order will be associated with the application of the "weak" level of the PP or to situations where the PP is not invoked.

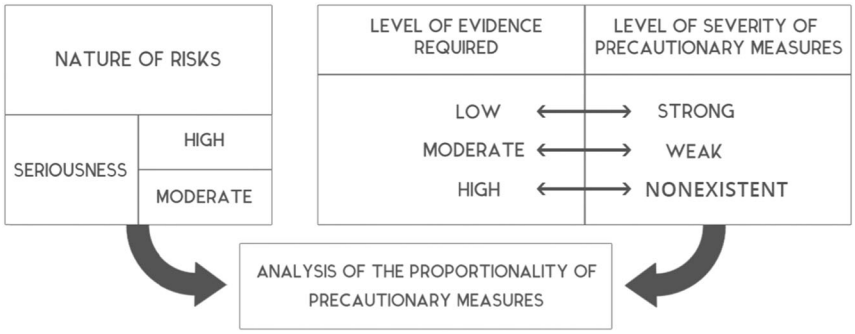

Fig. 1. Synthesis of the framework of analysis.

noted that the database only includes cases considered relevant by a committee of experts. Only seven case studies were identified as relevant for analysis due to their informative nature on factual and procedural issues. They pertain to the areas of waste co-incineration (4), high-voltage power transmission lines (2) and dam construction (1). Three other pertinent cases were identified upon consulting secondary sources (Gomes, 2013), in the areas of fishing resources, wind farms, and dam construction. These are areas of unproven risk to human health or the environment and they are also involuntary risks, making them difficult or impossible to avoid even if the people and/or entities subject to the risk are vigilant. The cases considered for analysis allow us to acknowledge the complex patterns of precautionary measures for different risks and for the same risk category. They also show the existing limitations in the implementation of the PP.

These proceedings include the entire course since the sentences of the Administrative and Tax Courts (ATCs) in the lower court, through the judgments of the NACC and SACC and the SAC. They took place between 2007 and 2014.

The cases selected cover regulatory disputes concerning public health and the environment with different contexts, presenting how each party understands the PP approach and its application. They demonstrate what currently takes place, in other words, the positions of the courts in the same judicial instance and in different instances and the reasons for the application of the PP. Although the number of cases available for analysis is reduced, we consider that systematic sampling based on a judgment logic is appropriate in this study as it explores the state of development of an unstructured phenomenon with multiple contexts and dimensions of analysis (Eisenhardt & Graebner, 2007; Yin, 2008). In addition, the qualitative analysis carried out with the intensive study of the selected cases allowed a more in-depth study of the different aspects of the problem and the specific characteristics of the different cases. But, despite this, more case studies would certainly allow to enrich the results obtained.

Following the case presentation, the positions of the parties involved and the judicial decisions and outcomes are described. The role of the PP is then explored in the decision-making processes with the support of the framework of analysis presented in Section 4.

5.1. Case Presentation

The cases that were selected for analysis are briefly presented below. There are four cases involving the co-incineration of hazardous waste brought against the Ministries of the Environment and Economy and the cement plants Cimpor and Secil by the municipalities of Coimbra (two cases), Sesimbra Palmela and Setúbal (two cases). These actions involve the possible effects of the practices of the Souselas and Outão plants on human health and the environment. They sought the suspension of the effectiveness of the Order of the Ministry of the Environment that exempted these plants from the Environmental Impact Assessment (Cases 1 and 3, hereinafter "Souselas EIA exemption" and "Outão EIA exemption") and the suspension of the allocation of operating licenses in these factories (Cases 2 and 4, hereinafter "Souselas co-incineration license" and "Outão co-incineration license").[12]

[12] Case 1: *Município de Coimbra v. Cimpor/Ministério do Ambiente*. Proc. 758/06.3BECBR. From www.dgsi.pt; Case 2: *A e B … v. Cimpor/Ministério do Ambiente*. Proc. 582/08.9BECBR. From www.dgsi.pt; Case 3: *Municípios de Setúbal, Palmela e Sesimbra v. Ministérios do Ambiente e da Economia.* Proc. 994/0. From www.dgsi.pt; Case 4: *Municípios de Setúbal, Palmela e Sesimbra v. Ministériodo Ambiente e Secil*. Proc. 994/06-B. From www.dgsi.pt.

