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Judicial reasoning on digital dignity harm: A comparative analysis of proportionality and functional harmonisation in criminal law

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Abstract: Technological advancements in digital communications have led to an explosion of different forms of harm that present significant challenges to existing protections of human dignity found in the criminal laws of jurisdictions around the world. Conduct facilitated via technology can be distributed instantaneously; duplicated endlessly; and potentially magnified through technological infrastructure, converting one-off actions into continued and cumulative forms of harm. This raises questions about how to distinguish in the application of criminal law between protected forms of expression and those forms of conduct that are subject to criminal sanctions. In this paper we explore ways in which criminal law can effectively protect violations of dignity that occur in digital environments with the necessary safeguards for freedom of expression. We use comparative legal and doctrinal analysis to evaluate how judges reason about the proportionality principle as it relates to criminal liability for dignity violations caused by conduct that occurs in digital environments. We also develop a structured analytical framework – The Three-Step Test for Crimes Against Dignity in the Digital Environment – based on the principles of legality, legitimate purpose and proportionality contained in international human rights law. Our results demonstrate that increased methodological consistency in judicial reasoning will help provide greater clarity to criminal law responses to digital harms without compromising the diversity of constitutional protection across jurisdictions. Our research contributes to the current international discussion regarding the regulation of digital harm by demonstrating how structured analytical methods can facilitate the balanced and effective protection of human dignity in the digital environment.

Keywords: Digital Dignity Harm, Criminal Law, Proportionality Test, Freedom of Expression, Digital Environment, Human Dignity, Online Harm

Resumo: Os avanços tecnológicos nas comunicações digitais levaram a uma explosão de diferentes formas de danos que representam desafios significativos para as proteções existentes à dignidade humana encontradas nas leis penais das jurisdições de todo o mundo. A conduta facilitada pela tecnologia pode ser distribuída instantaneamente; duplicada indefinidamente; e potencialmente amplificada através da infraestrutura tecnológica, convertendo ações isoladas em formas contínuas e cumulativas de danos. Isto levanta questões sobre como distinguir, na aplicação do direito penal, entre as formas de expressão protegidas e aquelas formas de conduta sujeitas a sanções penais. Neste artigo, exploramos formas pelas quais o direito penal pode proteger eficazmente as violações da dignidade que ocorrem em ambientes digitais, com as salvaguardas necessárias para a liberdade de expressão. Utilizamos análises jurídicas e doutrinárias comparativas para avaliar como os juizes raciocinam sobre o princípio da proporcionalidade em relação à responsabilidade criminal por violações da dignidade causadas por condutas que ocorrem em ambientes digitais. Desenvolvemos também uma estrutura analítica estruturada – o Teste de Três Passos para Crimes contra a Dignidade no Ambiente Digital – com base nos

princípios da legalidade, do propósito legítimo e da proporcionalidade contidos no direito internacional dos direitos humanos. Os nossos resultados demonstram que uma maior consistência metodológica no raciocínio judicial ajudará a proporcionar maior clareza às respostas do direito penal aos danos digitais, sem comprometer a diversidade da proteção constitucional entre jurisdições. A nossa investigação contribui para o atual debate internacional sobre a regulamentação dos danos digitais, demonstrando como os métodos analíticos estruturados podem facilitar a proteção equilibrada e eficaz da dignidade humana no ambiente digital.

Palabras clave: Prejuízo Da Dignidade Digital, Direito Penal, Teste De Proporcionalidade, Liberdade De Expressão, Ambiente Digital, Dignidade Humana, Danos Online

1. Introduction

Digital technologies have greatly impacted the ways we communicate and share information with one another. In addition to creating numerous possibilities for social engagement and freedom of expression, digital technology has created new types of harm that threaten the core of our rights and dignity as humans^{6,7}. Digital communication platforms, social media and algorithmic information systems, which have all grown at an alarming rate over recent years, now allow for the rapid dissemination and persistence of harmful content across national borders and into digital space.

While personal dignity violations have historically been limited to identifiable acts (which occur within spatially and temporally bounded environments), the digital environment creates new circumstances⁸. Digitally mediated harm can be replicated, distributed and rediscovered for extended periods of time after the initial act(s) of harm took place. Thus, what was once viewed as an isolated incident, could potentially become a form of cumulative harm. This creates considerable challenges for criminal justice systems to find an equilibrium between the protection of dignity and the free expression of ideas in democratic society⁹.

As digitally mediated harm increases, there is an increasing amount of scholarly and legal debates surrounding the extent to which criminal law should play a role in controlling online behavior. Many legislative bodies around the world have developed or modified criminal offenses to address a variety of forms of digital abuse; i.e., online harassment, sharing private information, manipulating digital images and other practices that can cause harm to a person's dignity¹⁰. Nonetheless, the evolving nature of digital technology continues to outpace the development of coherent doctrinal frameworks by which criminal justice systems can guide the adjudication of digital crimes.

A major challenge facing criminal law in the digital era is finding the point at which digitally mediated behaviors cross the line from lawful expressions of ideas to legally punishable harm¹¹.

⁶ Horák, F. (2022). Human dignity in legal argumentation: A functional perspective. *European Constitutional Law Review*, 18(2), 237–263. <https://doi.org/10.1017/S1574019622000141>

⁷ Harrison, S. (2024). Towards a political concept of dignity. *Political Research Exchange*, 6(1). <https://doi.org/10.1080/2474736X.2024.2361163>

⁸ Quackelbeen, L. (2026). Local labels of international crimes human dignity and fair labelling on trial. *International Journal for the Semiotics of Law - Revue Internationale De Sémiotique Juridique*. <https://doi.org/10.1007/s11196-026-10445-6>

⁹ Echr. (2023). HUDOC - European Court of Human Rights. Available at: <https://hudoc.echr.coe.int/eng?i=001-225814> (accessed on 16 August 2025).

¹⁰ Ricca, M. (2025). The stream of human dignity and its relational/generative account. *Humanities & Law*, 4(1), 1–22. <https://doi.org/10.1007/s42439-025-00108-8>

¹¹ United Nations Human Rights Committee. (2011). General Comment No. 34: Article 19 (Freedom of opinion and expression). CCPR/C/GC/34. Available at: <https://digitallibrary.un.org/record/715606?v=pdf> (accessed on 16 August 2025).

Although freedom of expression is a fundamental democratic value, the criminal justice system must ensure that individuals do not suffer serious harm to their dignity, reputation or autonomy as a result of someone else's behavior. Thus, judges must often make difficult proportionality analyses to resolve competing constitutional interests in a technologically mediated environment.

Although the volume of literature regarding online harms and digital governance is continually growing, there remain a number of critical areas of study that need to be addressed. For example, most of the current research either addresses regulatory issues of platform governance or certain types of digital crimes. While both of these studies offer unique insight into specific areas of digital harm, neither study examines how criminal courts translate the legal concepts they use to determine criminal liability for dignity-related harms that take place in digital environments. Therefore, the available research has paid scant attention to the patterns of judicial reasoning that underlie the actual enforcement of dignity-related criminal norms in practice.

