

Law in the Age of Complexity: Transdisciplinary Responses to Global Risks

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Abstract

In an increasingly interconnected and unpredictable global landscape, law is confronted with complex, multilayered risks that transcend traditional disciplinary boundaries. Phenomena such as transnational crime, human trafficking, migration pressures, technological disruption, and hybrid security threats challenge the capacity of legal systems to provide coherent and effective responses. This paper explores how a transdisciplinary approach — integrating insights from law, sociology, psychology, public policy, and data science — can improve both the understanding and management of such risks. The study adopts a conceptual and analytical methodology, complemented by a targeted review of international and European legal instruments and empirical research. It examines the limitations of exclusively normative frameworks and argues for the incorporation of contextual, behavioral, and systemic perspectives into legal reasoning and decision-making. Particular attention is devoted to the role of cognitive biases, moral disengagement, and institutional constraints in shaping judicial and policy outcomes. By bridging the gap between legal theory and social reality, the paper proposes a set of operational recommendations, including interdisciplinary training modules for legal professionals, decision-support tools grounded in risk indicators, and improved screening protocols for identifying vulnerability in complex cases. Ultimately, the paper argues that law, when reconceptualized through a transdisciplinary lens, can become more adaptive, responsive, and resilient in addressing the evolving nature of global risks.

Keywords: transdisciplinarity; global risks; legal complexity; human trafficking; vulnerability; decision-making; moral disengagement; interdisciplinary approach; risk governance; judicial processes.

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1. Introduction

Contemporary legal systems are increasingly confronted with complex and interconnected global risks that challenge traditional doctrinal and institutional frameworks. Phenomena such as human trafficking, cybercrime, irregular migration, environmental crises, and hybrid security threats operate across borders and involve multiple layers of causation, making them resistant to exclusively legalistic or state-centered solutions. These risks are not isolated events; rather, they form part of broader systemic dynamics characterized by uncertainty, interdependence, and rapid transformation. As such, they require legal responses that are both flexible and context-sensitive.

The COVID-19 pandemic, geopolitical instability, and accelerated technological change have further exposed structural vulnerabilities within legal and administrative systems. Emergency measures adopted during crises have often tested the balance between efficiency and the protection of fundamental rights, raising concerns about proportionality, accountability, and democratic oversight.² At the same time, digitalization and artificial intelligence have introduced new regulatory challenges, including issues related to data protection, algorithmic decision-making, and cyber resilience.³

These developments highlight a growing mismatch between the complexity of contemporary risks and the linear, compartmentalized nature of traditional legal reasoning. Legal norms, typically designed within stable and clearly defined frameworks, struggle to capture the fluid and evolving nature of global threats. Moreover, institutional responses are often constrained by bureaucratic fragmentation, limited coordination, and cognitive biases affecting decision-makers.

In this context, law must evolve beyond its traditional boundaries and engage with other disciplines to better understand and regulate complex social realities. A transdisciplinary approach enables the integration of normative legal analysis with empirical insights into human behavior, social structures, and tech-

² Organisation for Economic Co-operation and Development (OECD), *Building Trust to Reinforce Democracy: Main Findings from the 2021 OECD Survey on Drivers of Trust in Public Institutions* (Paris: OECD Publishing, 2022), <https://doi.org/10.1787/b407f99c-en>; World Economic Forum, *The Global Risks Report 2023*, 18th ed. (Geneva: World Economic Forum, 2023), <https://www.weforum.org/publications/global-risks-report-2023/>.

³ Roger Brownsword, *Law, Technology and Society: Reimagining the Regulatory Environment* (Abingdon: Routledge, 2019), <https://doi.org/10.4324/9781351128186>.

nological systems. For example, psychological research on decision-making under uncertainty⁴ and European policy analysis of vulnerability and marginalization⁵ provide useful tools for improving both legal interpretation and policy design.

This paper argues that a transdisciplinary framework combining law with insights from psychology, sociology, public policy, and data science offers a more robust and adaptive response to global risks. By bridging the gap between legal theory and social reality, such an approach enhances the capacity of legal systems to anticipate, manage, and mitigate complex risks while preserving the core values of the rule of law.