In the area of high-voltage power transmission lines, there are two cases that relate to actions brought against the Ministry of Economy and energy companies by a community in the Sintra region (Case 5, hereinafter "Sintra high-voltage line") and by tenants (Case 6, hereinafter "Viseu high-voltage line") concerning the exposure to the electromagnetic effects associated with those lines.[13] Two other cases relate to dam construction. One action was filed by the environmental association Quercus against EDP, Portugal's electricity utility company (Case 7, hereinafter "Sabor dam—Quercus") and another was filed by the League for the Protection of Nature (LPN) against the Water Institute (Case 8, hereinafter "Sabor dam—LPN"). Both related to the possible negative effects of the construction of the Sabor Dam in the north of Portugal on the environment.[14] Another case concerning fish resources (Case 9, hereinafter "Azores fish resources") is the result of an action by a fishermen association against the Ministry of Defense due to the lack of control over the risk of exhaustion of these resources.[15] A final case (Case 10, hereinafter "Alvaiázere wind farm") refers to the Alvaiázere wind farm in central Portugal resulting from an action by Quercus against the Ministry of Environment and an electricity company due to the possible negative effects on some species of fauna.[16]

5.2. Position of the Parties Involved

The analysis of the positions of the parties involved in the cases is presented in the following subsections. The positions of the parties that defend the acceptance of the restraining orders and those that are against it are considered separately. The position of the parties involved is focused on the two conditions of acceptance of a restraining order (see footnote 10). As these conditions also correspond to key requisites for precaution, the analysis of whether to invoke the PP is also considered.

[13]Case 5: *Freguesia de Monte Abraão v. Ministério da Economia e A … (REN)*. Proc. 04613/08. From www.dgsi.pt; Case 6: *Proprietários v. Empresas A … e B …* . Proc. 1722/07.OBEVIS. From www.dgsi.pt.

[14]Case 7: *Quercus, outros e A … v. EDP*. Proc. 1266/08.3BELSB. From www.dgsi.pt; Case 8: *Liga para a Protecção da Natureza (LPN) e Quercus v. Instituto da Água*. Proc. 387/08.7BEMDL-A. From www.icjp.pt.

[15]Case 9: *Associação de Pescadores dos Açores v. Ministério da Defesa*. *Proc. 05849/10.* From www.icjp.pt.

[16]Case 10: *Quercus v. Ministério do Ambiente, Município de … e S … (Empresa de Electridade)*. Proc.6795/10. From www.icjp.pt.

5.2.1. *Position of the Parties Defending the Acceptance of the Restraining Orders*

The parties that defend the acceptance of the restraining orders referred that existing evidence (from medical studies and opinions or from technical and economic studies) is indicative of the existence of potential irreversible risks or hard-to-repair damage to human health and/or to the environment. These damages were related to the effects of persistent organic pollutants released from co-incineration operations (in Cases 1–4), the exposure to electromagnetic waves (in Cases 5 and 6), the loss of environmental and landscape values (in Cases 7, 8, concerning dam construction and in Case 10, concerning wind farm construction), and the loss of fishing resources (in Case 9).

Regarding the weighting of interests, all the cases accepting the restraining order appeared more favorable than those refusing the restraining order when considering the benefits and costs for all the interests involved in the cases. For example, in the cases concerning the co-incineration of waste, the parties considered that safeguarding the environment and citizen's health was more relevant than the elimination of waste through co-incineration. In addition, other alternative legal and safer processes were available. With regard to the construction of the Sabor dam (Cases 7 and 8), the environmental associations stated that environmental and landscape values should prevail over the production of hydroelectric energy, which, in their opinion, could be produced elsewhere.

The PP was explicitly applied to justify the acceptance of restraining orders resulting in the suspension of the risk activities in Cases 1, 2, 3, 4, concerning co-incineration operations, 5 (Sintra high-voltage line), and 7 (Sabor dam—Quercus). It may also be considered implicitly invoked in the remaining cases, where the parties also required the suspension of the risk activity due to the seriousness of the potential hazard and the lack of evidence to solve uncertainty. In Cases 2 (Souselas co-incineration license), 3 (Outão EIA exemption), 5 (Sintra high-voltage line), and 7 (Sabor dam—Quercus) but also in Cases 8 (Sabor dam—LPN) and 10 (Alvaiázere wind farm), the need to reverse the burden of proof to the entity promoting the risk activity, which for some analysts is one of the instruments of the application of the PP, was also referred.

In Cases 1–4, concerning co-incineration operations, the acceptance of restraining orders were

defended by the municipalities involved despite the compliance with risk thresholds legally defined for pollutant emissions from the co-incineration of waste. The same occurred in Case 5 (Sintra high-voltage line), with the local community affected, and in Case 6 (Viseu high-voltage line), involving some tenants, regarding electromagnetic waves from high-voltage power lines. In a similar way, the measures to minimize the negative environmental impact that had been established for the Sabor dam in Cases 7 (Sabor dam—Quercus) and 8 (Dam construction—LPN) and for the Alvaiázere wind farm (Case 10) projects had not been considered sufficient by the parties (the environmental association Quercus in Cases 7 and 10 and the LPN in Case 8), to avoid potential damage to relevant species, habitats or ecosystems.