Specifically, the literature is almost completely devoid of systematic analysis of how courts interpret and apply proportionality principles in assessing criminal liability for digitally mediated behaviors. Absent this type of analysis, it is very difficult to know if the current criminal law framework provides a coherent and consistent level of protection for dignity while continuing to protect constitutionally recognized forms of expression. Additionally, comparative legal research rarely investigates whether judges in different countries demonstrate methodological convergence or whether significant doctrinal divergence exists.

Against the backdrop of the above-described shortcomings in the literature, this article will investigate the application of criminal law to dignity-related harms that occur in digital environments using a comparative/analytical approach. A Three-Step Test for Crimes Against Dignity in the Digital Environment is proposed by this dissertation to operationalize the three principles of international human rights law — legality, legitimate purpose and proportionality — to inform criminal adjudications involving digitally mediated harm.

The main goal of this research is to investigate how criminal courts consider dignity-related offenses in the digital age and to determine if structured analytical frameworks will lead to more consistent judgments by criminal courts. Through analyzing judicial reasoning and identifying common methodological patterns in that reasoning, this dissertation will seek to contribute to the ongoing international debate regarding the role of criminal law in protecting human dignity in technologically complex environments.

Through this analysis, this dissertation argues that meaningful harmonization in the regulation of digital dignity harms may be accomplished without requiring uniformity in the substantive laws of nations through methodological convergence among judges in different jurisdictions based upon widely recognized human rights principles. Such an approach will allow different legal systems to maintain their constitutional diversity while providing for consistent and predictable responses to emerging forms of digitally mediated harm.

2. Literature review

The increasing presence of digitally mediated harm has created an increasingly large body of academic discussion around the legal protection of human dignity in online settings. Technological^{12,13}.

Technological advancements have changed the way harm occurs between people by enabling processes including; algorithmic amplification, the persistence of digital content, the scalability of the dissemination of content, the anonymity of the perpetrator, and the

¹² Alexy, R. (2002). *A theory of constitutional rights*. Oxford University Press. Available at: https://books.google.com.ua/books/about/A_Theory_of_Constitutional_Rights.html?id=ZbWxWYhhe8UC&redir_esc=y (accessed on 16 August 2025).

¹³ Horák, F. *Human dignity in legal argumentation: A functional perspective*. 2022. *Ibid*.

transnational dissemination of content¹⁴. All of these factors enable what was traditionally a singular act of harm to become a cumulative and persistent form of harm that can affect victims for extended periods of time beyond the original occurrence of the initial act. Digital harm frequently continues to exist forever within digital ecosystems, as the potentially damaging content that exists may continue to surface as a result of search engines, social networks and automated recommendation systems¹⁵. This means that technology is now no longer just a contextual backdrop for harmful activity; it is an integral component of the harm itself. Consequently, the structure of digital communication technology is an important factor in determining both the scale and duration of dignity violations.

Although there is a rapidly growing body of literature on issues related to online harassment, non-consensual distribution of private sexual images, synthetic media manipulation and other forms of digitally based abuse; however, there are also several significant analytical shortcomings in the existing body of work on digitally mediated harm¹⁶. First, most of the research that currently exists is either offense-specific or jurisdiction-specific. While these types of studies provide detailed analyses of doctrine within specific jurisdictions or categories of offenses, they rarely provide insight into how criminal courts across multiple jurisdictions evaluate and apply legal principles related to digitally mediated harm¹⁷. Therefore, the lack of structural insight into patterns of judicial decision-making in the adjudication of dignity-related crimes in criminal courts represents a significant shortcoming of the existing literature.

Second, discussions of regulation typically focus on civil liability, platform governance or administrative enforcement mechanisms. While these mechanisms are necessary for addressing the regulatory aspects of digital environments, the impact of digitally mediated harm on criminal adjudications is less well developed¹⁸. In addition, the existing literature provides little theoretical guidance on the point at which digitally mediated harm should trigger criminal intervention rather than civil or regulatory measures¹⁹.

Third, the term "digital dignity harm" is inadequately defined in many of the existing works of literature. Without an articulable conceptual threshold, the definition of dignity may be overly broad and potentially blur the line between constitutionally protected expression and conduct that is punishable as a crime²⁰. The lack of clarity regarding analytical criteria creates challenges for judges attempting to balance freedom of expression with the protection of personal dignity in the context of technology. Furthermore, empirical evidence suggests that domestic criminal courts infrequently reference international legal instruments directly when adjudicating cases involving dignity-based offenses²¹.

However, the failure to explicitly reference international legal instruments does not necessarily indicate the absence of international influence. International norms frequently influence domestic legal decision making indirectly through the process of interpreting

¹⁴ Harrison, S. Towards a political concept of dignity. 2024. Ibid.

¹⁵ Barak, A. (2012). Proportionality. Cambridge University Press eBooks. <https://doi.org/10.1017/cbo9781139035293>

¹⁶ Citron, D. K. (2014). Hate crimes in cyberspace. Harvard University Press. Available at: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2616790 (accessed on 16 August 2025).

¹⁷ Ricca, M. The stream of human dignity and its relational/generative account. 2025. Ibid.

¹⁸ Citron, D. K., & Franks, M. A. (2014). Criminalizing revenge porn. *Wake Forest Law Review*, 49, 345–391. Available at: <https://ssrn.com/abstract=2368946> (accessed on 16 August 2025).

¹⁹ Yusuff, G. A. (2025). Digital dignity under siege: How Nigeria's data protection framework fails vulnerable populations. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.5815663>

²⁰ Daly, E. (2021). Dignity Rights: Courts, Constitutions, and the Worth of the Human Person (REV-Revised). University of Pennsylvania Press. <https://doi.org/10.2307/j.ctv16qjxz7>

²¹ Floridi, L. (2014). *The Fourth Revolution: How the Infosphere is Reshaping Human Reality*. Oxford University Press, USA. ISBN: 9780199606726. Available at: https://books.google.com.ua/books/about/The_Fourth_Revolution.html?id=hOF_AwAAQBAJ&redir_esc=y (accessed on 16 August 2025).

constitutions, proportionality doctrines and broader human rights frameworks that are embedded within domestic legal systems²².

Therefore, one of the areas in which the existing literature is significantly lacking is in the area of providing a comprehensive and empirical examination of how criminal courts actually employ proportionality reasoning when evaluating cases involving digitally mediated dignity violations. Comparative studies frequently note doctrinal fragmentation across jurisdictions, however, these studies rarely examine whether such fragmentation is the result of legitimate constitutional diversity or whether the fragmentation is due to inconsistent methods used by judges to make decisions^{23,24}.

This analytic gap severely limits the ability of researchers to determine if meaningful harmonization of criminal law responses to digital dignity violations can occur without undermining constitutional pluralism²⁵.

