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The regulatory paradox: Why efforts to govern AI may sabotage the global 'rescue culture' in insolvency

A Comparative Analysis of the EU and US Approaches to AI-Driven Insolvency Prediction

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Abstract

Insolvency rules are no longer merely instruments of closure; for some time, they have been transformed into levers for recovery. The transition from a liquidation culture to a rescue culture is now underway, as evidenced by Directive (EU) 2019/1023 and the US model of Chapter 11 and the SBRA, both oriented towards early detection mechanisms and more flexible restructuring procedures. In this context, predictive Artificial Intelligence has emerged as the technology best placed to give concrete form to the rescue culture: timely diagnoses, targeted plans, and greater efficiency. However, this article highlights a Double Regulatory Paradox that risks jamming the mechanism. In Europe, one could speak of a "Mandate vs. Barrier": on the one hand, the public obligation to promote accessible algorithmic tools; on the other, the AI Act may qualify advanced AI-driven EWTs as high-risk systems, thereby increasing the compliance costs for the providers, public-private developers and professional intermediaries that are expected to make such tools available to SMEs. The burden is therefore not imposed directly on SME debtors as users, but indirectly on the ecosystem that should develop affordable and accessible rescue-oriented tools. In the United States, the paradox assumes the form of "Innovation vs. Trust": a light regulatory framework encourages rapid experimentation, but the lack of binding standards fuels opacity and legal uncertainty, reducing the usability of AI as an evidentiary basis in Chapter 11 proceedings. The result? Two systems that, while moving in opposite directions, both fail to effectively integrate AI into crisis management. The solution is clear: insolvency-aware regulation capable of adapting to the context of crisis. In Europe, this means preferential lanes for rescue tools; in the United States, minimum standards of legal reliability. Only in this way can the promise of the rescue culture be translated into reality.

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1. Introduction: The 'Rescue Culture' meets AI

1.1 The Context: A Dual Transformation

1. Insolvency law stands today at the intersection of two epochal transformations. The first is technological. Artificial intelligence is redefining predictive capabilities in every sector of the economy, promising to revolutionise finance, risk management, and, inevitably, insolvency proceedings. The urgency of this transformation is well known to insolvency practitioners, often evoked through the metaphor of the company as a "melting ice cube"[2]. In this context, efficiency is not a luxury but a necessity to preserve residual value. The dominant theory of bankruptcy law itself, the *creditors' bargain theory*, prioritises efficiency and the reduction of transaction costs[3]. AI proposes itself as the most powerful tool to accelerate analysis, improve efficiency, and support decision-making[4].
2. The second transformation is philosophical. The global paradigm of insolvency law has shifted decisively. For decades, especially in many European jurisdictions, the dominant approach was liquidatory, an *ex-post* process focused on maximising creditor satisfaction according to the *par condicio creditorum*. This model has been progressively supplanted by a preventive philosophy, a "rescue culture," whose primary objective is no longer (solely) to liquidate, but to save the viable enterprise, preserve jobs, and give the entrepreneur a "second chance"[5].

1.2 A Shared Goal, Divergent Paths

3. This global trend towards rescue is a goal shared by major Western economies, but pursued through divergent regulatory paths. The European Union has codified this philosophy in Directive (EU) 2019/1023 (PRD), a public policy intervention that harmonises preventive restructuring frameworks and, crucially, imposes

2 Melissa B Jacoby and Edward J Janger, 'Ice Cube Bonds: Allocating the Price of Process in Chapter 11 Bankruptcy' (2014) 123 *Yale Law Journal* 862.

3 This theory suggests that insolvency law is designed to replicate the outcome creditors would have agreed upon if they had to establish rules without knowing their individual positions. Such a framework helps reduce the costs associated with creditors independently rushing to court to recover their claims. See Thomas H Jackson, *The Logic and Limits of Bankruptcy Law* (Harvard University Press 1986) 4–7, 10–12; Akshaya Kamalnath, 'The Future of Corporate Insolvency Law – A Review of Technology and AI-Powered Changes' (2024) 33 *International Insolvency Review* 40, 41.

4 Kamalnath (n 3) 41.

5 Daniele Vattermoli, 'Gli insolvency protocols nelle operazioni di ristrutturazione del gruppo di imprese in crisi' (2019) *Rivista di diritto bancario e dei mercati finanziari* 11–12.

a public mandate on Member States for the creation of "Early Warning Tools" (EWTs).

4. The United States, on the other hand, has long had a *rescue culture* rooted in its legal system, but pursues it through a debtor-friendly system based on the market. Chapter 11 of the Bankruptcy Code, by allowing the debtor to maintain control (*debtor-in-possession* or DIP) and propose a reorganisation plan, creates a powerful private incentive for the debtor to diagnose the crisis early and use every available tool to convince creditors and the court of the feasibility of the rescue. This approach was further strengthened for small businesses through the Small Business Reorganization Act (SBRA) of 2019.

1.3 The Central Thesis: The Double Regulatory Paradox

5. In both systems, predictive technologies would serve as the indispensable instrument for achieving the goals of the *rescue culture*[6]. In the European Union, anticipatory analysis systems could represent the most suitable means to give concrete implementation to the public mandate of early detection tools, ensuring their effective and large-scale application. In the United States, such solutions could instead operate as a market lever, allowing the private debtor to draft a credible and sustainable restructuring plan.
6. However, and this is the central thesis of this article, the adoption of this crucial technology is threatened by a "Double Regulatory Paradox". Both jurisdictions are developing regulatory frameworks for AI that, although born from opposing philosophies, end up sabotaging their own insolvency policy objectives. The same dilemma surfaces in the context of insolvency, where the adoption of predictive tools risks being hindered by regulatory barriers or transparency deficits. This phenomenon arises from what has been defined as the "control dilemma": regulating an emerging technology too early risks stifling innovation, while regulating too late allows harms to proliferate[7].
7. The EU paradox is not that Article 3 PRD directly requires SME debtors to purchase or operate high-risk AI systems. Article 3 PRD primarily places an obligation on Member States to ensure that debtors have access to clear, transparent and effective early warning tools. The difficulty lies elsewhere. If Member

6 Emmanuel Alanis, Sudheer Chava and Agam Shah, 'Benchmarking Machine Learning Models to Predict Corporate Bankruptcy' (2022) arXiv:2212.12051, 12 <https://arxiv.org/abs/2212.12051> accessed 17 November 2025.

7 David Collingridge, *The Social Control of Technology* (Frances Pinter 1980) 11; Claudio Novelli, Philipp Hacker, Simon McDougall, Jessica Morley, Antonino Rotolo and Luciano Floridi, 'Getting Regulatory Sandboxes Right: Design and Governance Under the AI Act' (2025) SSRN Working Paper, 2 <https://ssrn.com/abstract=5332161> accessed 28 October 2025.

States, public agencies or private partners seek to make those tools genuinely predictive by relying on AI, such systems may fall within the high-risk architecture of the AI Act. The resulting compliance obligations would then be borne mainly by developers, public-private consortia, software providers and professional intermediaries involved in designing, supplying or maintaining AI-driven EWTs. This may indirectly affect SMEs by reducing the availability of affordable tools, discouraging smaller providers from entering the market, and favouring large technology vendors able to absorb compliance costs. The paradox is therefore systemic rather than individual: a framework intended to make early diagnosis accessible to SMEs may unintentionally make the technological ecosystem required for that diagnosis less diverse, less affordable and less responsive to SME needs.