5.2.2. Position of the Parties Against Accepting the Restraining Orders

With the exception of Cases 5 (Sintra high-voltage line) and 6 (Viseu high-voltage line), the parties promoting the economic activities argued that there was no concrete or objective evidence of the existence of irreversible threats or harm resulting from the risks invoked by the opponent parties in the different cases. They based their views on scientific and technical opinions, on the results of scientific tests, and on the weighting of interests that were different from those cited by the opponent parties. This reflects the scientific controversy involving uncertainty about hazards in these areas of activity.

Regarding the weighting of interests they invoked that the damages to public health or the environment resulting from the refusal of the restraining orders were inferior to the environmental or economic losses that would result from their acceptance. For example, in the cases related to the co-incineration (Cases 1–4), the Ministries of the Environment and Economy and the cement plants involved considered the operation of the plants essential for the elimination of existing hazardous industrial waste—an environmental liability. They also highlighted the economic value of the resulting energy production. In the cases concerning high-voltage power lines, Cases 5 (Sintra high-voltage line) and 6 (Viseu high-voltage line), the Ministry of Economy and the energy companies involved prioritized the need to reinforce the public energy network to reduce the present external dependency on energy. With regard to the dam construction, Cases 7 (Sabor dam—Quercus) and 8 (Sabor dam—LPN), the regularization of the Douro river and the construction of a strategic water reserve were cited to be in public interest. The production of renewable energy and reduction in the emission of greenhouse gases were also referenced.

Thus, the position of these parties concerning the application of the PP to the cases under analysis, as was requested by their opponent parties, was naturally different. The PP was only applied to Cases 5 and 6 concerning high-voltage power lines. The Ministry of Economy and the energy companies involved in these cases considered that the compliance with established legal risk thresholds and measures to minimize negative environmental impacts reflected the application of the PP.

In Cases 3 (Outão EIA exemption) and 4 (Outão co-incineration license), the PP was also mentioned (by the Ministries of the Environment and Economy) and its legal validity recognized, but not its applicability due to the lack of objective evidence of a hazard for these cases. However, in the other cases related to the same area of co-incineration of waste, Cases 1 (Souselas EIA exemption) and 2 (Souselas co-incineration license), the same Ministries contested the legal validity of the PP "for lack of enshrinement in the Portuguese legal system."

5.3. Reasons for the Decisions of the Courts

In all 10 cases, appeals were made to the courts of first instance and in nine to the second instance (Appeal Court). Table I identifies the courts through which the proceedings moved through and the decisions of acceptance or nonacceptance of restraining orders.

In the first instance (ATCs), courts were favorable to the suspension of the potentially harmful activity in only three of the 10 cases analyzed, two of which were related to waste co-incineration and the other the monitoring of fishing resources in the Azores.

In the second instance (NACC and SACC), courts were favorable to the suspension of the potentially harmful activity in five cases where the sentence in the first instance had already been favorable to restraining orders as well as two other cases, relating to waste co-incineration and high-voltage power transmission lines.

Finally, in the third and last instance, the SAC was always unfavorable to restraining orders for the suspension of the potentially harmful activity.

Table I. Favorable (+) and Unfavorable (–) Decisions to Restraining Orders by Area of Activity, Case, and Court

		ATCs										
Area of Activity	Case	Coimbra	Almada	Sintra	Viseu	Lisboa	Mirandela	P. Delgada	Leiria	SACC	NACC	SAC
Co-incineration	1	+									+	–
	2	–									+	–
	3		+							+		–
	4		–							–		–
High-voltage lines	5			–						–		–
	6				–						+	–
Dam construction	7					–				–		–
	8						–				–	–
Fish resources	9							+		+		–
Wind farm	10								–	–		

In the following sections, a brief analysis of the reasons for the courts' decisions in the various decision-making bodies is presented.

5.3.1. First Instance

In the first instance (ATCs), there were three favorable decisions approving the restraining orders (Cases 1, 3, and 9) and seven unfavorable decisions (the remaining cases). The favorable decisions were based on the application of the PP. In Cases 1 (Souselas EIA exemption) and 3 (Outão EIA exemption), related to the co-incineration of waste, the PP was referred as an EU principle for environmental protection applicable when dealing with uncertainty resulting from the lack of knowledge of possible health effects on local populations and "the mere possibility of environmental damage." The court requested the suspension of the co-incineration and an environmental impact assessment study. In Case 9 (Azores fish resources), the PP was not explicitly mentioned but appears to be implicit when the court stated that there was evidence of potential irreversible damage to ecosystems and to the economy resulting from the reduction of fisheries' surveillance in the region under consideration.