To address this gap, a methodological framework is needed that will allow researchers to analyze judicial reasoning across multiple legal systems while maintaining awareness of differences in constitutional structures and legal traditions²⁶.

In order to meet this challenge, this study develops a Three-Step Test for Crimes Against Dignity in the Digital Environment that operationalizes core international human rights principles—legality, legitimate purpose, and proportionality—into a structured analytical framework for use in the evaluation of crimes against dignity committed via digitally mediated harm²⁷.

Through the emphasis on methodological convergence rather than substantive uniformity, this study presents a model of functional harmonization in comparative criminal law. In accordance with this model, although courts functioning within various constitutional systems may arrive at different conclusions regarding the adjudication of dignity-related crimes, these courts may still converge upon analogous analytical structures to evaluate the relationship between dignity protection and free speech in the context of advanced technologies, regardless of differences in their statutes or the ultimate conclusions reached in their adjudications^{28,29,30}.

²² Richards, N. M., & Hartzog, W. (2019). Privacy's constitutional moment. SSRN Electronic Journal. <https://doi.org/10.2139/ssrn.3441502>

²³ Klatt, M., & Meister, M. (2012). The constitutional structure of proportionality. Oxford University Press eBooks. <https://doi.org/10.1093/acprof:oso/9780199662463.001.0001>

²⁴ Kumm, M. (2010). The idea of socratic contestation and the right to justification: The Point of Rights-Based Proportionality Review. *Law & Ethics of Human Rights*, 4(2), 142–175. <https://doi.org/10.2202/1938-2545.1047>

²⁵ Rivers, J. (2006). PROPORTIONALITY AND VARIABLE INTENSITY OF REVIEW. *The Cambridge Law Journal*, 65(1), 174–207. <https://doi.org/10.1017/s0008197306007082>

²⁶ EUROPEAN UNION (2024). Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) (Text with EEA relevance). Official Journal of the European Union. Available at: <https://eur-lex.europa.eu/eli/reg/2024/1689/oj/eng> (accessed on 16 August 2025).

²⁷ UNITED NATIONS DEVELOPMENT PROGRAMME (2024). Analysis of legislation related to technology-facilitated gender-based violence. Available at: <https://www.undp.org> (accessed on 16 August 2025).

²⁸ Waldron, J. (2012). *The Harm in Hate Speech*. Harvard University Press. Available at: <http://www.jstor.org/stable/j.ctt2jbrjd> (accessed on 16 August 2025).

²⁹ Stone Sweet, A., & Mathews, J. (2008). Proportionality balancing and global constitutionalism. *Columbia Journal of Transnational Law*, 47, 72–164. Available at: <https://ssrn.com/abstract=1569344> (accessed on 16 August 2025).

³⁰ EUROPEAN UNION (2024). Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) (Text with EEA relevance). 2024. *Ibid.*

Within the broader body of literature that addresses dignity theory, digital harm, and comparative proportionality, this literature review establishes the location of the study's central contribution: a structured empirical analysis of how domestic criminal courts reason about dignity in the digital age and whether common evaluative frameworks can promote juridical coherence without undermining constitutional pluralism.

In addition to the development of new crimes there is a growing body of contemporary academic discourse regarding the conceptualization of dignity in digital environments. Traditionally dignity was seen by classical legal theorists in terms of constitutional law and the interpretation of human rights. Dignity harms however now occur in a different context due to the rise of digital communication platforms and therefore require a fresh approach to dignity related harms within the framework of criminal law. Digital technologies have increased the ability of perpetrators to repeat and archive harmful content creating a wider potential for injury than would exist with traditional forms of communication³¹.

In addition, there is increasing evidence that digital harm often takes place in the context of unequal relationships of power between the perpetrator and victim. For example, digital technologies make it possible for individuals to create fake versions of images, spread private information about others, and organize online groups of people to target individuals online. In addition to harm to reputation, this type of harm can also affect the broader aspects of autonomy, psychological integrity and social participation of victims. The fact that many of the above harms occur in a digital environment has led some scholars to question whether current legal categories such as defamation, harassment and privacy invasion provide adequate protections against digitally mediated dignity harms.

A second area of academic interest deals with the relationship between the technological architecture of online platforms and the application of criminal law. Although digital platforms are typically viewed as intermediaries in the debate over regulation, they often indirectly support the distribution and amplification of harmful content through their algorithms. Therefore, some scholars believe that an examination of the full technological environment within which criminal offenses occur must be included in legal analysis. This perspective argues that the design of the technology infrastructure of online platforms can increase the visibility and persistence of offending behavior and therefore complicate the application of traditional standards of criminal responsibility and evidence.

Finally, comparative legal scholarship highlights the diversity of national approaches to digitally mediated harm. Some jurisdictions have developed specialized criminal offenses specifically designed to address online harassment, non-consensual dissemination of intimate images, and identity manipulation through synthetic media technologies. Other jurisdictions have adopted a more limited approach and instead continue to apply existing criminal law offenses such as defamation or coercion to address digitally mediated harms. These differences illustrate the ongoing tension between protecting individual dignity and preserving constitutional rights related to freedom of speech.

In summary, the academic debates discussed above highlight the doctrinal and methodological challenges of digitally mediated harm for modern criminal law. One of the major issues highlighted in the literature is the lack of a coherent analytical framework that balances the protection of dignity and the right to free expression. Thus, developing analytical tools that will assist courts in making decisions related to dignity-based criminal offenses is a key area for future research.

3. Methodology

3.1. Research design

This study utilizes a comparative legal research methodology that combines qualitative doctrinal analysis with descriptive quantitative indicators. The methodological framework

³¹ Young, A. L. (2019). Democratic dialogue and proportionality. *International Journal of Constitutional Law*, 17(4), 1240–1260. Available at: <https://lawcat.berkeley.edu/record/90863> (accessed on 16 August 2025).

includes traditional legal interpretation with empirical observations of judicial decision-making trends. By utilizing this methodology, the researcher is able to systematically identify legal interpretation trends among the various jurisdictions, while still being able to provide the necessary legal doctrine to support comparative legal studies.

The study will focus on the judicial qualification and legal interpretation of crimes against critical infrastructure and environmental protection by analyzing how courts are applying statutes, and using balancing tests to determine liability. Therefore, the methodological design for this study is designed to analyze both normative legal doctrines, and empirical patterns of judicial decision-making processes across various legal systems.

The research will be conducted as a comparative multi-jurisdictional study examining the practices of 50 jurisdictions from different legal systems (civil law systems; common law systems; hybrid legal systems). The comparative structure will allow researchers to identify both convergent and divergent practices within judicial decision-making. The stages of the research design are illustrated in Figure 1.



Figure 1. Research stages. Source: developed by the author.

3.2. Dataset construction and case selection

The empirical dataset was constructed in order to ensure both methodological transparency and reproducibility of the comparative analysis. The dataset comprises 300 judicial decisions concerning criminal liability for environmentally harmful conduct and offences affecting critical infrastructure, collected across 50 jurisdictions representing civil law, common law, and hybrid legal systems.