2. Theoretical Framework: Law and Complexity

The concept of complexity in legal studies refers to the dynamic and often unpredictable interactions among legal norms, social behavior, institutional practices, and broader systemic conditions. Unlike traditional linear models of legal reasoning, which are based on clear causation, stability, and predictability, complex systems are characterized by uncertainty, nonlinearity, feedback loops, and emergent outcomes that cannot be fully anticipated through conventional doctrinal analysis.⁶ In such systems, small changes in context or behavior may generate disproportionately large effects, challenging the assumption that legal rules produce uniform and controllable outcomes.

From this perspective, law can no longer be understood as a closed, self-referential system, but rather as an adaptive subsystem embedded in broader social, economic, and technological environments. Legal norms interact continuously with informal practices, institutional cultures, and behavioral patterns, leading to outcomes that are often contingent and context-dependent. This interaction becomes particularly visible in areas such as transnational crime, human trafficking, and cybercrime, where multiple jurisdictions, actors, and risk factors intersect in complex and evolving configurations.⁷

Legal complexity is further amplified by globalization and digitalization,

⁴ Daniel Kahneman, Olivier Sibony, and Cass R. Sunstein, *Noise: A Flaw in Human Judgment* (New York: Little, Brown Spark, 2021).

⁵ European Commission, “Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the EU Strategy on Combatting Trafficking in Human Beings 2021–2025,” COM(2021) 171 final, April 14, 2021, <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52021DC0171>.

⁶ Pierpaolo Vivo, Daniel M. Katz, and J. B. Ruhl, “A Complexity Science Approach to Law and Governance,” *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences* 382, no. 2270 (2024): 20230166, <https://doi.org/10.1098/rsta.2023.0166>.

⁷ Neil Boister, *An Introduction to Transnational Criminal Law*, 2nd ed. (Oxford: Oxford University Press, 2018), <https://doi.org/10.1093/law/9780198795995.001.0001>; United Nations Office on Drugs and Crime (UNODC), *Global Report on Trafficking in Persons 2022* (New York: United Nations, 2023), <https://doi.org/10.18356/9789210023351>.

which blur traditional boundaries between domestic and international law, public and private regulation, and human and algorithmic decision-making. For example, the rise of platform economies and artificial intelligence has created hybrid regulatory spaces in which legal responsibility, accountability, and enforcement are increasingly difficult to define.⁸ In such contexts, exclusively normative approaches focused on formal rules and hierarchical structures often fail to capture the underlying drivers of behavior or to produce effective and sustainable interventions.

Moreover, complexity challenges the epistemological foundations of legal reasoning. The assumption that legal actors operate as fully rational decision-makers is increasingly questioned by behavioral research demonstrating the influence of cognitive biases, heuristics, and institutional constraints on legal interpretation and application.⁹ As a result, legal outcomes are shaped not only by formal norms but also by psychological and organizational factors.

In response to these challenges, transdisciplinarity emerges as a necessary methodological and theoretical framework. Unlike interdisciplinarity, which involves the juxtaposition or integration of existing disciplinary perspectives, transdisciplinarity seeks to develop new analytical models that transcend disciplinary boundaries and generate a more holistic understanding of complex phenomena. It emphasizes problem-oriented research, the co-production of knowledge, and the inclusion of both academic and practical expertise.

Applied to law, a transdisciplinary approach enables the integration of normative analysis with empirical data, behavioral insights, and systemic modeling. It facilitates a shift from reactive regulation to anticipatory governance, in which legal systems are better equipped to identify emerging risks, understand their underlying dynamics, and design adaptive responses. Ultimately, this framework reconceptualizes law not as a static set of rules but as a dynamic, evolving system capable of learning, adaptation, and resilience in the face of complexity.

3. Global Risks and Legal Challenges

Global risks are increasingly defined by their systemic nature, cross-border implications, and capacity to generate cascading effects across multiple sectors. Unlike traditional risks, which could be managed within relatively stable legal and institutional frameworks, contemporary global risks are characterized by high levels of uncertainty, interdependence, and rapid escalation. As the World Economic Forum has emphasized, phenomena such as organized crime, forced displacement, digital insecurity, environmental degradation, and institutional erosion are not only interconnected but also mutually reinforcing, creating complex

⁸ Brownsword, *Law, Technology and Society*.