The weighting of interests was also stressed by the courts to justify the acceptance of the restraining orders. In Cases 1 (Souselas EIA exemption) and 3 (Outão EIA exemption), public health and the environment were referred to as a priority, and in Case 9 (Azores fish resources), the impact of the protection of the fisheries' resources was referred as very relevant for local employment and revenue and the export of canned fish.

Restraining orders were rejected in the remaining cases by the courts of the first instance. Compliance with legal risk thresholds (Case 2—Souselas co-incineration license), measures to minimize negative impacts resulting from Environmental Impact Statements (Cases 7—Sabor dam—Quercus and 10—Alvaiázere wind farm), and both risk thresholds and impact minimization measures (Cases 4—Outão co-incineration license and 5—Sintra high-voltage line) were considered sufficient for protection against irreparable damage to human health (Cases 2, 4, and 5) or to animal species and habitats (Cases 7 and 10). These cases show that many courts attach significant weight to the opinion of the competent public authorities that determine socially acceptable risk levels. The PP was only mentioned by the court in Case 5, where it stated that the PP was implicit in the application of minimization measures aimed at "safeguarding the most serious risks." However, in the other cases (Cases 2, 4, 7, and 10), the PP was not mentioned even though there was compliance with measures to minimize negative impacts and risk thresholds. Finally, in Cases 6 (Viseu high-voltage line) and 8 (Sabor dam—LPN) courts stated that there were only conjectures or insufficient knowledge of hazards and the PP was not mentioned.

Some of the courts also highlighted the weighting of interests to justify the rejection of the restraining orders. For example, in Case 7 (Sabor dam—Quercus), the court stressed the public relevance of the dam for the production of energy and in Case 10 (Alvaiázere wind farm), the need not to prejudice economic interests involved in the wind farm project. In these cases, economic and political motivations appear to be the most relevant in the context of the balance of interests required for proper decision making by the courts.

Finally, we should note that the positions of the courts in Cases 2 (Souselas co-incineration license) and 4 (Outão co-incineration license) were different from the positions taken by the same courts (courts of Coimbra and Almada), two years earlier, in Cases 1 (Souselas EIA exemption) and 3 (Outão EIA exemption), respectively, in which they were in favor of the restraining orders, for the same co-incineration plants (Souselas and Outão). In these cases, ATCs were unfavorable to restraining orders, highlighting compliance with risk thresholds and measures to minimize negative impacts, when the uncertainty conditions of the potential co-incineration damage were the same as before.[17]

5.3.2. Second Instance

In the second instance (North Administrative Central Court—NACC and South Administrative Central Court—SACC), there were five favorable decisions, accepting the restraining orders (Cases 1, 2, 3, 6, and 9) and five unfavorable decisions (Cases 4, 5, 7, 8, and 10). Two of the favorable cases to the restraining order in the second instance had been unfavorable in the lower court, Cases 2 (Souselas co-incineration license) and 6 (Viseu high-voltage line). The PP was invoked by the courts in all cases where the decision was favorable to the acceptance of the restraining order. In these cases, the courts considered that, despite uncertainty and scientific controversy, facts given as proven indicated that there were potentially serious hazards to human health and the environment, from waste co-incineration (NACC in Cases 1—Souselas EIA exemption and 2—Souselas co-incineration license and SACC in Case 3—Outão EIA exemption), the high-voltage power lines (NACC in Case 6—Viseu high-voltage line), and the exploitation of fish resources (SACC in Case 9—Azores fish resources). They also recommended carrying out studies to deepen knowledge on potential hazards and, in some cases (Cases 1, 2, and 3), referred the need to reverse the burden of proof to the entities responsible for the activities with risk. In Case 9, although the principle of prevention was invoked, the decision was justified on a precautionary rather than a prevention basis: the court saw an uncertainty situation and referred the need to act in advance to protect the environment against the suspicion of a serious potential damage.

Regarding the weighting of interests, the right to health and a clean environment was considered more relevant than the public economic interests involved in the value of energy production resulting from the co-incineration of waste in Cases 1 (Souselas EIA exemption), 2 (Souselas co-incineration license) and 3 (Outão EIA exemption), and from high-voltage power lines in Case 6 (Viseu high-voltage line). In addition, the courts considered that energy production could be carried out in alternative ways.