8. The US Paradox can be read as a clash between innovation and usability, or rather, "Innovation vs. Trust". The US approach, laissez-faire and fragmented (unstable Executive Orders, voluntary standards, ineffective self-regulation), incentivises rapid innovation. The market produces powerful tools. However, this very absence of mandatory federal rules and transparency creates a "trust deficit"[8]. The tools tend to be opaque[9] and legally "toxic," making them difficult to admit or rely upon as an evidentiary basis in a formal Chapter 11 proceeding, where accountability is fundamental. Furthermore, private sector self-regulation has proven to lack credible enforcement mechanisms[10]. As highlighted by reference authors, voluntary commitments without legal constraints guarantee neither accountability nor transparency, leaving managerial discretion intact[11]. This confirms that, in the US context, the absence of binding federal standards for AI produces the same problem: solutions with high technical capacity, but legally precarious[12].

1.4 Research Question and Methodology

9. This article addresses the following research question: How do the EU and US regulatory frameworks on insolvency and AI facilitate or hinder the development, deployment and legal use of trustworthy AI tools for early crisis detection

8 Tatevik Davtyan, 'The U.S. Approach to AI Regulation: Federal Laws, Policies, and Strategies Explained' (2025) 16(2) *Case W. Res. J.L. Tech. & Internet* 223.

9 Risto Uuk, Camilo I Gutierrez and others, 'A Taxonomy of Systemic Risks from General-Purpose AI' (2024) 13 <arXiv:2412.07780> accessed 29 October 2025.

10 Roberto Tallarita, 'Who Will Enforce AI's Social Purpose?' *ProMarket* (16 March 2024) <https://www.promarket.org/2024/03/16/who-will-enforce-ais-social-purpose> accessed 27 October 2025.

11 Lucian A Bebchuk and Roberto Tallarita, 'The Illusory Promise of Stakeholder Governance' (2020) 106 *Cornell Law Review* 91 <https://ssrn.com/abstract=3544978> accessed 27 October 2025.

12 *Ibid.*

and restructuring? To answer, a qualitative methodological approach based on comparative legal analysis is adopted. The analysis does not limit itself to describing the laws but critically examines their interactions and systemic contradictions, using primary sources (legislative acts, EOs) and secondary sources (academic literature, institutional reports). The objective is to evaluate the adequacy and internal coherence of the respective approaches regarding the declared goal of the *rescue culture*.

1.5 Structure of the Paper

10. The paper is structured into seven sections. Following this introduction, Section 2 analyses the EU's "public mandate" for EWTs, establishing the technological demand. Section 3 examines the US "market incentive" for reorganisation, defining its parallel technological demand. Section 4 maps the two divergent approaches to AI regulation (EU and US), defining the regulatory "barriers". Section 5 develops the core of the argument, analysing the "Double Regulatory Paradox" in depth. Section 6 discusses the implications, including the partial effectiveness of regulatory sandboxes, and advances recommendations. Section 7 concludes by synthesising the results and proposing the necessity of an AI regulation that is "conscious of the crisis context".

2. The EU "Public Mandate" Approach to Insolvency Prevention

2.1 The Philosophy of the PRD

11. Directive (EU) 2019/1023 marks the pinnacle of a decade-long path aimed at realigning European insolvency and restructuring law. Overcoming traditional national systems, historically fragmented and often oriented towards liquidation, it introduces a harmonised framework for preventive restructuring. The PRD is characterised by a clearly interventionist approach oriented towards social protection, aimed at spreading a true culture of prevention and corporate recovery[13], with the goal of preserving the viability of companies and, indirectly, jobs[14].

13 Bob Wessels, 'Europe deserves a new approach to insolvency proceedings' (2007) 4(6) *European Company Law* 253.

14 Nicola Soldati, 'La Direttiva (UE) 2019/1023 e l'evoluzione delle procedure concorsuali nell'ottica della continuità aziendale e dell'emersione tempestiva della crisi d'impresa' (2020) *Rivista del commercio internazionale* 217.

12. This public *policy* intervention is based on the observation that companies, especially SMEs, often enter proceedings too late, when the "ice cube"[15] has already largely melted. The rationale thus translates into a precise strategy: intervene before the crisis becomes irreversible. The proposed solution is not to wait for the inevitable melting of the "cube," but to anticipate intervention, combining legal tools—preventive restructuring frameworks—and diagnostic tools—early warning tools.
13. Authoritative doctrine observes how European harmonisation aims precisely to make timely action possible, providing a regulatory framework that allows addressing the crisis when there is still a margin for recovery[16]. In this perspective, the PRD aims to ensure that debtors in financial difficulty can access truly effective restructuring frameworks, capable of being activated at an early stage[17] — that of the "likelihood of insolvency"— so as to prevent overt insolvency and preserve the viability of the enterprise[18].

2.1.1 Origins of the Current Model: Early Warning Denmark and the European network

14. The inclusion of EWTs in Article 3 of the PRD represents the formalisation of an approach to early crisis management that had matured over time. This is not to suggest that Denmark was the first European jurisdiction to experiment with early warning mechanisms. Informal, court-driven alert mechanisms had already existed in jurisdictions such as France and Belgium, both with praetorian roots. Early Warning Denmark is relevant here for a narrower reason: it offered a structured, service-oriented and data-friendly model that later influenced the EU policy debate and the Early Warning Europe network.
15. As early as 2011, the European Parliament had recognised the value of early warning mechanisms, while considering the adoption of a single substantive insolvency law at European level impracticable[19]. The European Commission

15 Jacoby and Janger (n 2).

16 Horst Eidenmüller and Kristin van Zwieten, 'Restructuring the European Business Enterprise: The EU Commission Recommendation on a New Approach to Business Failure and Insolvency' (2015) SSRN Working Paper, 5–6, 12 <https://ssrn.com/abstract=2662213> accessed 28 October 2025.

17 On the importance of coordination as an instrument of prevention and recovery, see Vattermoli (n 5) 14–16.

18 Ana Maria Fagetan, 'Corporate Insolvency Laws in Selected Jurisdictions: US, England, France and Germany – A Comparative Perspective' (2025) 14 *Laws* 21, 2.

19 European Parliament, Resolutions adopted by the European Parliament during the sittings of 15–17 November 2011 [2013] OJ C 153 E.

followed in 2012 with the Communication "Single Market Act II"[20], calling for a modernisation of insolvency regimes to favour the "second chance" for companies; this line of action was subsequently developed in the Communication COM(2012) 742, titled "A new European approach to business failure and insolvency," addressed to the European Parliament, the Council, and the European Economic and Social Committee[21].

16. A concrete step was the Commission Recommendation of 12 March 2014 on a new approach to business failure and insolvency[22]. This recommendation, although non-binding, already outlined key principles later taken up by the PRD, such as the need for preventive restructuring frameworks accessible at an early stage for viable enterprises in financial difficulty. However, the poor adherence of Member States to this recommendation, as noted by the Commission itself in 2015, highlighted the need for a stronger legislative instrument. The decisive push came from the Action Plan for the Capital Markets Union (CMU) of 2015, which identified divergences in national insolvency laws as a structural obstacle to cross-border investments[23]. In this context, the harmonisation of restructuring law became a measure instrumental to the broader objective of the CMU, leading to the proposal of the PRD in November 2016[24].
17. In this path towards the PRD, pre-existing national experiences provided essential operational models and practical lessons. Particularly influential was the Early Warning Denmark (EWD) programme, operational since 2007. Born in a legal context traditionally oriented towards liquidation, EWD was configured as a unique public service of its kind, offering impartial, confidential, and free assistance to companies in financial difficulty[25]. The heart of EWD is not an administrative or judicial mechanism, but a network of volunteer consultants (about 120-130 active). These are senior professionals with experience in insolvency law, accounting, management, strategy, and other disciplines relevant to

20 Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, 'Single Market Act II: Together for New Growth' (COM(2012) 573 final, 3 October 2012).