⁹ Kahneman, Sibony, and Sunstein, *Noise*.

risk environments that challenge conventional regulatory approaches.¹⁰

These dynamics place significant pressure on legal systems, which must operate within fragmented jurisdictions, limited enforcement capacities, and evolving normative expectations. The growing gap between the pace of global transformation and the adaptability of legal frameworks raises critical questions about the effectiveness, legitimacy, and resilience of law in addressing such challenges.

3.1. Human Trafficking and Vulnerability

Human trafficking remains one of the most complex and adaptive forms of transnational crime, embedded in broader socioeconomic and geopolitical contexts. Trafficking networks exploit structural inequalities, migration pressures, armed conflicts, and governance deficits, making the phenomenon highly resistant to traditional law-enforcement strategies.¹¹ Despite significant advances in international and European legal frameworks, responses remain predominantly centered on criminalization, prosecution, and border control.

However, such approaches often overlook the multidimensional nature of victimization. Vulnerability is not a static attribute but a dynamic and context-dependent condition shaped by factors such as poverty, gender inequality, social exclusion, psychological trauma, and institutional failures.¹² This perspective requires legal systems to move beyond rigid categorizations of “victim” and “offender” and to adopt more nuanced, individualized assessments.

Furthermore, psychological phenomena such as coercion, dependency, trauma bonding, and learned helplessness play a critical role in shaping victims’ behavior and their interactions with legal institutions. Failure to account for these factors may lead to misidentification, secondary victimization, or ineffective protective measures. Consequently, integrating legal analysis with psychological and sociological insights is essential to developing more effective and humane responses.

3.2. Technological Risks and Cybercrime

The rapid digitalization of society has fundamentally transformed the risk landscape, giving rise to new forms of criminality and new regulatory challenges. Cybercrime, identity theft, online exploitation, and large-scale data breaches are increasingly sophisticated, transnational, and difficult to detect or prosecute. At

¹⁰ World Economic Forum, *The Global Risks Report 2024*, 19th ed. (Geneva: World Economic Forum, 2024), <https://www.weforum.org/publications/global-risks-report-2024/>.

¹¹ UNODC, *Global Report on Trafficking in Persons 2022*.

¹² European Commission, “EU Strategy on Combatting Trafficking in Human Beings 2021–2025.”

the same time, emerging technologies such as artificial intelligence and algorithmic decision-making introduce additional concerns relating to bias, opacity, and accountability.¹³

Legal systems face significant difficulties in keeping pace with technological innovation. Regulatory frameworks are often reactive, fragmented, and constrained by jurisdiction, whereas technological developments evolve at an accelerated rate. This mismatch produces legal uncertainty, enforcement gaps, and inconsistent standards across jurisdictions.

Moreover, the use of automated systems in public administration and judicial processes raises fundamental questions about due process, transparency, and fairness. Although algorithmic tools may enhance efficiency, they may also reproduce or amplify existing social biases if they are not properly designed and regulated.¹⁴ Legal responses must therefore incorporate not only technical expertise but also ethical and human rights considerations.

3.3. Institutional Fragility

Institutional fragility is a critical dimension of global risk because the effectiveness of legal responses depends largely on the capacity, integrity, and coordination of public institutions. Crises — whether health-related, economic, or security-driven — tend to expose structural weaknesses, including limited resources, bureaucratic inertia, fragmented governance, and insufficient inter-agency cooperation.¹⁵

Such vulnerabilities can undermine both the implementation of legal norms and the legitimacy of institutional action. In a crisis, pressure to act swiftly may lead to the adoption of exceptional measures that bypass standard procedures and potentially affect fundamental rights and democratic accountability. Over time, this practice can erode public trust and weaken the social contract between citizens and institutions.

Institutional responses are also influenced by organizational cultures and decision-making constraints, including risk aversion, path dependence, and cognitive biases. These factors may hinder innovation, reduce responsiveness, and limit the ability of institutions to adapt to rapidly changing environments.