In the cases that did not accept the restraining orders, courts emphasized the compliance with both legal risk thresholds and measures to minimize or compensate for negative impacts as issued by the Environmental Impact Assessments and Statements (SACC in Case 4—Outão co-incineration license and 5—Sintra high-voltage line) or with measures to minimize or compensate for negative impact (SACC in Cases 7—Sabor dam—Quercus and 10—Alvaiázere wind farm and NACC in Case 8—Sabor dam—LPN). In these cases, the courts did not mention the PP. However, in the judgments of Cases 4, 5, and 7, the SACC invoked the application of the PP as it supported the published SACC. As a matter of fact, the courts' interpretation of the concepts of precaution and prevention seem confusing. Precautionary measures with different levels of severity should apply proportionally to risks with different levels of seriousness of potential hazards while preventive measures should apply only to risk situations where scientific evidence has clarified the cause-effect relationship of the potential hazards. Cases 4, 5, and 7 deal with uncertain risks, thus precaution and not prevention should have been invoked.

Regarding the weighting of interests, in Case 4 (Outão co-incineration license) the court highlighted the relevance of the co-incineration operation and the resulting elimination of the existing waste liability. In the other cases, the courts considered that the public economic interests of energy production and the environmental interests in the concerned locations could be counterbalanced by the impact of minimization measures that could prevent the most serious environmental and economic damages. In these cases, court decisions show the importance attached by the courts to the determinations of the competent public authorities (measures to minimize negative impacts) and also their concern in reconciling environmental protection and economic interests.

[17] In Case 4, the ATC itself further acknowledged that the exposure time for causing damage to human health was not known but this uncertainty did not lead the court to be more precautionary this time.

Finally, we note some divergences between the courts of second instance in their reasoning behind similar risks. In the two cases related to the Souselas (Case 2) and Outão (Case 4) co-incineration plants where the suspension of the licenses granted to those plants was requested, in Case 4 (Outão co-incineration license), the SACC maintained the decision of the previous instance, which was unfavorable to the restraining order, while in Case 2 (Souselas co-incineration license), the NACC, in response to a similar appeal, decided differently (the decision was now favorable to the restraining order). The same kind of divergence also occurred in Cases 5 (Sintra high-voltage line) and 6 (Viseu high-voltage line) related to high-voltage line projects.

5.3.3. Third Instance

The decisions of the SAC were always unfavorable to the restraining orders in all the analyzed cases.[18]

The SAC generally considered factual matters relating to the existence of specific hazards and to the weighting of interests outside of its competences, and stated that its role was only to assess compliance with rules for establishing facts. Thus, the SAC seems to rely on the opinion of the competent public authority and also to limit its intervention in areas involving the development of economic activities. In Cases 1 (Souselas EIA exemption) and 3 (Outão EIA exemption), the SAC stated that potential damages resulting from the operation of the co-incineration plants claimed by the municipalities, should have been assessed before when the plant's operations were licensed. In Case 9 (Azores fish resources), the SAC considered that the protection of the Portuguese fishermen's interests, as claimed before the court, should not be regulated by the inspection rules of the economic zone that were referenced in the case.

In Cases 2 (Souselas co-incineration license), 4 (Outão co-incineration license), 7 (Sabor dam—Quercus), and 8 (Sabor dam—LPN), the SAC stated that the risk situations were mere unproven risk conjectures. In Cases 5 (Sintra high-voltage line) and 6 (Viseu high-voltage line), the SAC stated that measures to safeguard risks had been implemented (in Case 5) and legally defined risk limits had been met (in Case 6), thus avoiding serious hazards. In some of these cases, the SAC also referred the weighting of interests to justify the rejection of the restraining orders. In Case 2, for example, the SAC stated that the nonelimination of the environmental liability of disposing industrial waste that would result from the suspension of the co-incineration would be more relevant than any damage from the plant's operations.

The SAC mentioned the PP in Cases 2 (Souselas co-incineration license), 3 (Outão EIA exemption), 4 (Outão co-incineration license), 5 (Sintra high-voltage line), 6 (Viseu high-voltage line), and 7 (Sabor dam—Quercus), stating that its application to these cases was not valid due to the nonexistence of evidence of serious hazards. In Cases 2, 3, 4, and 6, the plaintiffs were said to bear the burden of proof. In Cases 2, 3, and 6 the PP was also referred to as a general principle of environmental protection to be considered only as a political and legislative general orientation of States in the context of the pursuit of public interests in general. In these cases, the SAC shows that it considers that the PP does not determine any precise obligation but only a possible legal influence whose circumstances are not clarified. In Case 6, the SAC also referred to precaution as meaning protection against any and all risks. We note that in saying this the court was disregarding the essential proportionality of the PP.

5.4. Discussion: Application of the Framework of Analysis

5.4.1. Seriousness of the Hazards

The seriousness of the hazards in each of the practices considered in the study was characterized based on the risk criteria presented in Section 4.1. The environmental and economic information on the risks and their contexts available in the courts' judgments was used to make an assessment of the different risks in relation to the various risk criteria. We reached the following conclusions on the nature of the risks as displayed in Table II.