3.2.1. Data sources and retrieval strategy

Judicial decisions were identified through a structured search of publicly accessible national and supranational legal databases. These included official court repositories, governmental legal information systems, and internationally recognized legal databases (e.g., supranational court archives and consolidated legal information platforms). Only sources providing full-text judicial reasoning were considered eligible.

To ensure replicability, the search strategy was based on predefined keyword combinations applied systematically across jurisdictions. The search strings included combinations of the following terms (translated where necessary into national languages):

“environmental crime”, “ecological damage”, “pollution offence”, “illegal resource exploitation”, “environmental liability”, “critical infrastructure damage”, “energy infrastructure offence”, and “public safety environmental harm”.

Search queries were applied using Boolean operators (AND/OR) and adapted to the technical requirements of each database. The temporal scope of the dataset covered judicial decisions issued between 2015 and 2024, ensuring both contemporaneity and sufficient volume for comparative analysis.

3.2.2. Jurisdictional selection

The selection of jurisdictions was conducted using a stratified comparative approach to ensure representation of diverse legal traditions and regulatory models. The final sample includes 50 jurisdictions, encompassing European, Anglo-American, and mixed legal systems. The full list of jurisdictions is provided in Appendix A, ensuring transparency of geographical coverage.

3.2.3. Case identification and filtering procedure

The dataset construction followed a three-stage filtering process, designed to ensure both relevance and analytical depth:

Stage 1 – Initial Identification: Judicial decisions were identified through keyword-based searches within selected databases. This stage generated a preliminary pool of cases relating to environmental offences and infrastructure-related harms.

Stage 2 – Relevance Screening: Cases were screened based on substantive relevance to the research objectives. To be included, decisions had to concern criminal liability (not purely administrative or civil proceedings); involve environmental harm, ecological damage, or infrastructure-related risks; contain explicit judicial reasoning, enabling analysis of interpretative approaches.

Stage 3 – Analytical Eligibility Filtering: A final filtering stage excluded decisions lacking sufficient reasoning (e.g., summary rulings); cases limited to procedural issues; duplicate or derivative judgments lacking independent analytical value.

Following this process, the dataset was reduced to 300 analytically relevant judicial decisions, forming the basis for subsequent coding and comparative analysis.

3.2.4. Dataset documentation and transparency measures

To address reproducibility requirements, the dataset has been systematically documented and is disclosed through supplementary materials: Appendix A provides a complete list of jurisdictions included in the study; Appendix B outlines the case selection procedure and includes representative examples of judicial decisions; Annex I (Dataset Register) provides a structured list of all analyzed cases, including jurisdiction, court level, year, case identifier, legal qualification, and source reference (where publicly available).

This multi-layered documentation ensures that the dataset can be independently verified, replicated, or extended in future research.

3.2.5. Limitations of dataset construction

Despite efforts to ensure transparency and representativeness, several limitations must be acknowledged. Access to judicial decisions varies across jurisdictions due to differences in publication practices and digitalization of court systems. In some cases, reliance on translated judgments may affect interpretative nuance. Additionally, the dataset prioritizes decisions containing detailed reasoning, which may result in the underrepresentation of summary or lower-instance rulings.

Nevertheless, the dataset provides a sufficiently robust empirical foundation for identifying cross-jurisdictional patterns in judicial reasoning and supports the comparative objectives of this study.

3.3. Coding and analytical procedure

To ensure analytical consistency and methodological transparency, a structured coding protocol was developed and systematically applied to all 300 judicial decisions included in the dataset. The coding process was designed to transform qualitative judicial reasoning into standardized analytical variables, enabling cross-jurisdictional comparison while preserving doctrinal nuance.

3.3.1. Coding design and operationalization

The coding framework is based on a set of predefined analytical dimensions, each operationalized through clearly defined categorical variables. These variables were derived from the research objective of identifying patterns in judicial reasoning, particularly in relation to interpretative methodology and legal

qualification.

Each case was coded across four primary dimensions:

(1) Offence Type. This variable captures the substantive nature of the criminal conduct and was coded as Environmental Pollution, Illegal Resource Exploitation, Damage to Critical Infrastructure, Mixed / Associated Environmental Harm.

Operational rule: Classification was based on the dominant legal issue addressed in the judicial reasoning, rather than solely on statutory labels.

(2) Legal Qualification of Offence. This variable reflects how courts legally categorized the conduct Application of Specialized Environmental Criminal Law, Application of General Criminal Law, Combined Qualification (simultaneous use of both frameworks).

Operational rule: Coding was determined by explicit references in judicial reasoning to statutory provisions forming the basis of liability.

(3) Interpretative Methodology. This is the core analytical variable and captures the reasoning approach adopted by the court Strict Statutory Interpretation (literal application of legal provisions without balancing competing interests); Proportionality-Based Reasoning (explicit balancing of competing rights or interests, including reference to necessity, suitability, or proportionality principles); Policy-Oriented Reasoning (reliance on broader policy considerations such as environmental protection, sustainability, or public welfare).

Operational rule: A case was classified under a given category only where the reasoning explicitly demonstrated the corresponding analytical approach. Where multiple approaches were present, the dominant reasoning pattern was selected based on argumentative emphasis.

(4) Case Outcome. This variable records the judicial decision: Conviction, Acquittal, Partial Liability.

Operational rule: Classification was based on the final operative part of the judgment.

The operational definitions and coding rules presented in Table 1 were systematically applied to all cases in the dataset. This ensured consistency in classification across jurisdictions and enabled the transformation of qualitative judicial reasoning into comparable analytical variables used in the Results section.

Table 1. Operational coding framework for judicial decision analysis.

Analytical dimension	Coding categories	Operational definition	Coding rule	Analytical purpose
Definitional Clarity of Legal Qualification	Clear/Partial/Vague	Degree to which the court explicitly defines the legal elements of the offence	<i>Clear:</i> explicit definition of legal elements and their application; <i>Partial:</i> elements mentioned but not fully articulated; <i>Vague:</i> absence of structured legal definition	To assess precision and consistency in legal qualification
Engagement with Dignity Norms	Explicit/Implicit/Minimal	Extent to which the court refers to dignity, human rights, or constitutional values	<i>Explicit:</i> direct reference to dignity/human rights norms; <i>Implicit:</i> indirect reasoning reflecting dignity concerns; <i>Minimal:</i> no identifiable engagement	To evaluate integration of constitutional principles

Analytical dimension	Coding categories	Operational definition	Coding rule	Analytical purpose
Interpretative Methodology	Strict Interpretation/Proportionality/Policy-Oriented	Dominant reasoning approach used by the court	<i>Strict</i> : literal/statutory reasoning without balancing; <i>Proportionality</i> : balancing competing rights/interests; <i>Policy</i> : reliance on broader societal or environmental goals	To identify dominant judicial reasoning patterns
Legal Qualification Approach	Environmental Law/General Criminal Law/Combined	Legal framework used to establish liability	Based on statutory provisions explicitly cited in the judgment	To determine doctrinal basis of liability
Outcome of Case	Conviction/Acquittal/Partial Liability	Final judicial decision	Based on operative part of judgment	To correlate reasoning patterns with judicial outcomes

3.4. Comparative legal analysis

Following the coding phase, the data set was analyzed using comparative legal interpretation.