21 Commission, 'A New European Approach to Business Failure and Insolvency' (Communication) COM(2012) 742 final, 12 December 2012.

22 Commission Recommendation of 12 March 2014 on a new approach to business failure and insolvency [2014] OJ L 74/65.

23 J M G J Boon, H Koster and R D Vriesendorp (eds), *Implementation of the EU Preventive Restructuring Directive, Part I* (Eleven International Publishing 2023) 175.

24 David C Ehmke, Jennifer L L Gant, Gert-Jan Boon, Line Langkjaer and Emilie Ghio, 'The European Union Preventive Restructuring Framework: A Hole in One?' (2019) 28(2) *International Insolvency Review* 184, 184–185.

25 Morten Møller and Piya Mukherjee, 'Early Warning Systems in Denmark and Europe' (2019) Summer *Eurofenix* 20–21.

corporate *turnaround*. Managed by Regional Business Development Centres, the programme has assisted almost 6,000 companies in over fifteen years, providing specialist support at a stage where entrepreneurs often lack the resources for private consulting[26].

18. The EWD experience generated crucial empirical evidence. First, the demand for assistance appears relatively constant, almost independent of macroeconomic cycles, suggesting often endogenous causes of crisis in SMEs[27]. Second, the criticality of timing emerged: many entrepreneurs contact EWD too late, when rescue options are limited. This delay is frequently linked to psychological factors: denial, projection of blame onto outsiders, stress, or apathy. This required EWD consultants to develop not only technical competencies ("hard skills") but also relational and empathetic capabilities ("soft skills")[28]. The social stigma of bankruptcy, particularly strong in family SMEs, remains a significant obstacle to seeking help[29].
19. Another Danish innovation was the experimentation with the use of big data and predictive technologies to *proactively* identify at-risk companies by analysing digital financial statements. This *data-driven* approach allows EWD consultants to contact companies often unaware of the gravity of their situation, foreshadowing the potential of AI-based EWTs. The EWD model demonstrated its validity and was exported through the Early Warning Europe (EWE) project, launched in 2016 with EU funding (COSME)[30]. The project confirmed the transferability of the model but also highlighted the need to adapt it to different national contexts. It is against this background of national experimentation, European diffusion and growing awareness of the limits of traditional systems that the obligation to provide EWTs was codified in Article 3 of the PRD[31].

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26 *Ibid.*

27 Møller and Mukherjee (n 25) 22.

28 *Ibid.*

29 Jonathan McCarthy, 'A Class Apart: The Relevance of the EU Preventive Restructuring Directive for Small and Medium Enterprises' (2020) 21(4) *European Business Organization Law Review* 895, 905.

30 COSME was the EU programme for the competitiveness of enterprises and small and medium-sized enterprises (SMEs) which ran for the period 2014–2020. For the 2021–2027 period, its activities have been absorbed into the broader single market programme, while the financial instruments have been absorbed into InvestEU <https://single-market-economy.ec.europa.eu/smes/cosme_en> accessed 17 November 2025.

31 Marco Speranzin and Francesco Marotta, 'Early Warning Tools and Preventive Restructuring Following the Transposition of the EU Insolvency Directive in Italy' (2022) 8 *Revista General de Insolvencias y Reestructuraciones* 187.

2.2 The 'Early Warning Tools' Mandate

20. Article 3 PRD codifies the obligation to provide early warning tools, transforming prior national experiences and European soft-law initiatives into a legal requirement. Models such as the Danish one and the EWE network demonstrated the effectiveness of an approach based on free counselling, networks of experts and, increasingly, data-driven forms of risk identification; the PRD now makes this a mandatory requirement for Member States[32]. The mandate is clear: ensure debtors have access to tools that are transparent, timely, and capable of identifying signals of probable insolvency, stimulating early interventions. While not imposing a single model, the rule leaves ample room for adaptation, suggesting solutions ranging from alert systems based on missed tax or social security payments, to public or private advisory services, to incentives for qualified third parties to signal emerging criticalities[33].
21. The Italian implementation in its national Insolvency Code translated these principles into concrete indicators, such as delays in wage payments and notifications by qualified public creditors (national tax and social security authorities)[34]. However, the failure to transpose provisions relating to access to information by workers' representatives highlights a tension between the European framework and the national one[35].
22. On a doctrinal level, some reflections, although prior to the PRD, helped shape the debate. As early as 2007, a transition from a "law of morality" to a "law of continuity" was invoked, laying the cultural foundations for an insolvency law oriented towards rescue[36]. Concurrently, the "fully collective" criterion was proposed as a parameter to distinguish insolvency procedures worthy of universal recognition,

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32 Directive (EU) 2019/1023 of the European Parliament and of the Council of 20 June 2019 on preventive restructuring frameworks [2019] OJ L 172/18, Article 3.

33 Emilie Ghio, Jennifer L L Gant, Gert-Jan Boon, David C Ehmke, Line Langkjaer and Eugenio Vaccari, 'Harmonising Insolvency Law in the EU: New Thoughts on Old Ideas in the Wake of the COVID-19 Pandemic' (2021) 30(3) *International Insolvency Review* 429; Lorenzo Stanghellini, 'Il Codice della crisi dopo il d.lgs 83/2022: la tormentata attuazione della direttiva europea in materia di 'quadri di ristrutturazione preventiva', *Ristrutturazioni Aziendali* (21 July 2022) 3.

34 Alessandro Nigro and Daniele Vattermoli, *Diritto della crisi delle imprese* (6th edn 2023); Lorenzo Stanghellini, 'Il codice della crisi di impresa: una primissima lettura (con qualche critica)' (2019) *Il Corriere Giuridico* 449.

35 Andrea Pilati, 'The protection of employees in the early warning tools and preventive restructuring frameworks: the EU Directive 2019/1023 and the Italian Crisis and Insolvency Code' (2025) 18 *Italian Labour Law e-Journal* 114, 116–117.

36 Wessels (n 13); Bob Wessels and Stephan Madaus, *Business Rescue in Insolvency Law – An Instrument of the European Law Institute* (2017) <https://ssrn.com/abstract=3032309> accessed 17 November 2025.

implicitly clarifying that alert tools and hybrid procedures cannot be assimilated *tout court* to insolvency proceedings[37].

23. These insights are no longer merely theoretical: the PRD first translated the need for alert tools and restructuring mechanisms into positive law. Currently, the recently adopted Directive (EU) 2026/799, often referred to as "Insolvency III", further consolidates this framework, introducing targeted harmonisation measures on pre-pack proceedings[38], avoidance actions, asset tracing, directors' duties and creditors' committees.
24. Together with the cross-class cram-down mechanism[39] established by the PRD, these tools remain at the centre of an intense doctrinal debate regarding the balance between creditor protection and business continuity at European level[40].
25. In this sense, Article 3 is not merely a technical device, but a signal of the cultural transformation of European insolvency law, building on earlier national experiments and doctrinal developments.