5.4.2. Analysis of the Consistency in the Application of the PP

In this section, the framework is applied to the analysis of the positions of the parties and courts in order to obtain a global view of the consistency of the application of the PP in the analyzed cases. This analysis is based on the outcome of the courts' decisions and on the language expressed in the judgments. The level of the evidence required by the parties and the

[18]Case 10 was not taken to the third instance.

Table II. Level of Potential Seriousness of Hazards by Area of Activity

Area of Activity	Assessment Criteria				Seriousness of Hazards
	Relevance of Potential Danger	Irreversibility	Geographical Dispersion	Relevance of Interests Involved	
Co-incineration	High	High	High	High	High
High-voltage lines	High	High	Moderate	Moderate	Moderate
Dam construction	Moderate	High	Moderate	High	Moderate
Fish resources	Moderate	High	High	High	Moderate
Wind farm	Moderate	High	Moderate	High	Moderate

courts and the corresponding level of severity of the precautionary measures taken are identified.

The sources of information of the parties involved, supporting their decisions, were multiple, generally scientific opinions and technical and economic studies. Despite the lack of knowledge and the uncertainties in the assessment of the hazards and in the weighting of interests in the areas of activity concerned, neither the analysis of uncertainties nor its relevance were presented by the parties.

The positions of the plaintiffs and the opponents in each case, were naturally opposite to each other. The reasons for disagreement were whether or not the available scientific information was considered sufficient to prove the existence of a potential hazard and the divergent results of their weighting of interests.

According to the framework of analysis (section 4), the risk situations were assessed as intolerable by the plaintiffs. They applied the PP explicitly or implicitly, in all cases, at its "strong" level: They were in favor of accepting the restraining orders despite any protective measures that may have been established. For the opponents, however, the risk situations were assessed as acceptable in most of the cases: hazards were considered unproved and not requiring any protective action. Only in Cases 5 and 6 related to high-voltage power lines, were the risk situations assessed as tolerable, requiring compliance with risk thresholds and measures to minimize negative impacts to thus avoid the most serious hazards. Therefore, according to the framework of analysis, the PP was applied by the opponent parties at its "weak" level in these two cases.

The courts in their judgments and decisions analyzed the seriousness of the hazards and the level of scientific uncertainty of the potential damages based on the facts that were presented by the parties. The courts' position on the application of the PP are presented in Table III. They were based on the information about the hazards and their impact contained in the parties' reports. They are classified as strong, weak, and nonexistent based on the analysis of the judicial outcome. This allows to verify the divergences among the different court instances in the interpretation and application of the PP.

Table III. Level of Potential Seriousness of Hazard and Level of Application of Precaution

Case Number	Area of Activity	Level of Application of Precaution		
		First Instance	Second Instance	Third Instance
1	Co-incineration	Strong	Strong	–
2		Weak	Strong	–
3		Strong	Strong	–
4		Weak	Weak	–
5	High-voltage lines	Weak	Weak	Weak
6		–	Strong	Weak
7	Dam construction	Weak	Weak	–
8		–	Weak	–
9	Fish resources	Strong	Strong	–
10	Wind farm	Weak	Weak	

Note: "–" indicates situations where the PP was not applied.

The PP was applied in its "strong" interpretation by the court of first instance and second instance in three cases, two related to the co-incineration of waste and one related to fishing resources. In these cases, the risk situations were considered very serious and thus the required level of evidence was low. The courts agreed on the existence of potential hazards and a weighting of interests favoring the acceptance of the restraining orders.

The PP was applied at its "weak" level by the courts of the first and second instance in four cases

related to the areas of co-incineration of waste, high-voltage power lines, dam, and wind farm construction. In these cases, each risk situation was considered tolerable and the level of evidence required was moderate (decisions were based on the compliance with risk thresholds or measures to minimize negative impacts).

The decisions of the court of first and second instances diverged in the three remaining cases. Precautionary measures with different levels of severity were applied in one of the co-incineration cases. In two other cases involving high-voltage power lines and dam construction, the risk situations were considered acceptable by the courts of first instance, not requiring any measures for risk protection. In the courts of second instance however, the existence of the hazard was considered proved in the first case and the PP was applied at its "strong" level. In the second case, measures to minimize negative impacts were considered sufficient by the court to avoid most serious hazards (PP applied at its "weak" level).

In the third instance, court all risk situations were considered acceptable, not needing any measures for risk protection with the except of two cases related to high-voltage power lines, where the PP was applied at its "weak" level.

In summary, the courts have different positions in the different instances regarding the application of the PP, with contradictory arguments in the same case or in similar cases in the same area of activity. A more clear understanding of these differences is not possible due to the lack of clarification of uncertainties and the level of seriousness of the hazards as perceived by the courts.