Addressing institutional fragility therefore requires not only legal reform but also broader governance strategies focused on capacity-building, transparency, and collaborative networks. Strengthening institutional resilience involves

¹³ Brownsword, *Law, Technology and Society*.

¹⁴ Michael Veale and Frederik Zuiderveen Borgesius, “Demystifying the Draft EU Artificial Intelligence Act—Analysing the Good, the Bad, and the Unclear Elements of the Proposed Approach,” *Computer Law Review International* 22, no. 4 (2021): 97–112, <https://doi.org/10.9785/crl-2021-220402>.

¹⁵ OECD, *Building Trust to Reinforce Democracy*.

improving coordination mechanisms, promoting evidence-based policymaking, and fostering a culture of adaptability and accountability.

4. Behavioral and Cognitive Dimensions of Decision-Making in Criminal Law

Decision-making occupies a central position in criminal law because it affects both the effectiveness of justice and the protection of fundamental rights. Traditionally, criminal law has been grounded in principles such as legality, culpability, proportionality, and individual responsibility. Contemporary research demonstrates, however, that the application of these principles is significantly influenced by cognitive, psychological, and institutional factors, particularly in complex cases involving global risks.

Criminal justice actors, including judges, prosecutors, and law-enforcement officials, frequently operate under conditions of uncertainty, evidentiary ambiguity, and time pressure. In such contexts, decision-making is not purely deductive or rule-based; it is also shaped by bounded rationality and reliance on heuristics.¹⁶ This raises important concerns about the consistency, fairness, and predictability of criminal justice outcomes.

4.1. Cognitive Biases in Criminal Proceedings

Cognitive biases exert a significant influence on criminal proceedings, affecting multiple stages of the process, from investigation and prosecution to adjudication and sentencing. Although criminal law is grounded in principles of objectivity and rationality, decision-makers operate under conditions of uncertainty, time pressure, and incomplete information. Reliance on cognitive shortcuts may therefore become almost inevitable, yet these mental mechanisms can distort the evaluation of evidence and the interpretation of facts.

One of the most pervasive biases in criminal proceedings is confirmation bias, which may lead investigators and prosecutors to favor information that supports their initial hypotheses while disregarding or undervaluing exculpatory evidence. This tendency can shape the entire trajectory of a case, influencing not only the direction of the investigation but also the construction of prosecutorial narratives. Alternative explanations may consequently be insufficiently explored, increasing the risk of erroneous conclusions.

Anchoring bias similarly plays a crucial role in judicial decision-making, particularly in sentencing. Initial reference points, such as prosecutorial recommendations or statutory thresholds, can exert a disproportionate influence on final judgments. Even when judges strive to maintain independence and objectivity,

¹⁶ Kahneman, Sibony, and Sunstein, *Noise*.

such anchors may unconsciously frame their assessment of proportionality and fairness, leading to variation in sentencing outcomes.

The availability heuristic is another important cognitive factor, especially in cases involving serious or highly publicized crimes. In such situations, decision-makers may rely on readily recalled examples — often shaped by media coverage or recent experience — when assessing risk or determining the severity of a threat. This may result in an overestimation of danger and, consequently, in responses that are more punitive or precautionary than the circumstances warrant.

These cognitive distortions are particularly problematic in complex criminal cases, such as those involving human trafficking, organized crime, or terrorism, where evidentiary structures are fragmented and depend heavily on narrative reconstruction. The combination of ambiguity, emotional salience, and institutional pressure creates fertile ground for bias-driven decision-making. Empirical research confirms that such biases may contribute to wrongful convictions, inconsistent sentencing practices, and inadequate protection of victims.¹⁷

Recognizing the presence and effects of cognitive biases is therefore essential to improving the quality and fairness of criminal justice processes. It underscores the need for structured decision-making frameworks, enhanced training for legal professionals, and the incorporation of behavioral insights into procedural safeguards to mitigate the risks associated with human judgment in complex legal environments.