2.3 The Crucial Focus on SMEs

26. The PRD's mandate assumes its true importance when read in combination with its implicit but crucial focus: Small and Medium-sized Enterprises. These are the backbone of the European economy, but they are also the most vulnerable. Most recent empirical research shows that the failure rate of SMEs in Europe is "quite high," with over 50% of new companies not surviving five years and more than 200,000 small businesses failing every year[41]. The survey is illuminating for two reasons. First, it confirms that traditional predictive models, often developed for

37 Horst Eidenmüller, 'What Is an Insolvency Proceeding?' (2018) 92 *American Bankruptcy Law Journal* 53.

38 Directive (EU) 2026/799 of the European Parliament and of the Council of 30 March 2026 harmonising certain aspects of insolvency law [2026] OJ L, 2026/799, arts 4–19, 20–35, 36–38, 39–40 and 41–55.

39 Directive (EU) 2019/1023 of the European Parliament and of the Council of 20 June 2019 on preventive restructuring frameworks [2019] OJ L 172/18, arts 9 and 11.

40 Adrian Thery, 'The pre-pack regulation in the EU Commission proposal for a second insolvency directive' (2023) *European Insolvency and Restructuring Journal* 2–3 <https://eirjournal.com/article/download/18096/20135> accessed 17 November 2025.

41 Andrés Navarro-Galera and others, 'Empirical Research to Identify Early Warning Indicators of Insolvency in Small and Medium-Sized Enterprises (SMEs)' (2024) 27(2) *Revista de Contabilidad – Spanish Accounting Review* 344, 345; Eurostat, *Key Figures on European Business* (Publications Office of the European Union 2022) < https://ec.europa.eu/eurostat/web/products-key-figures/-/ks-06-22-075> accessed 17 November 2025; Confederación Española de la Pequeña y Mediana Empresa (CEPYME), *Crecimiento Empresarial: Situación de las Pymes en España Comparada con la de Otros Países Europeos. Alternativas para Facilitar el Crecimiento de las Pymes Españolas* (2021) <https://www.cepyme.es/wp-content/uploads/2021/11/Documento-Crecimiento-Empresarial-CEPYME.pdf> accessed 17 November 2025.

large companies, have "rather low levels of accuracy when applied to SMEs"[42]. Second, it demonstrates that to effectively predict SME crises, purely financial indicators are not enough: complex variables, both quantitative and qualitative, are necessary, such as the number of employees, the sector of activity, legal form, export level, involvement in legal proceedings, and corporate structure[43].

27. Therefore, the PRD does not require simple financial ratio calculators, but sophisticated diagnostic systems capable of managing complex and specific data for SMEs, in order to provide timely and accurate alerts. It does not define early warning tools in detail, leaving Member States ample margin to develop technologically advanced solutions[44]. The PRD establishes only a minimum framework for EWTs: it requires Member States to ensure access to clear and transparent early warning mechanisms but leaves them considerable discretion as to whether such tools should remain simple rule-based alerts or evolve into more sophisticated, data-driven systems.

2.4 The Induced Technological Demand: Why This Mandate Implies AI

28. Here legal demand transforms into technological demand. The analysis required to fulfil the mandate of Article 3, especially in the context of SMEs, cannot be effectively performed by traditional methods.
29. This technological demand follows from the functional requirements of Article 3 PRD itself. An effective EWT must identify early signs of financial distress, process heterogeneous information and provide clear signals before insolvency becomes irreversible. In the SME context, this task is particularly difficult because distress may emerge from a combination of accounting, behavioural, sectoral and operational variables. This is why AI-based tools are relevant: not because Article 3 PRD expressly mandates AI, but because advanced predictive systems may be necessary to make early warning tools sufficiently timely and accurate in practice.
30. Among currently available technologies, artificial intelligence architectures based on Machine Learning (ML) appear among the most promising computational

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42 *Ibid* 346; Francesco Ciampi, 'Corporate Governance Characteristics and Default Prediction Modelling for Small Enterprises: An Empirical Analysis of Italian Firms' (2015) 68(5) *Journal of Business Research* 1012, 1012–1025 <https://doi.org/10.1016/j.jbusres.2014.10.003> accessed 20 November 2025.

43 *Ibid* 347–348; Loredana Cultrera and Xavier Brédart, 'Bankruptcy Prediction: The Case of Belgian SMEs' (2016) 15(1) *Review of Accounting and Finance* 101; Aneta Ptak-Chmielewska, 'Bankruptcy Prediction of Small- and Medium-Sized Enterprises in Poland Based on the LDA and SVM Methods' (2021) 22(1) *Statistics in Transition New Series* 179.

44 PRD, Article 3 and recitals 22–24.

paradigms to address the analytical complexity necessary for early risk management, proving particularly useful in the context of smaller enterprises. Unlike traditional deterministic approaches—based on static rules or linear models[45]—ML allows learning from heterogeneous and unstructured data, modelling non-linear relationships and evolutionary dynamics between accounting, behavioural, and environmental variables[46].

31. For the purposes of insolvency law, the relevant point is not the internal mathematical architecture of the model, but the type of legal and economic task it can support. AI-driven EWTs may, for instance, identify abnormal payment delays, detect recurring liquidity shortages, compare a debtor's financial trajectory with sectoral distress patterns, flag inconsistencies in restructuring assumptions, or generate early alerts based on tax, wage, social security and accounting data. These applications are directly linked to the preventive rationale of Article 3 PRD.
32. For peripheral economic actors—often excluded from traditional scoring models due to a lack of structured data—ML offers a gateway to fairer, more adaptive, and contextualised risk assessment systems capable of capturing weak signals and supporting decisions aligned with the preventive rationale reflected, for example, in Article 3 PRD. These capabilities articulate, in particular, along three operational lines:
    - Analysis of unstructured data: NLP and textual-analysis techniques allow distress signals to be extracted from narrative corporate disclosures, including annual reports, directors' reports and management commentary[47].
    - Identification of complex patterns: Deep neural models are capable of detecting correlations among dozens of financial and non-financial variables that would escape a human analyst or a logistic regression model[48].
    - Real-time operability: ML systems can generate dynamic alerts based on updated data flows, improving decision timeliness[49].
33. Therefore, the PRD does not impose the adoption of AI-based tools. However, if Article 3 PRD is to produce genuinely effective, timely and scalable EWTs for

45 Richard A. Johnson, Dean W Wichern*, Applied multivariate statistical analysis (6th ed.). Pearson Prentice Hall*, 2007, p. 3 ss.

46 Christopher M Bishop, (2006), *Pattern Recognition and Machine Learning.* Springer, pp. 1-3, 225-227.

47 Yousry Ahmed, Mohamed Elsayed and Bin Xu, 'Bankruptcy in the UK: Do Managers Talk the Talk Before Walking the Walk?' (2024) 35(4) *British Journal of Management* 2011, 2013–2015.

48 Ruize Gao, Shaoze Cui, Yu Wang and Wei Xu, 'Predicting Financial Distress in High-Dimensional Imbalanced Datasets: A Multi-Heterogeneous Self-Paced Ensemble Learning Framework' (2025) 11 *Financial Innovation* 50, 1–4 <https://doi.org/10.1186/s40854-024-00745-w> accessed 31 October 2025.

49 Waleed A Zogaan, Nouran Ajabnoor & Abdullah A Salamai 'Leveraging Deep Learning for Risk Prediction and Resilience in Supply Chains' (2025) *Journal of Big Data* <https://journalofbigdata.springeropen.com/articles/10.1186/s40537-025-01143-4> accessed 31 October 2025.

SMEs, AI-based systems may become one of the most suitable technological means to operationalise that mandate. Ignoring this technological dimension would risk reducing Article 3 PRD to a formal obligation with limited practical effectiveness.