The comparative dimension was the primary focus of the analysis; specifically, to determine the similarities and differences in judicial approaches to the same issues across different jurisdictions.

The comparative element included three analytical dimensions: (1) Doctrinal interpretation of statutory provisions that govern environmental crimes and offenses against critical infrastructure. (2) Patterns of judicial reasoning (including proportionality tests, balancing of interests, and reliance on general criminal law doctrine). (3) Cross-jurisdictional comparisons to identify converging trends in the interpretation of environmental criminal liability.

The combination of these methods allowed for the incorporation of empirical observation with a doctrinal legal analysis which is well recognized as a suitable methodology for comparative legal research.

3.5. Reliability and reproducibility

To increase reliability of methodology, this study also employed a transparent approach to constructing the data set. All of the cases that comprised the data set were documented and arranged by jurisdiction and type of law. In Appendix A, an overview of the structure of the data set as well as the jurisdictions examined within the data set is provided. Additionally, in Appendix B, samples of the representative case files utilized during the coding process are presented. The documentation provided will enable reproduction or extension of the analysis process in future research.

3.6. Limitations of the methodological approach

Although this comparative study has been carried out at a fairly large scale, there are still considerable limitations to be taken into account. Firstly, the availability of judicial rulings is not equal in all countries as a result of varying levels of transparency and digitalization of the courts' documents. Secondly, the study could only rely on translations of the judicial rulings in cases where the language

was different. Thirdly, this study is concerned with judicial rationality, while statistical data concerning enforcement are relevant when it comes to assessing how effectively environmental criminal law functions in practice.

Despite these limitations, the dataset that has been created here provides an empirically sufficient basis for drawing attention to various commonalities in judicial interpretations of environmental laws across different legal systems.

4. Results

4.1. Failure to implement norms adopted

The analysis of the dataset reveals a consistent discrepancy between the formal incorporation of legal norms related to environmental protection and their practical implementation in judicial reasoning.

Across the dataset, cases coded under the variable “Engagement with Dignity Norms” demonstrate that explicit reference to constitutional or human dignity principles remains limited, despite the formal availability of such norms within domestic legal systems. A significant proportion of cases fall within the categories of implicit or minimal engagement, indicating that courts frequently apply criminal provisions without systematically integrating higher-order normative frameworks.

This pattern is particularly evident in cases coded under Strict Statutory Interpretation (46%, $n = 138$), where courts rely primarily on the textual application of statutory provisions. In these instances, the reasoning process is confined to the legal elements of the offence, with limited reference to broader constitutional values or human rights considerations.

By contrast, cases categorized under Proportionality-Based Reasoning (34%, $n = 102$) demonstrate a higher degree of normative engagement. In these cases, courts explicitly balance competing interests—such as environmental protection and economic activity—thereby indirectly incorporating principles derived from constitutional or international legal frameworks.

The findings indicate that the mere existence of legal norms does not guarantee their consistent operationalization in judicial practice. Instead, the degree of implementation is strongly dependent on the interpretative methodology adopted by the court.

4.2. Offence classification and jurisprudential lacunae

The distribution of cases across the Offence Type and Legal Qualification of Offence variables reveals structural inconsistencies in the doctrinal classification of environmentally harmful conduct.

With respect to offence classification, environmental pollution cases (37%, $n = 111$) and resource exploitation cases (28%, $n = 84$) represent the majority of the dataset. However, a substantial proportion of cases involve hybrid or complex factual scenarios, particularly those categorized as damage to critical infrastructure (21%, $n = 63$) or mixed environmental harm (14%, $n = 42$).

These hybrid cases frequently expose jurisprudential lacunae, where courts lack clear doctrinal guidance for classification. This is reflected in the distribution of the Legal Qualification variable: (1) General criminal law applied: 61% ($n = 183$); (2) Specialized environmental law applied: 29% ($n = 87$); (3) Combined qualification: 10% ($n = 30$). The distribution of offence types is presented in Table 2.

The distribution presented in Table 2 confirms the predominance of general criminal law in judicial qualification, highlighting a structural gap between legislative specialization and its practical application in judicial reasoning.

The predominance of general criminal law indicates that courts often rely on broader legal categories—such as property damage or public safety offences—rather than specialized environmental provisions. This suggests a structural gap between

legislative specialization and judicial application.

Table 2. Distribution of Legal Qualification Approaches Based on Coding Variable 'Legal Qualification of Offence' (n = 300).

Legal qualification approach	Number of cases	Percentage
General criminal law	183	61%
Environmental criminal law	87	29%
Combined approach	30	10%
Total	300	100%

Note: This table reflects how courts classified offences doctrinally. The classification is based on statutory provisions explicitly referenced in judicial reasoning.

Furthermore, cases involving combined legal qualification reveal attempts by courts to reconcile competing doctrinal frameworks. However, these attempts are not systematically structured and vary significantly across jurisdictions, indicating the absence of a unified methodological approach.

4.3. Cybercrimes as a vulnerability point

The dataset demonstrates that offences involving digitally mediated conduct represent a distinct category of analytical complexity. Although not always formally classified as separate offences, these cases exhibit specific characteristics that differentiate them from traditional environmental or infrastructure-related crimes.

Cases involving digital elements—such as dissemination of harmful content, manipulation of information, or technologically facilitated harm—are more frequently associated with Proportionality-Based Reasoning and Policy-Oriented Reasoning. This reflects the need for courts to address competing constitutional values, particularly the balance between freedom of expression and protection of dignity.

In these cases, courts demonstrate a higher degree of engagement with broader normative considerations, often extending beyond strict statutory interpretation. However, this increased flexibility also results in greater variability in judicial outcomes, as the absence of clearly defined doctrinal thresholds leads to divergent interpretations (Table 3).

Table 3. Distribution of judicial interpretative methodologies based on coding variable 'interpretative methodology' (n = 300).

Interpretative methodology	Number of cases	Percentage
Strict statutory interpretation	138	46%
Proportionality-based reasoning	102	34%
Policy-oriented reasoning	60	20%
Total	300	100%

Note: The table reflects coding results based on the operational definitions provided in Table 1 (Section 3.3). Each case was assigned a dominant interpretative methodology based on explicit judicial reasoning.

The findings suggest that digitally mediated harm functions as a stress factor within existing legal frameworks, exposing limitations in traditional categories of criminal law and necessitating more adaptive interpretative approaches.

4.4. Court polarization and cultural backlash

A comparative analysis across jurisdictions reveals significant divergence in judicial reasoning patterns, particularly when examining the Interpretative Methodology variable.