4.2. Moral Disengagement and Criminal Responsibility

The concept of moral disengagement is relevant to criminal law both for understanding offender behavior and for analyzing institutional responses. Offenders involved in complex crimes, such as trafficking networks or cybercrime, may justify their actions through mechanisms such as diffusion of responsibility, minimization of harm, or dehumanization of victims.¹⁸

At the institutional level, moral disengagement may manifest itself in procedural formalism or desensitization toward victims, especially in high-volume caseload environments. For example, victims of trafficking may be treated primarily as sources of evidence rather than as rights-bearing individuals, leading to secondary victimization within the criminal justice process.

This dual dimension — individual and institutional — highlights the need

¹⁷ Birte Englich and Thomas Mussweiler, “Sentencing under Uncertainty: Anchoring Effects in the Courtroom,” *Journal of Applied Social Psychology* 31, no. 7 (2001): 1535–51, <https://doi.org/10.1111/j.1559-1816.2001.tb02687.x>; Vanessa Meterko and Glinda Cooper, “Cognitive Biases in Criminal Case Evaluation: A Review of the Research,” *Journal of Police and Criminal Psychology* 37, no. 1 (2022): 101–22, <https://doi.org/10.1007/s11896-020-09425-8>.

¹⁸ Albert Bandura, *Moral Disengagement: How People Do Harm and Live with Themselves* (New York: Worth Publishers, 2016).

for criminal law to incorporate not only normative standards but also insights into human behavior and ethical reasoning.

4.3. Risk Assessment and Decision-Making in Criminal Justice

Risk assessment plays a critical role in criminal law, particularly in matters such as pretrial detention, sentencing, parole, and preventive measures. Evaluating risk, however, involves significant uncertainty and is susceptible to both cognitive biases and structural limitations.

In recent years, actuarial tools and algorithmic systems have increasingly been used to support decision-making in criminal justice. Although these tools promise greater objectivity and consistency, they also raise concerns about transparency, accountability, and potential discrimination.¹⁹

Moreover, the precautionary logic underlying certain criminal-law measures — such as preventive detention or expanded surveillance — reflects a shift toward risk-based governance. Although this may enhance security, it also challenges traditional principles such as the presumption of innocence and proportionality.

4.4. Toward a Behaviorally Informed Criminal Law

Incorporating behavioral insights into criminal law represents a significant step toward improving both procedural fairness and substantive justice. Although the normative foundations of criminal law rest on principles such as legality, culpability, and proportionality, their practical application is inevitably mediated by human cognition and institutional dynamics. A behaviorally informed criminal justice system acknowledges this reality by recognizing that decision-making is influenced not only by legal rules but also by psychological factors, including cognitive biases, emotional responses, and contextual pressures.

Such an approach does not seek to replace traditional legal reasoning. Rather, it refines and supports that reasoning by integrating empirical knowledge about how individuals actually perceive, interpret, and act on information in complex situations. In this sense, behavioral insights serve as a corrective mechanism aimed at narrowing the gap between formal legal standards and real-world decision-making.

One central implication of this perspective is the need for specialized training for legal professionals. Judges, prosecutors, and law-enforcement officers should have a deeper understanding of cognitive biases and decision-making under uncertainty. Such training can enhance self-awareness and encourage more reflective and balanced judgments, particularly in cases involving ambiguous or

¹⁹ Veale and Zuiderveen Borgesius, “Demystifying the Draft EU Artificial Intelligence Act.”

incomplete evidence.

Equally important is the adoption of trauma-informed approaches to the treatment of victims, especially in sensitive cases such as human trafficking and sexual exploitation. Recognizing the psychological effects of trauma enables legal actors to interpret victim behavior more accurately, including apparent inconsistencies in testimony or reluctance to cooperate, thereby reducing the risk of misjudgment or secondary victimization.

Furthermore, structured decision-making frameworks can promote greater consistency and transparency in criminal proceedings. By providing standardized criteria and procedural safeguards, these frameworks help limit arbitrariness and ensure that comparable cases are treated similarly. At the same time, the increasing use of algorithmic and data-driven systems in criminal justice requires careful scrutiny. Although these technologies may enhance efficiency, they also raise critical concerns about transparency, accountability, and compliance with fundamental rights. Meaningful human oversight and effective legal safeguards are therefore essential.