2.5 Concrete uses of AI-driven EWTs in insolvency prevention

34. AI-driven EWTs may be used in at least four concrete ways. First, they may support early diagnosis by identifying payment delays, liquidity deterioration, tax arrears, wage arrears or changes in working-capital patterns before formal insolvency occurs. Secondly, they may support viability assessments by distinguishing temporary liquidity stress from structural non-viability. Thirdly, they may assist restructuring planning by testing whether projected cash flows are compatible with proposed repayment schedules. Fourthly, they may support public or professional intermediaries by prioritising cases that require human intervention. In all these scenarios, AI does not replace the debtor, the advisor or the court. It operates as a triage and decision-support mechanism, making the preventive logic of the PRD more operational.

3. Market Logic and Rescue Culture in the US Framework

3.1 Historical Evolution and Structural Nodes of Chapter 11

35. To fully understand the "US Paradox" (Innovation vs. Trust) and the nature of the *private* demand for AI in the American system, it is essential to analyse the historical evolution and systematic structure of Chapter 11. Unlike the European model, which stems from a public mandate, the US model is a product forged by judicial practice in response to economic crises, and only subsequently codified and refined by the legislature[50]. This path generated a system focused not on "prevention," but on *ex-post* management of the crisis through a flexible, negotiated, and market-driven process. Its architecture, as we shall see, developed through distinct phases.

3.2 From Equity Receivership to the Bankruptcy Code

36. As mentioned, the US approach to reorganisation has essentially *praetorian* roots, developing from federal court rulings of the 19th century; it initially arose

50 Harvey R Miller and Shai Y Waisman, 'Is Chapter 11 Bankrupt?' (2005) 47(1) *Boston College Law Review* 129, 129–132.

as a response to the failure of large railroad companies[51]. These enterprises, characterised by assets extending beyond single state borders, could not be liquidated without irremediably compromising their *going-concern value*[52], and precisely this need drove judges to elaborate innovative solutions that would later constitute the core of modern corporate reorganisation discipline.

37. Equity courts then began to appoint "receivers" (often existing management) at the request of a creditor (via a "creditor's bill") and with the debtor's consent[53].
38. The procedure culminated in a foreclosure sale that was effectively a fiction: investment bankers and bondholder committees ("protective committees") were the only possible buyers, using their debt to "buy" the assets ("credit bidding") and transfer them to a new company, excluding dissenting creditors and small shareholders. This system, although innovative, was harshly criticised for being opaque, controlled by Wall Street insiders, and for violating creditor priority by allowing old shareholders to maintain a stake in the new entity (*Boyd* case)[54].
39. The Great Depression and SEC criticism of these abuses led to the Chandler Act[55], which codified reorganisation but divided it into two distinct procedures: Chapter X[56] and Chapter XI[57]. Chapter X was intended for large public companies; it was rigid, reflected distrust in management, imposed the appointment of an independent *trustee*, and gave a central oversight role to the SEC[58]. Due to its slowness, cost, and removal of management, large companies avoided it[59]. Chapter XI, instead, was designed for smaller companies and for restructuring unsecured debt only. It was flexible, fast, and, above all, kept management in charge (the *debtor-in-possession* or DIP)[60].

51 Stephen J Lubben, 'Railroad Receiverships and Modern Bankruptcy Theory' (2004) 89(6) *Cornell Law Review* 1420, 1422–1425.

52 Miller and Waisman (n 50) 130; see generally Act of June 22, 1938, ch. 575, 52 Stat. 840 (1938), repealed by Bankruptcy Reform Act of 1978, Pub. L. 95-598, 92 Stat. 2549.

53 David A Skeel Jr, *Debt's Dominion: A History of Bankruptcy Law in America* (Oxford University Press 2001) 48–70.

54 *Northern Pacific Railway Co v Boyd*, 228 US 482 (1913).

55 Harvey R Miller and Shai Y Waisman, 'Does Chapter 11 Reorganization Remain a Viable Option for Distressed Businesses for the Twenty-First Century?' (2004) 78 *American Bankruptcy Law Journal* 153, 166–167.

56 Act of 22 June 1938, ch 575, 52 Stat 840, 883.

57 Act of 22 June 1938, ch 575, 52 Stat 840, 905.

58 Harvey R Miller and Erica M Ryland, 'The Role of Mega Cases in the Development of Bankruptcy Law' in *The Development of Bankruptcy and Reorganization Law in the Courts of the Second Circuit of the United States* (Matthew Bender 1995) 189, 210.

59 Miller and Waisman (n 50) 169–170.

60 Skeel (n 53) 48–70.

40. The dual system proved, however, inadequate. Large companies began to use (or "abuse") the flexible Chapter XI to avoid the rigid Chapter X, even when they had public debt and complex structures. This led to costly and lengthy preliminary legal battles just to decide which procedure was the "right" one[61]. In response, Congress created the Commission on Bankruptcy Laws in 1970. The Commission's 1973 Report (H.R. Doc. No. 137) identified this duplication as inefficient and recommended a single, comprehensive reorganisation chapter[62]. This recommendation was the basis of the Bankruptcy Reform Act of 1978, which created the modern Chapter 11. The new Chapter 11 merged the two approaches: it took the flexibility and the *Debtor-in-Possession* (DIP) principle from Chapter XI and combined them with sophisticated creditor protections (such as the *disclosure statement*, voting by class, and the application of the *absolute priority rule*) from Chapter X[63]. The explicit goal became the rehabilitation of the enterprise.
41. The 1978 Code was perceived by many as overly debtor-friendly. The Bankruptcy Abuse Prevention and Consumer Protection Act (BAPCPA) of 2005[64] marked, therefore, a significant "backlash" in favour of creditors. While not altering the base structure, BAPCPA imposed rigid deadlines, particularly drastically shortening the DIP's exclusivity period to propose a plan (§ 1121)[65] and imposing a short deadline for the assumption or rejection of leases (§ 365(d)(4))[66], making reorganisation faster but also more difficult and expensive for the debtor.
42. Since Chapter 11 had become too burdensome for SMEs, Congress passed the Small Business Reorganization Act (SBRA) in 2019, establishing Subchapter V of Chapter 11 of the Bankruptcy Code. This regulatory intervention represented a significant turning point in insolvency discipline for small-scale enterprises, configuring a true "fast track" for the rescue of smaller business entities[67]. The new structure simplified procedures and significantly reduced costs, eliminating, among other things, the obligation to appoint a committee of unsecured creditors, unless otherwise ordered by the judge[68].
43. One of the most innovative aspects of the SBRA is the suspension of the Absolute Priority Rule (APR) in non-consensual plans. Instead of this rule, the legislature

61 *General Stores Corp v Shlensky*, 350 US 462, 466 (1956).
62 Senate Report No 95-989 (1978) 9, reprinted in 1978 US Code Congressional and Administrative News 5787, 5795.
63 William L Norton Jr, *Norton Bankruptcy Law and Practice* (Thomson Reuters 2005) vol 1, para 3:13.
64 Bankruptcy Abuse Prevention and Consumer Protection Act of 2005, Pub L No 109-8, 119 Stat 23 ('BAPCPA').
65 BAPCPA, Pub L No 109-8, § 411, 119 Stat 23, 106–107.
66 BAPCPA, Pub L No 109-8, § 404, 119 Stat 23, 104–105.
67 Fagetan (n 18) 21–22.
68 11 USC §§ 1181(b), 1183, 1187 and 1191.

introduced the principle of the "Best Efforts Rule," according to which the debtor can maintain ownership of the enterprise provided they allocate the entire projected disposable income to the restructuring plan for a period between three and five years[69]. This mechanism, strongly oriented towards debtor protection, allows the entrepreneur not only to preserve economic activity but also to safeguard their professional role and business continuity.