In areas with higher uncertainty and seriousness of the hazards, higher ambiguity may arise leading to less uniform court decisions.. In these areas, more detailed studies and research are needed and a stricter precautionary approach should be applied.

Apart from disagreements in the assessments and decisions, the positions of the parties and the judgments of the courts in some cases showed some lack of clarity in the application of the concept of precaution. In Cases 6 (Viseu high-voltage line), 8 (Sabor dam—LPN), 9 (Azores fish resources), and 10 (Alvaiázere wind farm) the PP was not invoked by the plaintiff parties although they recognized the seriousness of the hazards and the presence of uncertainties. The same occurred with the court of first instance in the case of fish resources. There was also some confusion with the concept of prevention in three decisions of the court of second instance (Cases 4—Outão co-incineration license, 5—Sintra high-voltage line, and 8—Sabor dam—LPN) regarding the level of clarification of uncertainties and the definition of risks involved as proven or unproven risks.

Seeking to obtain some general sense of the decisions made by the lower courts, despite the small number of cases in the sample analyzed, it may perhaps be concluded that there was a greater propensity for decisions favorable to the acceptance of restraining orders in cases where human health (in the areas of waste co-incineration and high-voltage power lines) could be threatened. This corresponded to the application of precaution at its most severe level. In cases where the most relevant risks are related to the natural environment (dam construction and wind farm), courts decide against the acceptance of restraining orders ensuring the pursuit of economic activities and interests. Finally, in the case concerning the preservation of fish resources, the decision in favor of the restraining order is at the same time aimed at defending marine ecosystems and the economic interests of fishermen and the region.

However, the decisions of the SAC, which were always unfavorable to the restraining orders and close to the view of the administrative authorities seem to reflect the priority given to national economic and political interests over local or regional environmental interests or its concern not to intervene to restrict the development of economic activities in certain areas. They may also reflect the Supreme Court's reluctancy to apply the PP because of its unclear meaning and in the absence of a firm legally binding PP in national legislation.

A further question could be raised in this regard: assessing the relative importance given to the application of legal principles (such as the PP) and to government policies in the resolution of disputes.

5.4.3. Analysis of the Proportionality of Precautionary Measures

Finally, the framework was applied to the analysis of the proportionality of precautionary decisions in order to conclude whether the more restrictive measures corresponded to or not to situations where the seriousness of the potential hazards was greater: "yes" if precaution is strong (weak) when seriousness of the hazard is high (moderate) and "no" otherwise (see Table IV). The results obtained reflect the divergences in the decisions of the courts. Assuming the scenario for the levels of seriousness of the

Table IV. Proportionality of the Precautionary Measures

Case Number	Area of Activity	Level of Seriousness of Hazards	Proportionality of Precautionary Measures		
			First Instance	Second Instance	Third Instance
1	Co-incineration	High	Yes	Yes	–
2			No	Yes	–
3			Yes	Yes	–
4			No	No	–
5	High-voltage lines	Moderate	Yes	Yes	Yes
6			–	No	Yes
7	Dam construction	Moderate	Yes	Yes	–
8			–	Yes	–
9	Fish resources	Moderate	No	No	–
10	Wind farm	Moderate	Yes	Yes	

Note: "–" indicates situations where the PP was not applied.

hazards in the different areas of activity considered in the framework (see section 5.4.1), the decisions of the courts were only proportional to the level of protection required in 14 of the 29 judgments analyzed. These results show, in the context of the framework assumptions, the diversity in the understanding of the nature of risks and the interpretation of the PP.

The analysis of the results demonstrates that the applied precautionary measures are proportional to the level of seriousness of hazards in five of the eight cases where the PP was applied in the first instance (co-incineration—2, high-voltage line—1, dam—1, and wind farm—1), in seven of the 10 cases in the second instance (co-incineration—3, high-voltage line—1, dam—2, wind farm—1) and in the two cases where the PP was applied in the third instance.

6. CONCLUSIONS

The analysis of the judicial cases selected for review in this study allowed to observe how the courts, in their role of balancing conflicting interests, deal with unproven risks and apply the PP in Portugal in areas of activity relevant to public health and the environment. The PP was invoked by judges in several judicial instances. Despite ambiguity in the definition of the PP, some common issues were considered for the analysis of precaution by the courts: the need to analyze risks, requiring some level of evidence and excluding hypothetical risks, and the need to weight different interests and impacts and to consider alternatives with less risk.