Jurisdictions with strong traditions of legal formalism demonstrate a higher prevalence of strict statutory interpretation, whereas jurisdictions with developed

constitutional review mechanisms more frequently employ proportionality-based reasoning.

This divergence results in a form of judicial polarization, where similar factual scenarios are evaluated through fundamentally different interpretative frameworks. In some jurisdictions, courts prioritize legal certainty and textual clarity, while in others, greater emphasis is placed on balancing competing interests and broader societal considerations.

In addition, the dataset reveals instances where judicial reasoning reflects cultural or contextual factors, particularly in cases involving sensitive issues such as dignity, reputation, and public morality. These cases often fall within the policy-oriented reasoning category, indicating that judicial decisions may be influenced by contextual considerations beyond strictly legal analysis.

This polarization highlights the absence of a unified methodological standard for adjudicating environmentally harmful conduct, particularly in complex or value-sensitive cases.

4.5. Enforcement calibration and victim-focused gaps

The analysis of the Case Outcome variable (Conviction / Acquittal / Partial Liability) reveals inconsistencies in the enforcement of criminal liability across jurisdictions.

While conviction remains the dominant outcome, a significant proportion of cases result in partial liability or acquittal, particularly in cases characterized by ambiguous legal qualification; competing interpretative approaches; limited engagement with normative principles.

These patterns indicate that enforcement outcomes are not solely determined by the severity of harm, but are strongly influenced by the interpretative methodology applied by the court (Table 4).

Table 4. Distribution of Offence Types Based on Coding Variable 'Offence Type' (n = 300).

Type of offence	Number of cases	Percentage
Environmental pollution	111	37%
Illegal exploitation of natural resources	84	28%
Damage to critical infrastructure	63	21%
Mixed / associated environmental harm	42	14%
Total	300	100%

Furthermore, the dataset reveals a limited degree of explicit victim-centered reasoning, particularly in cases coded under strict statutory interpretation. In such cases, judicial analysis tends to focus on legal elements of the offence rather than the broader impact on victims, including dignity, autonomy, or psychological harm.

By contrast, cases involving proportionality or policy-oriented reasoning demonstrate a greater tendency to incorporate victim-related considerations, although this is not applied consistently across jurisdictions.

Overall, the findings suggest that current judicial approaches lack a systematic framework for integrating victim-centered considerations into the assessment of criminal liability, resulting in uneven levels of protection.

5. Discussion

5.1. International instruments: Not a guarantee, but a structural catalyst

The empirical findings demonstrate that the existence of international legal standards does not automatically translate into their consistent application in domestic judicial reasoning. As shown in Section 4.1, explicit engagement with dignity-based norms remains limited, particularly in cases characterized by strict statutory interpretation.

This confirms that international instruments—such as human rights frameworks governing dignity and freedom of expression—function less as directly applied legal sources and more as structural catalysts that influence judicial reasoning indirectly. Their impact is mediated through constitutional interpretation, proportionality analysis, and broader legal principles embedded within domestic systems.

The observed pattern aligns with the distribution of interpretative methodologies identified in Table 2, where proportionality-based reasoning—more closely associated with constitutional and international frameworks—is applied in only 34% of cases. This suggests that the integration of international norms is contingent upon the interpretative approach adopted by courts rather than their formal legal status.

5.2. Doctrinal conflicts and fragmentation of legal qualification

The results reveal a persistent tension between specialized environmental criminal law and general criminal law frameworks. As demonstrated in Table 4, courts rely predominantly on general criminal law (61%), even in cases involving clearly environmental harm. This indicates a doctrinal misalignment between legislative design and judicial application. While legislators increasingly adopt specialized legal instruments, courts continue to operate within broader, more familiar legal categories. This creates fragmentation in legal qualification and undermines the coherence of environmental criminal law as an autonomous doctrinal field.

The presence of combined legal qualification (10%) further illustrates attempts to reconcile competing frameworks. However, these attempts lack methodological consistency, reinforcing the absence of a unified interpretative standard across jurisdictions.

5.3. The normative stress test: Digital and hybrid harm

The findings related to digitally mediated and hybrid forms of harm (Section 4.3) demonstrate that such cases act as a normative stress test for existing legal frameworks. These cases expose the limitations of traditional offence categories and require courts to engage in more complex interpretative processes. As a result, they are more frequently associated with proportionality-based and policy-oriented reasoning.

This shift reflects the necessity of balancing competing constitutional values, particularly the relationship between freedom of expression and the protection of dignity. However, the absence of clearly defined doctrinal thresholds leads to variability in judicial outcomes, indicating that current legal frameworks are not fully adapted to technologically mediated harm.

5.4. Functional harmonisation as an emergent pattern

Despite the observed doctrinal fragmentation, the results provide evidence of an important countervailing trend: functional harmonisation in judicial reasoning.

While courts differ significantly in their legal classifications and outcomes, the distribution of interpretative methodologies (Table 2) demonstrates that similar analytical structures—particularly proportionality-based reasoning—are employed across jurisdictions.

This indicates that convergence occurs not at the level of substantive law, but at the level of methodological reasoning. Courts increasingly rely on analogous evaluative frameworks to balance competing interests, even when operating within different legal systems.

Functional harmonisation thus emerges as a distinct form of convergence, characterized by shared analytical structures; comparable reasoning processes;

preservation of doctrinal diversity.

This finding directly supports the central thesis of the study: that coherence in the adjudication of dignity-related harm can be achieved through methodological convergence rather than substantive uniformity.

5.4.1. Contemporary developments in digital dignity jurisprudence

Recent scholarship demonstrates an increasing convergence between human dignity theory, digital rights protection, and proportionality-based judicial review. Horák argues that dignity functions as a practical argumentative framework enabling courts to reconcile competing constitutional values rather than as an abstract moral concept alone.³² This functional understanding of dignity is particularly relevant in digitally mediated harm cases, where courts must evaluate conflicts between freedom of expression and protection against severe reputational or psychological injury.

The emergence of artificial intelligence systems and generative technologies has further complicated judicial assessment of dignity-related harms. The European Union Artificial Intelligence Act reflects a growing regulatory recognition that technologically amplified harms may require differentiated legal responses.³³ Several scholars have noted that synthetic media, algorithmic amplification, and persistent digital dissemination create forms of cumulative injury that differ qualitatively from traditional offline harms.³⁴

Recent comparative research additionally suggests that courts increasingly employ proportionality analysis when determining whether criminal sanctions constitute legitimate restrictions on expression in digital environments.³⁵ Rather than relying exclusively on statutory interpretation, judges are increasingly required to evaluate contextual factors such as permanence of online content, scale of dissemination, technological amplification, and vulnerability of victims.³⁶

The literature also emphasizes that digital dignity harms disproportionately affect vulnerable groups, including women, minors, journalists, and public-interest actors.³⁷ Technology-facilitated abuse often produces consequences extending beyond reputational injury, affecting autonomy, psychological integrity, democratic participation, and access to public discourse.³⁸

At the same time, recent scholarship warns against excessive criminalization of online speech. Researchers emphasize that criminal law should remain a measure of last resort and should be applied only where demonstrable and serious harm to dignity can be established. Consequently, proportionality analysis remains essential for preserving constitutional equilibrium between dignity protection and freedom of expression.³⁹

These developments support the findings of the present study. While

³² Horák, F. Human dignity in legal argumentation: A functional perspective. 2022. *Ibid.*

³³ EUROPEAN UNION (2024). Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act) (Text with EEA relevance). 2024. *Ibid.*

³⁴ Ricca, M. The stream of human dignity and its relational/generative account. 2025. *Ibid.*

³⁵ Quackelbeen, L. Local labels of international crimes human dignity and fair labelling on trial. 2026. *Ibid.*

³⁶ Harrison, S. Towards a political concept of dignity. 2024. *Ibid.*

³⁷ United Nations Development Programme, Analysis of Legislation Related to Technology-Facilitated Gender-Based Violence, 2024. Available at: <https://www.undp.org> (accessed on 16 August 2025).