44. As observed by consolidated scientific literature, such an approach has sparked debate also in relation to the effective participation of creditors in voting on plans, highlighting criticalities in cases where a significant part of eligible voters do not exercise their vote[70]. However, the SBRA model has been recognised as an effective tool to promote preventive restructuring and favour the survival of distressed companies, with a positive impact on economic stability and the efficiency of the bankruptcy system[71].

3.3 Structural Nodes of Litigation

45. Historical evolution has created a procedural arena defined by specific doctrinal tensions, embodied by fundamental court cases that define its boundaries. At the heart of Chapter 11 is the presumption that the debtor remains in control (DIP)[72], whose main negotiation tool is the exclusive right to propose a reorganisation plan for a period (initially) of 120 days (§ 1121). Once this term expires or is shortened, as made easier by BAPCPA, any creditor can propose a competing plan (liquidatory or reorganisation), breaking the debtor's control.
46. Asset management constitutes another crucial node; 11 USC § 542 requires third parties to deliver ("turnover") company assets in their possession. In *United States v. Whiting Pools, Inc.* (1983)[73], the Supreme Court confirmed this power extensively, ordering the IRS (US tax agency) to return assets it had legally seized before the Chapter 11 petition[74]. The decision established that the rehabilitation goal of Chapter 11 prevails over the individual creditor's right to execute seizure, as assets are necessary for effective reorganisation[75].
47. A further terrain of tension regards executory contracts. Section 365 of the Bankruptcy Code gives the DIP the crucial power to assume (keep) beneficial

69 11 USC § 1191(b)–(c).
70 Melissa B Jacoby, 'Bankruptcy Voting and the Limits of Disclosure' (2023) 131 *Yale Law Journal* 1322.
71 Fagetan (n 18) 13.
72 11 USC §§ 1107(a) and 1104(a).
73 *United States v Whiting Pools Inc*, 462 US 198, 203 (1983).
74 *Whiting Pools* (n 73) 209–211.
75 *Whiting Pools* (n 73) 203–204, citing HR Rep No 95-595, 220 (1977).

contracts and reject burdensome ones[76]. This power is essential for operational restructuring[77]. However, such power has been limited by a "literal" interpretation by some courts[78].

48. In In re Catapult Entertainment, Inc., the court ruled that, under 11 USC § 365(c)(1), a DIP could not assume a non-assignable licence contract without the licensor's consent, even if the DIP had no intention of assigning it to a third party[79].
49. This "hypothetical" interpretation of § 365(c)(1)[80] contrasts with the pro-rehabilitation policy associated with *Whiting Pools*[81] and may create significant obstacles for debtors whose business depends on non-assignable licences, including software or intellectual property licences.
50. The Absolute Priority Rule (APR), inherited from Chapter X, establishes that creditors must be paid in full before shareholders (equity) can receive or retain any value (§ 1129(b))[82]. However, the so-called "new value exception" has fuelled heated debate, according to which old shareholders would be enabled to "buy" the new company by contributing new capital, even if creditors are not paid in full[83]. The roots of this tension go back to criticisms of receiverships (*Boyd* case)[84], where insiders kept equity. Thus, the Supreme Court, in *LaSalle* (1999), neither confirmed nor denied the exception but made it extremely difficult to apply, establishing that old shareholders cannot have the *exclusive* right to propose a plan based on new value, as this violates the APR[85].
51. Respect for distributive priorities represents another delicate junction. Although Chapter 11 imposes a statutory order, the pressure to keep the company alive generated the *necessity doctrine*, which allows the DIP to pay pre-petition claims of certain "critical" vendors to ensure their continued collaboration. This practice, exemplified in cases like *In re Ionosphere Clubs*[86], is a technical violation of priority (paying some unsecured creditors before others and before priority creditors) but has often been tolerated in the name of rehabilitation, even if harshly criticised. The Supreme Court in *Jevic* (2017) subsequently put a brake

76 11 USC § 365(a).
77 *NLRB v Bildisco & Bildisco*, 465 US 513, 528 (1984).
78 *In re Catapult Entertainment Inc*, 165 F 3d 747, 750–751 (9th Cir 1999).
79 *Ibid.*
80 *Catapult* (n 78) 750–751.
81 *United States v Whiting Pools Inc*, 462 US 198, 203–04 (1983).
82 Miller and Waisman (n 50) 138; 11 USC § 1129(b)(2)(B)(ii).
83 Stephen J Lubben, 'Railroad Receiverships and Modern Bankruptcy Theory' (2004) 89 *Cornell Law Review* 1420, 1424; *Northern Pacific Railway Co v Boyd*, 228 US 482 (1913).
84 *Northern Pacific Railway* (n 83).
85 *Bank of America National Trust and Savings Association v 203 North LaSalle Street Partnership*, 526 US 434, 458 (1999).
86 *In re Ionosphere Clubs Inc*, 98 BR 174, 178 (Bankr SDNY 1989).

on these deviations, establishing that agreed liquidations (*structured dismissals*) cannot violate the Code's priority order[87].

52. Finally, Chapter 11 has been used creatively to resolve not only financial crises but also mass tort liability crises, as in the *Johns-Manville* asbestos case[88]. In asbestos cases, Chapter 11 has been used to create a trust under § 524(g), funded by company assets, which becomes the sole source of compensation for present and future asbestos-related claims. More broadly, mass-tort Chapter 11 cases have also relied on channelling injunctions and third-party releases, a practice recently restricted by the Supreme Court in *Purdue*[89].
53. This demonstrates the flexibility of Chapter 11, which has evolved from a purely financial instrument to a mechanism for resolving complex public policy disputes.

3.4 The Induced 'Private' Technological Demand

54. This regulatory framework generates a demand for AI "from the bottom up," driven by the market and private actors, for three fundamental reasons:
    1. For Self-Diagnosis (Debtor): The burden of proof is on the debtor. To successfully access Chapter 11 or SBRA, the debtor must act before the enterprise is unrecoverable. They need sophisticated diagnostic tools to monitor their financial health and catch distress signals early.
    2. For Credibility (Restructuring Plan): The heart of the procedure is the plan. The DIP must convince creditors and the judge that its financial projections are realistic and that the plan is feasible. A plan based on advanced predictive analysis (AI) that models different scenarios may have greater evidentiary and persuasive value than projections based solely on static spreadsheet modelling.
    3. For Efficiency (Professionals): In the context of increasing digitisation of legal practices, insolvency professionals—particularly lawyers, financial advisors, and technical consultants—are also called upon to rethink their operational methodologies in light of technological tools that not only reduce costs but redefine the perimeter of human intervention. This trend is particularly evident in complex cases, where document analysis and information flow management require significant resources.

87 *Czyzewski v Jevic Holding Corp*, 580 US 451, 466–467 (2017).
88 *In re Johns-Manville Corp*, 68 BR 618, 624–626 (Bankr SDNY 1986).
89 *Harrington v Purdue Pharma LP*, 144 S Ct 2071, 2082–2088 (2024).