Ultimately, a behaviorally informed approach does not weaken the normative structure of criminal law. On the contrary, it reinforces that structure by aligning legal principles with empirical realities. By integrating psychological and behavioral dimensions, criminal law can become more responsive to the complexities of human behavior, more equitable in its application, and more resilient in addressing the evolving challenges posed by global risks.

5. Transdisciplinary Approaches to Risk Governance in Criminal Law

The growing complexity of global risks requires a profound reconfiguration of criminal law, moving beyond its traditional reactive and punitive orientation toward a more anticipatory, preventive, and integrative paradigm. In this evolving context, transdisciplinarity is an essential framework for rethinking both criminal policy and institutional practice. By incorporating insights from psychology, criminology, sociology, and data science, criminal law can respond more effectively to the multifaceted nature of contemporary criminal phenomena.

Conventional approaches to criminal law have long prioritized identifying, prosecuting, and punishing offenders. Although these core functions remain indispensable, they are insufficient when addressing complex forms of criminality such as human trafficking, cybercrime, and organized crime. These phenomena are deeply embedded in broader socioeconomic structures and behavioral dynamics that cannot be adequately understood or managed through exclusively normative legal frameworks. A transdisciplinary approach permits a more comprehensive understanding of the underlying mechanisms and can therefore support the development of more effective and sustainable responses.

Within this framework, prevention increasingly becomes a central objective of criminal policy. Prevention involves not only situational strategies aimed at reducing opportunities for crime, but also broader social interventions designed to address root causes such as poverty, marginalization, and lack of education. In the specific context of human trafficking, prevention cannot be achieved solely through criminal sanctions; it requires coordinated social policies targeting vulnerability and exploitation. European Union law — including Directive 2011/36/EU as amended by Directive (EU) 2024/1712 — and related policy developments emphasize the importance of victim-centered and prevention-oriented responses.²⁰ The integration of empirical data, behavioral insights, and risk analysis into criminal policy further enhances its capacity to generate targeted and evidence-based interventions.

At the level of criminal proceedings, the prosecution of complex crimes presents considerable evidentiary and procedural challenges. Transnational criminal networks operate across multiple jurisdictions, employ sophisticated concealment strategies, and often exploit individuals who are reluctant or unable to cooperate with authorities. In such circumstances, traditional investigative techniques may prove inadequate. A transdisciplinary perspective supports the development of more advanced investigative methods, including financial analysis and digital forensics, as well as behavioral approaches that facilitate a deeper understanding of both victim and offender conduct. Strengthening interinstitutional and international cooperation mechanisms, including through Eurojust and Europol, is equally important. In addition, victim-sensitive and trauma-informed practices can improve the interpretation and assessment of testimony, thereby enhancing both procedural fairness and evidentiary accuracy.²¹

A significant transformation in contemporary criminal law is the consolidation of a victim-centered paradigm, particularly in cases involving serious human rights violations such as trafficking, exploitation, and abuse. Transdisciplinary approaches contribute decisively to this shift by integrating psychological and social perspectives into legal frameworks. Victims are increasingly recognized not merely as evidentiary resources but as individuals with complex needs requiring protection, support, and empowerment. This perspective entails early

²⁰ Directive 2011/36/EU of the European Parliament and of the Council of April 5, 2011, on Preventing and Combating Trafficking in Human Beings and Protecting Its Victims, and Replacing Council Framework Decision 2002/629/JHA, 2011 O.J. (L 101) 1, <https://eur-lex.europa.eu/eli/dir/2011/36/oj/eng>, as amended by Directive (EU) 2024/1712 of the European Parliament and of the Council of June 13, 2024, 2024 O.J. L 2024/1712, <https://eur-lex.europa.eu/eli/dir/2024/1712/oj/eng>; European Commission, “EU Strategy on Combatting Trafficking in Human Beings 2021–2025.”