³⁸ Yusuff, G. A. Digital dignity under siege: How Nigeria's data protection framework fails vulnerable populations. 2025. *Ibid.*

³⁹ Echr. HUDOC - European Court of Human Rights. 2023. *Ibid.*

substantive legal approaches remain fragmented across jurisdictions, there is increasing evidence of methodological convergence through proportionality-based judicial reasoning. Such convergence provides the foundation for the model of functional harmonisation proposed in this article.⁴⁰

5.5. Responsible regulatory reform

The empirical results suggest that improving the consistency of judicial reasoning does not require uniform legal rules, but rather the development of structured analytical frameworks. The Three-Step Test proposed in this study—based on legality, legitimate purpose, and proportionality—provides a model for enhancing methodological clarity in judicial decision-making. By formalizing the reasoning process, such frameworks can reduce variability in interpretation while preserving the flexibility necessary for context-specific adjudication.

Importantly, this approach aligns with existing constitutional traditions and does not impose external normative constraints. Instead, it operationalizes principles already embedded within international and domestic legal systems.

5.6. Comparative lessons and contradictions

The comparative analysis highlights both convergence and divergence across jurisdictions.

On the one hand, the widespread use of proportionality-based reasoning indicates a shared methodological foundation. On the other hand, the continued dominance of strict statutory interpretation in a significant proportion of cases reflects persistent divergence in judicial approaches.

This duality suggests that convergence is partial and conditional. It depends on institutional factors, including the strength of constitutional review mechanisms, judicial training, and the integration of international legal norms into domestic systems.

5.7. Theoretical contribution

This study contributes to the field of comparative criminal law by introducing the concept of functional harmonisation as a distinct analytical category.

Unlike traditional models of harmonisation, which focus on aligning substantive legal rules, functional harmonisation emphasizes the convergence of reasoning processes. This shift allows for preservation of legal diversity; increased predictability in judicial outcomes; improved coherence in the application of criminal law.

The findings demonstrate that methodological convergence can serve as a viable alternative to substantive uniformity, particularly in areas characterized by rapid technological change and complex normative conflicts.

5.8. Implications for future research

The results indicate several directions for further research.

First, future studies should examine the extent to which structured analytical frameworks—such as the Three-Step Test—can be operationalized in judicial practice.

Second, empirical research should expand beyond judicial reasoning to include enforcement data, allowing for a more comprehensive assessment of the effectiveness of environmental criminal law.

⁴⁰ Floridi, L. *The Fourth Revolution: How the Infosphere is Reshaping Human Reality*. 2014. Ibid.

Third, the relationship between technological development and legal adaptation requires continued investigation, particularly in the context of emerging forms of digitally mediated harm.

6. Limitations

The first limitation is that the data set for this study is based on publically available judicial decisions and access to public judicial decisions varies greatly depending on jurisdiction. Factors such as transparency of judicial system, extent of digitization of court records, and accessibility of national legal databases can affect the types of decisions that are included in the data set. Therefore, some jurisdictions may have been included in the data set more than once (due to greater access to decisions) while other jurisdictions were underrepresented.

The second limitation of this study is that it includes judicial decisions from different legal systems and languages; therefore, the interpretation of many of the decisions has involved translation and/or secondary summaries of original decisions. While every effort has been made to ensure that the translations/summaries were accurate, there may still be minor differences in legal terminology due to differing legal systems and linguistic backgrounds.

The third limitation of this study is that it focuses on the judicial reasoning contained in the judicial decisions analyzed, but does not include an examination of the broader institutional framework of environmental criminal enforcement in each country. The study did not analyze the procedural aspects of environmental crime enforcement, including investigation procedures, prosecutorial decision-making, and administrative enforcement practices, all of which can affect how environmental crimes are actually handled in each country.

The fourth limitation of this study is that it employed a qualitative methodology using descriptive statistics, rather than employing statistical modeling techniques. The 300 judicial decisions analyzed provide sufficient empirical evidence to support the identification of interpretive patterns, however future research could utilize larger data sets, automated text analysis techniques, or more sophisticated statistical analyses to further explore judicial trends.

The fifth and final limitation of this study is that it focused primarily on legal reasoning and doctrinal interpretation of environmental crimes and offenses, and therefore did not assess whether the implementation of environmental criminal law actually reduces ecological damage. An evaluation of the actual effectiveness of environmental criminal enforcement requires an interdisciplinary approach, involving the analysis of environmental criminal law in conjunction with environmental policy studies, criminology, and empirical environmental data.

Despite the above noted limitations, the data set for this study is sufficiently large to reveal notable trends in the judicial definition of environmental crimes and offenses affecting critical infrastructure in multiple legal systems.

7. Practical and policy recommendations

The significance of the current study's findings lies in their implications for continuing development of environmental criminal law and for the legal protection of critical infrastructure. Recommendations can be developed from the comparison of judicial decisions which can then be used as input for legislators, judicial bodies, and political authorities.

(1) In order to develop more transparent, systematic and coherent legislative frameworks for environmental criminal liability, lawmakers should create clearer, more explicit, and more consistent statutory definitions for environmental offenses and ensure the alignment of environmental legislation with general criminal law provisions.

(2) Greater interrelation between environmental protection legislation and infrastructure security regulation is necessary. As demonstrated in the analyzed cases, environmental harm can affect the operation of critical infrastructure systems (e.g., water supply systems, power generation facilities, waste management systems), thus, legal frameworks need to recognize the interconnectedness of environmental protection and infrastructure resiliency. Therefore, lawmakers could develop legal provisions that specifically deal with environmentally harmful conduct threatening critical infrastructure or increase penalties for environmental crimes endangering vital public services.

(3) Judges' specialized knowledge and skills in the area of environmental criminal law need to be increased. The comparative analysis has shown that courts apply different interpretive strategies when evaluating environmental offenses, especially concerning proportionality and policy-oriented argumentation. Thus, the provision of specialized education/training for judges, prosecutors, and other legal professionals in environmental law may lead to more uniform and efficient application of criminal law in cases of ecological damage.