55. Among emerging technologies, Technology-Assisted Review (TAR) has established itself as a useful tool for automated review of large volumes of documents, thanks to semantic clustering and supervised learning capabilities[90].
56. Adoption remains uneven. According to INSOL International, only a minority of insolvency professionals have used TAR or learning-based review tools. Nevertheless, the direction of travel is clear. Digital filing systems, electronic case-management portals and competitive pressure among professional firms are making AI-assisted document review increasingly relevant in restructuring and insolvency practice.
57. An emblematic example is represented by *Ross Intelligence*, an AI-based system designed to assist in legal research, also used in insolvency cases by US law firms like Baker Hostetler[91]. Although the project was subsequently discontinued, it marked a turning point in the use of AI for simplifying legal consulting activities[92], anticipating the integration of conversational tools like ChatGPT.
58. The adoption of such technological tools is characterised by a gradual diffusion process: initially circumscribed to larger operators, it tends to expand progressively with the reduction of implementation costs and increased market familiarity[93]. Such dynamics reflect a technology penetration model that, in the context of insolvency proceedings and practical applications, impacts the actors' capacity to integrate innovative solutions into their organisational setups. In this scenario, efficiency is not just a managerial goal but an underlying legal principle, as highlighted by the *creditors' bargain theory*, according to which insolvency law should reflect the hypothetical agreement among creditors aimed at minimising transaction costs and preserving the enterprise's residual value[94].

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90 Maura R Grossman and Gordon V Cormack, 'The Grossman-Cormack Glossary of Technology-Assisted Review' (2014) 7 *Federal Courts Law Review* 85, 110–111.

91 Karen Turner, 'Meet "Ross," the Newly Hired Legal Robot' *The Washington Post* (16 May 2016) <https://www.washingtonpost.com/news/innovations/wp/2016/05/16/meet-ross-the-newly-hired-legal-robot/> accessed 31 October 2025.

92 ROSS Intelligence, a legal technology start-up that ceased operations in 2021, has become the focal point of a landmark dispute concerning generative artificial intelligence. On 11 February 2025, the Delaware District Court held in *Thomson Reuters Enterprise Centre GmbH v ROSS Intelligence Inc* that the use of more than 2,200 Westlaw editorial headnotes to train an AI system constituted copyright infringement rather than fair use, characterising the practice as an act of unfair competition; see *Thomson Reuters Enterprise Centre GmbH v ROSS Intelligence Inc*, No 1:20-cv-00613-SB (D Del, 11 February 2025). The decision is currently under appeal before the US Court of Appeals for the Third Circuit, No 25-2153.

93 Kamalnath (n 3) 45; Jennifer Dickfos, 'AI and the Insolvency Profession: The State of Play' (2018) 26(4) *Insolvency Law Journal* 172; Catarina Frade and Ana Filipa Conceição, 'The Performance of the Courts in the Digital Era: The Case of Insolvency and Restructuring Proceedings' (2020) 29 *International Insolvency Review* 346.

94 Jackson (n 3) 4–7, 10–12.

59. In summary, while the EU imposes EWTs as a public good, the US incentivises predictive AI as a private competitive weapon for restructuring success.

4. The AI Regulatory Layer: Precaution vs. Permission

60. Now we overlay these two different "demands" for AI with the respective emerging regulatory frameworks governing the technology itself.

4.1 The EU's "Precautionary Barrier": The AI Act

61. The European Union has adopted a regulatory approach to artificial intelligence distinguished by its precautionary, horizontal, and risk-based nature, culminating in the adoption of the AI Act. This legislation aims to ensure the development of trustworthy AI, safeguarding fundamental rights and promoting transparency, security, and human oversight[95]. The regulation classifies AI systems into four risk categories: minimal, limited, high, and unacceptable, imposing obligations proportionate to the severity of the potential risk[96]. High-Risk AI Systems (HRAI) are subject to stringent requirements regarding documentation, governance, traceability, and oversight. As provided in Annex III of the AI Act, systems affecting economic and social rights fall into this category, including those used for access to credit, recruitment, education, and justice[97].
62. In this context, it is reasonable to believe that Early Warning Tools (EWTs) employed in insolvency proceedings—as predictive tools influencing critical decisions on business continuity and access to restructuring procedures—may fall within the high-risk category, depending on their design, function and legal effects. Such tools, if used to evaluate the probability of insolvency or to activate early warning mechanisms, exert a direct impact on property rights and access to judicial protection, thus falling within the AI Act's scope[98]. Their function is broadly analogous to "creditworthiness evaluation" (point 5.b)[99], and their

95 Laurie A Harris, *Regulating Artificial Intelligence: U.S. and International Approaches and Considerations for Congress* (CRS Report R48555, 4 June 2025) 2–4.

96 Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence (Artificial Intelligence Act) [2024] OJ L, 2024/1689, arts 5–7, 50 and 69, Annex III.

97 AI Act, Annex III.

98 Anne-Gabrielle Haie and others, 'A Comparative Analysis of the EU, US and UK Approaches to AI Regulation' *Steptoe* (30 April 2024) <https://www.steptoe.com/en/news-publications/steptechtoe-blog/a-comparative-analysis-of-the-eu-us-and-uk-approaches-to-ai-regulation.html> accessed 17 November 2025.

99 AI Act, Annex III, point 5(b).

decisions have a direct impact on access to services and the fundamental rights of debtors and their employees[100].

63. Article 9 imposes a continuous and documented risk management system, while Article 10 establishes stringent requirements on data quality and governance, including active bias mitigation[101]. The latter may entail the use of special categories of data, generating interpretive tensions with the GDPR[102]. As highlighted by authoritative doctrine, the European approach is distinguished by systemic coherence and rights protection, in contrast to the US model, which is more fragmented and sectoral[103].
64. The principle of transparency and explainability, sanctioned by Article 13 of the AI Act, requires that AI systems be designed to allow users to understand the meaning of generated results and use them correctly in the reference context. For complex models ("black boxes"), this requirement of explainability[104] is one of the greatest technical and economic challenges. Added to this is the principle of human oversight, provided by Article 14 of the AI Act, requiring that AI systems be designed to be subject to supervision by a human operator, who must retain the possibility to intervene in functioning, as well as to ignore or annul produced results.
65. Article 15 of the AI Act requires high-risk AI systems to achieve appropriate levels of accuracy, robustness and cybersecurity throughout their lifecycle[105]. For AI-driven EWTs, this obligation also connects high-risk AI compliance with the broader EU cybersecurity framework. Where such tools qualify as products with digital elements, the Cyber Resilience Act (CRA)[106] may become relevant; where the provider or supporting public infrastructure falls within the scope of

100 *Ibid*.

101 AI Act, Articles 9–10; Harris (n 95) 4.

102 AI Act, Article 10(5); Thorsten Jelinek, 'AI Governance: EU and US Converge on Risk-Based Approach amid Stark Differences' *Hertie School Centre for Digital Governance* (15 April 2024) <https://www.hertie-school.org/en/digital-governance/research/blog/detail/content/ai-governance-eu-and-us-converge-on-risk-based-approach-amid-stark-differences> accessed 17 November 2025.

103 Alex Engler, 'The EU and US Diverge on AI Regulation: A Transatlantic Comparison and Steps to Alignment' *Brookings Institution* (25 April 2023) <https://www.brookings.edu/articles/the-eu-and-us-diverge-on-ai-regulation-a-transatlantic-comparison-and-steps-to-alignment/> accessed 17 November 2025.

104 AI Act, Article 13.

105 Filippo Bagni, 'Regulatory Sandboxes as a Bridge Between AI and Cybersecurity: Exploring the Interplay Between the AI Act and the Cyber Resilience Act' in *CybersecNatLab White Paper on Regulatory Sandboxes for AI and Cybersecurity* (CINI Cybersecurity National Lab 2025) 64–66.