Based on the framework of analysis described in this study, different interpretations of the PP by the courts and two different types of outcome and precautionary measures were verified in the cases reviewed. The PP was applied at a "strong" level in the areas of waste co-incineration (Cases 1—Souselas EIA exemption and 3—Outão EIA exemption by the court of first instance and Cases 1, 2—Souselas co-incineration license and 3 by the court of second instance), high-voltage lines (Case 6—Viseu high-voltage line only by the court of second instance), and fish resources (Case 9—Azores fish resources in both instances). The suspension of the risk activities was required and the need to wait for better clarification on the uncertain risks was highlighted. In most of these cases, the courts consider that the burden of proof should be borne by the entities responsible for the risk activity.

The PP was applied at a "weak" level in the areas of waste co-incineration (Cases 2—Souselas co-incineration license and 4—Outão co-incineration license by the court of first instance and Case 4 by the court of second instance), high-voltage lines (Case 5—Sintra high-voltage line by the courts in the three instances and Case 6—Viseu high-voltage line only in the third instance), dam construction (Case 7—Sabor dam—Quercus by the court of first instance and Cases 7 and 8—Sabor dam—LPN by the court of second instance), and wind farm (Case 10—Alvaiázere wind farm in both instances). In these cases, the development of the risk activity was allowed but compliance with risk thresholds or with mitigation measures was required.

Regarding the consistency of the outcomes, in most of the cases the courts had different outcomes in different instances. They used different information, attached different levels of seriousness to the potential hazards and required different levels of evidence

to invoke and apply the PP. There also appeared to be some lack of clarity in the application of the concept of precaution by some courts. The analysis of the proportionality of the precautionary measures also demonstrated, in the context of the assumptions of the applied framework of analysis, the differences in the understanding of the nature of risks and in the interpretation of the PP.

In the analyzed cases, a greater propensity for favorable decisions in the acceptance of restraining orders may perhaps be verified in the courts of lower instances, where human health could be threatened (in the areas of waste co-incineration and high-voltage power lines). However, the decisions of the SAC were always unfavorable to the restraining orders. This may reflect the absence of a firm legally binding PP in national legislation or its commitment to particular policy goals and outcomes.

Based on the study of the cases reviewed, some lessons may be learned on the regulation of the PP, which are in line with other theoretical and empirical studies carried out in other countries (Assemblée Nationale, 2012; Grandjean, 2004; Van Dijk et al., 2011).

Decisionmakers face difficulties such as the use of relevant but sometimes unclear risk information, lacking an uncertainty analysis, with insufficient scientific basis and credibility. There was no clear separation of risk analysis and risk management. Risks were not targeted rationally and the analysis of the level of proof required for the issuing of precautionary measures was insufficient. In addition, costs and benefits and criteria for the weighting of interests, which may involve economic, social, and political choices, were not clearly considered in most of the cases reviewed and tradeoffs were also not considered.

To respond to these issues, the regulation of the PP should benefit from more explicit requirements and criteria for the clarification of uncertainties, the seriousness of the hazards, the burden and the level of evidence required to apply precautionary measures, and the extent to which decisions are driven by scientific evidence and economic and social reasons. Areas of activity that involve greater uncertainty and potential seriousness of hazards will require further scrutiny so that precaution can be more consensual. This could help to recognize the perception of uncertainty and of the seriousness of the hazards in the different court levels and counteract divergent decisions in relation to similar risks as currently occurs in many cases. In particular, in disputes related to the environment, judicial decisions should be more demanding in the technical assessment of risks and in the weighting of interests and less dependent on the subjective perspectives of judges.

In this context, it is essential that courts have the technical support and guidance of a high-quality scientific and independent expertise in the analysis of environmental and economic information. More specifically, in order to contribute to a better assessment and operationalization of precautionary decisions in the future, it is prudent to ensure the use of the best available scientific information on potential environmental damage and economic and social effects. Factors for assessing the seriousness of the hazards, such as the magnitude, reversibility and spatial and temporal scale of possible impacts and the perceived value of the threatened environment should be considered. Some factors should also be considered for assessing the degree of scientific uncertainty such as the level of uncertainty and the potential to reduce uncertainty economically and within a reasonable time frame. When information is incomplete or unavailable, choices made should be justified by listing the most relevant scientific evidence or considering alternatives with less uncertainty. Minimum levels of scientific evidence, based on the assessment of social risk perception and precautionary measures, adapted to the nature of the risks and their impacts could also be defined.

Accordingly, it would be possible to improve the content of court proceedings, facilitate the work of judges, reduce discretion, and achieve better decisions. This will also lead to greater predictability and to the reduction of the number of court disputes with the inherent time and cost savings. With more consistent procedural schemes and guidelines on the type of measures required, the developments in case law will enable to further clarify the application of precaution to different types of risk. The comparison between different precautionary measures and its own legal validity could also be made more effective.

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