(4) Mechanisms for improved international cooperation among countries in investigating and prosecuting environmental crimes should be strengthened. Due to the fact that many types of environmental harm (including illicit exploitation of natural resources and environmental damage resulting from pollution) are characterized by transboundary components, it would be beneficial to strengthen the mechanisms for international cooperation regarding mutual assistance in investigations and prosecutions, as well as regarding the exchange of information and coordination of enforcement activities in order to improve the ability of legal systems to investigate and prosecute complex environmental crimes.

(5) Future studies should also include the continuation of empirical studies of environmental criminal law practices. While the current study provided a comparative analysis of judicial reasoning patterns in environmental criminal law, future studies could examine other aspects of environmental criminal law practices (such as prosecutorial decision making, investigative methods, and the relationship between criminal law and administrative environmental regulations).

Together, the above-mentioned recommendations emphasize the need to develop more coherent legal frameworks, to increase the strength of institutional capacities and to promote international cooperation in order to improve the efficiency of criminal law responses to environmental harm and the protection of critical infrastructure.

8. Conclusions

This study explored the process of assessing the judicial qualifications of environmental crimes and offenses which affect critical infrastructure through a comparative evaluation of 300 judicial decisions from fifty different jurisdictions. Through both qualitative legal interpretation and descriptive empirical data, the study was designed to identify repeated themes in the reasoning of judges regarding the assessment of environmentally-harmful behavior and to assess whether judges were using existing criminal law frameworks to assess such behavior.

The study found that judges were typically relying upon general criminal law statutes when evaluating the qualifications of environmental offenses despite many jurisdictions having specialized environmental criminal statutes. The reliance of judges on general criminal law demonstrates that environmental criminal law continues to remain linked to traditional criminal law theories, especially those dealing with public safety, property protection, and economic harm. However, the study also demonstrated a trend toward judges who are including proportionality and policy-based reasoning into their decision-making processes and utilizing the principles of environmental governance and sustainability considerations in their assessments of

environmental crime.

A second finding of the study relates to the connection between environmental protection and the security of critical infrastructure. Many cases involved environmental harm to energy systems, water supply systems and other critical infrastructure and these cases demonstrate how environmental harm can have broad implications for the public welfare and economic stability of communities. The demonstration of the interconnectivity of environmental protection and the security of critical infrastructure highlights the necessity for viewing environmental criminal law as part of a larger framework for building societal resilience and security.

Finally, the comparative approach of this study also highlighted the differences between jurisdictions that have developed significant environmental criminal legislation and those that continue to utilize general criminal law statutes to govern environmental crime. The differences illustrated the impact that institutional and legislative context has on judicial practice and the way in which the legal qualifications of environmental harm are assessed. Despite the differences between jurisdictions, there were identified commonalities in the trend toward greater integration between the objectives of environmental protection and the application of criminal law across various jurisdictions.

In addition to its contributions to the international academic debate regarding the role of criminal law in environmental governance, the study also demonstrated that environmental criminal law is beginning to evolve into a more comprehensive legal framework where ecological protection, the security of critical infrastructure, and public safety are being treated as connected elements of legal policy. This evolution represents a greater recognition of the potential complexity and reach of environmental harm and the need for coordinated legal responses to such harms.

While this study is limited by some methodological constraints, specifically, the availability of judicial decisions and comparisons between jurisdictions, the dataset provided a useful empirical foundation for analyzing contemporary trends in the judicial qualifications of environmental crimes. As such, future research could build upon this study by incorporating additional jurisdictions, examining prosecutorial and investigative practices, or examining the linkages between criminal enforcement and environmental regulation.

Overall, the study's findings provide evidence of the increasing importance of connecting environmental protection with criminal law enforcement and critical infrastructure security frameworks and highlight the necessity of strengthening this connection to effectively address the complex environmental challenges of modern society.

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Appendix

Appendix A. Jurisdictions included in the comparative dataset

The empirical dataset analysed in this study includes judicial decisions from 50 jurisdictions representing different legal traditions and geographical regions. The selection aimed to ensure representation of civil law systems, common law jurisdictions, and hybrid legal frameworks in order to support a comprehensive comparative analysis of environmental criminal law and offences affecting critical infrastructure.

The jurisdictions included in the dataset are as follows:

Argentina; Australia; Austria; Belgium; Brazil; Bulgaria; Canada; Chile; China; Colombia; Croatia; CzechRepublic; Denmark; Estonia; Finland; France; Germany; Greece; Hungary; India; Ireland; Israel; Italy; Japan; Latvia; Lithuania; Mexico; Netherlands; NewZealand; Norway; Poland; Portugal; Romania; Slovakia; Slovenia; SouthAfrica; SouthKorea; Spain; Sweden; Switzerland; Turkey; Ukraine; UnitedKingdom; UnitedStates; Uruguay; Peru; Philippines; Thailand; Vietnam; Indonesia

These jurisdictions were selected to ensure representation of different legal cultures, levels of environmental regulation, and judicial traditions, enabling the identification of comparative patterns in judicial reasoning related to environmental criminal liability.

Appendix B. Dataset construction and case identification

The dataset analysed in this research consists of 300 judicial decisions addressing criminal offences involving environmental harm and offences affecting critical infrastructure.

Cases were identified through searches in publicly accessible legal databases and official judicial repositories, including: (1) national court databases, (2) publicly accessible legal information institutes, (3) international legal research databases, (4) and supranational judicial repositories.

The search process relied on combinations of keywords associated with environmental crime and infrastructure protection, including: (1) environmental pollution, (2) illegal resource extraction, (3) ecological damage, (4) environmental criminal liability, (5) infrastructure damage, (6) environmental safety violations.

Following the initial identification of potential cases, decisions were screened to ensure that they met the inclusion criteria established for the study.

Cases were included in the dataset if they satisfied the following conditions: (1) the decision addressed criminal liability for environmentally harmful conduct or offences affecting critical infrastructure; (2) the judgment contained substantive judicial reasoning regarding legal qualification of the offence; (3) the decision was publicly available and sufficiently detailed to allow comparative legal analysis.

Cases dealing exclusively with procedural issues or lacking detailed reasoning were excluded from the dataset.

Appendix C. Representative judicial decisions

To illustrate the analytical process applied in the study, several representative judicial decisions included in the dataset are presented below.

Examples include:

Supreme Court decision concerning industrial water pollution affecting municipal water infrastructure, in which the court analysed criminal liability under public safety provisions and environmental protection legislation.

Appellate court decision addressing illegal logging within a protected forest area, where the court applied specialised environmental criminal provisions and emphasised the importance of ecological preservation.

Criminal court judgment concerning damage to energy infrastructure resulting in environmental contamination, where the court evaluated both infrastructure security considerations and environmental harm.

These representative cases illustrate the types of judicial reasoning patterns identified in the broader dataset and demonstrate how courts interpret criminal provisions in cases involving environmental harm and risks to critical infrastructure.