²¹ Directive 2012/29/EU of the European Parliament and of the Council of October 25, 2012, Establishing Minimum Standards on the Rights, Support and Protection of Victims of Crime, and Replacing Council Framework Decision 2001/220/JHA, 2012 O.J. (L 315) 57, <https://eur-lex.europa.eu/eli/dir/2012/29/oj/eng>.

identification through vulnerability-assessment tools, the provision of comprehensive psychological, legal, and social assistance, and the prevention of secondary victimization throughout criminal proceedings. It also requires a nuanced understanding of the effects of trauma on memory and testimony, a concern reflected in European instruments such as Directive 2012/ 29/EU on victims' rights.

Simultaneously, the rise of risk-based governance in criminal justice reflects a broader shift toward preventive and data-driven approaches. Risk-assessment tools are increasingly employed in areas such as pretrial detention, sentencing, and probation, with the aim of enhancing consistency and efficiency in decision-making. Their use, however, raises significant legal and ethical concerns, particularly regarding transparency, accountability, and the potential for discriminatory outcomes.²² Such tools must therefore be subject to rigorous legal scrutiny and complemented by meaningful human oversight.

Ultimately, integrating transdisciplinary perspectives supports the development of a more coherent and adaptive model of criminal justice. Such a model is characterized by enhanced coordination among legal, social, and administrative institutions, the use of evidence-based policymaking, and the capacity to respond flexibly to emerging risks.²³ Importantly, it seeks to maintain a careful balance between repression and prevention, ensuring that the pursuit of security does not undermine fundamental rights and legal guarantees. In this sense, transdisciplinarity not only strengthens the effectiveness of criminal law but also contributes to its legitimacy and resilience in an increasingly complex global environment.

6. Conclusions

The analysis undertaken in this paper highlights the profound transformation that criminal law must undergo in response to the increasing complexity of global risks. Contemporary forms of criminality, such as human trafficking, cybercrime, and organized transnational networks, are no longer confined to clearly defined legal or territorial boundaries. Instead, they are embedded in dynamic socioeconomic, technological, and psychological contexts that challenge traditional models of legal reasoning and institutional response.

In this environment, the limitations of a purely reactive and punitive approach to criminal law become increasingly evident. Although the core functions of investigation, prosecution, and punishment remain essential, they are insufficient to address the structural and behavioral dimensions of complex crime. The findings of this study demonstrate that effective responses require a shift toward a more anticipatory, preventive, and adaptive framework grounded in a deeper

²² Veale and Zuiderveen Borgesius, "Demystifying the Draft EU Artificial Intelligence Act."

²³ Christopher Ansell and Jacob Torfing, *Public Governance as Co-Creation: A Strategy for Revitalizing the Public Sector and Rejuvenating Democracy* (Cambridge: Cambridge University Press, 2021), <https://doi.org/10.1017/9781108765381>.

understanding of risk, vulnerability, and human behavior.

A central argument of this paper is that transdisciplinarity offers a viable and necessary pathway for this transformation. By integrating perspectives from psychology, sociology, criminology, and data science, criminal law can move beyond formalistic interpretations and develop more context-sensitive and evidence-based solutions. This approach enhances not only the effectiveness of legal interventions but also their legitimacy by aligning legal processes with the lived realities of individuals and communities affected by crime.

Particular attention has been devoted to the role of behavioral and cognitive factors in shaping criminal justice outcomes. The influence of cognitive biases, moral disengagement, and institutional constraints underscores the need for a more reflective and informed approach to legal decision-making. Similarly, the consolidation of a victim-centered paradigm represents a significant normative and practical advance, emphasizing the importance of protection, dignity, and participation in criminal proceedings.

At the same time, the growing reliance on risk-based and technology-driven tools in criminal justice introduces new challenges relating to transparency, accountability, and fundamental rights. These developments require careful regulation and continuous evaluation to ensure that innovation does not compromise the core principles of the rule of law.

Ultimately, the future of criminal law in the age of complexity depends on its capacity to evolve into an integrated and resilient system capable of addressing both the causes and consequences of global risks. This entails strengthening institutional cooperation, promoting interdisciplinary expertise, and maintaining an appropriate balance between repression and prevention. By embracing a transdisciplinary perspective, criminal law can better fulfill its dual function of protecting society and upholding justice in an increasingly uncertain and interconnected world.

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