106 Regulation (EU) 2024/2847 of the European Parliament and of the Council of 23 October 2024 on horizontal cybersecurity requirements for products with digital elements (Cyber Resilience Act) [2024] OJ L, 2024/2847.

essential or important entities, the NIS2[107] Directive may also impose additional organisational and security obligations. These instruments are not obstacles in themselves, but they contribute to the cumulative compliance environment in which providers of AI-driven EWTs must operate.

66. However, the impact of such obligations is profound: compliance costs deriving from the joint application of AI Act regimes and sectoral instruments—particularly for HRAI systems—can impose disproportionate burdens for small and medium enterprises and start-ups, negatively affecting innovation capacity and market access, potentially favouring established technology operators[108].
67. Technical standardisation is also relevant. In theory, harmonised standards should make compliance easier by translating legal obligations into operational specifications. In practice, however, the standardisation process may initially create uncertainty, especially for smaller providers that lack the resources to follow and influence technical committees. This reinforces the article's central claim: the AI Act may not prohibit AI-driven EWTs, but it may shape the market in ways that make affordable, SME-oriented tools harder to develop.

4.2 The US "Trust Deficit" Barrier: Permission and Fragmentation

68. The US approach to AI regulation is permissive, fragmented, and reactive (*ex-post*), as evidenced by comparative studies highlighting the "mosaic" nature of US governance[109]. To date, there is no federal "AI Act": the discipline presents itself rather as a fragmented set of existing sectoral rules (e.g., anti-discrimination)[110], state initiatives[111], and federal guidelines[112]. In the absence of a

107 Directive (EU) 2022/2555 of the European Parliament and of the Council of 14 December 2022 on measures for a high common level of cybersecurity across the Union (NIS 2 Directive) [2022] OJ L 333/80.

108 Antonella Zarra, 'Operationalizing AI Regulatory Sandboxes: A Look at the Incentives for Participating Start-Ups and SMEs Beyond Compliance' in *CybersecNatLab White Paper on Regulatory Sandboxes for AI and Cybersecurity* (CINI Cybersecurity National Lab 2025) 102–106.

109 Alex Engler, 'The EU and US Diverge on AI Regulation: A Transatlantic Comparison and Steps to Alignment' *Brookings Institution* (25 April 2023) <https://www.brookings.edu/articles/the-eu-and-us-diverge-on-ai-regulation-a-transatlantic-comparison-and-steps-to-alignment/> accessed 17 November 2025; Matt O'Shaughnessy and Matt Sheehan, 'Lessons from the World's Two Experiments in AI Governance' *Carnegie Endowment for International Peace* (14 February 2023) <https://carnegieendowment.org/posts/2023/02/lessons-from-the-worlds-two-experiments-in-ai-governance> accessed 17 November 2025.

110 Marcin Szczepański, 'United States Approach to Artificial Intelligence' (European Parliament Think Tank, 17 January 2024) <https://www.europarl.europa.eu/thinktank/en/document/EPRS_ATA(2024)757605> accessed 17 November 2025.

111 National Conference of State Legislatures, 'AI Legislation Database' (April 2025) <https://www.ncsl.org/financial-services/artificial-intelligence-legislation-database> accessed 17 November 2025.

112 Harris (n 95) 5–6; NIST (n 118).

Congressional act, federal policy, as seen, has been guided by Executive Orders, creating an unstable landscape subject to radical changes with every administration change[113].

69. E.O. 14110 of the Biden Administration marked a moment of regulatory "maximalism," imposing over 100 actions on federal agencies and focusing on creating "safe, secure, and trustworthy" AI[114]. It established the AI Safety Institute (AISI) and introduced reporting obligations for the most powerful models[115]. E.O. 14179 of the Trump Administration promptly revoked E.O. 14110, returning policy to a more *laissez-faire* approach, criticising "excessive precautionary regulation" and refocusing on "global dominance" and removing barriers to innovation[116]. This political seesaw makes it difficult for developers to rely on a stable long-term regulatory strategy[117].
70. The pillar of US governance remains the NIST AI Risk Management Framework (AI RMF), a reference standard promoting a socio-technical approach to risk and defining characteristics of trustworthy AI, but explicitly voluntary[118]. Federal agencies are encouraged to use it, but there is no obligation for the private sector[119]. The rest of regulation is entrusted to self-regulation and voluntary industry commitments, as demonstrated by agreements signed in 2023 between the White House and major tech companies[120]. This approach has been subject to severe criticism by Tallarita[121]. Analysing "social purpose" governance structures adopted by labs like OpenAI (controlled by a nonprofit with a mission to ensure AGI "benefits all of humanity")[122], Anthropic (public benefit

113 Brian Kaplan and Ute Krudewagen, 'Comparing the US AI Executive Order and the EU AI Act' *DLA Piper* (7 December 2023) <https://knowledge.dlapiper.com/dlapiperknowledge/globalemploymentlatest-developments/2023/comparing-the-US-AI-Executive-Order-and-the-EU-AI-Act.html> accessed 17 November 2025.

114 Executive Order 14110, 'Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence' (1 November 2023) 88 Fed Reg 75191.

115 White House, 'Fact Sheet: Biden-Harris Administration Secures Voluntary Commitments from Leading Artificial Intelligence Companies' (21 July 2023) <https://www.presidency.ucsb.edu/documents/fact-sheet-biden-harris-administration-secures-voluntary-commitments-from-leading> accessed 17 November 2025.

116 Executive Order 14179, 'Removing Barriers to American Leadership in Artificial Intelligence' (23 January 2025) 90 Fed Reg 8741.

117 Hadrien Pouget and Matt O'Shaughnessy, *Reconciling the U.S. Approach to AI* (Carnegie Endowment for International Peace, 3 May 2023) <https://carnegieendowment.org/research/2023/05/reconciling-the-us-approach-to-ai> accessed 17 November 2025.

118 NIST, *Artificial Intelligence Risk Management Framework (AI RMF 1.0)* (NIST AI 100-1, January 2023).

119 Harris (n 95) 5–6.

120 White House (n 115).

121 Tallarita (n 10).

122 OpenAI, 'OpenAI Charter' (2018) <https://openai.com/charter> accessed 17 November 2025.

corporation with a *long-term benefit trust*)[123], and DeepMind (sold to Google in 2014 with the condition of an *independent ethics board*)[124], it becomes obvious how such commitments lack credible enforcement mechanisms. Investor pressures for profit maximisation—as demonstrated by the failed attempt of the OpenAI board to fire Sam Altman in November 2023, blocked by Microsoft and Thrive Capital[125]—make ethical self-control almost impossible without external "checks and balances"[126], as James Madison warned in Federalist No. 51[127] and, before him, Montesquieu in *"Esprit des lois"* [128].

71. The risk, as highlighted by several analysts[129], is that self-regulation transforms into "ethics-washing" or "risk-washing," i.e., an appearance of responsibility devoid of substance[130]. In the absence of a unitary federal framework, States are creating a regulatory patchwork[131]: California has enacted targeted transparency measures, such as SB 942[132], while broader frontier-model safety proposals such as SB 1047 were vetoed; Colorado enacted SB 24-205[133] on high-risk AI systems, and Washington adopted ESSB 5838[134] establishing an AI task force.

123 Anthropic, 'The Long-Term Benefit Trust' (19 September 2023) <https://www.anthropic.com/news/the-long-term-benefit-trust> accessed 31 October 2025; Anthropic, 'Company' <https://www.anthropic.com/company> accessed 31 October 2025.

124 Catherine Shu, 'Google Acquires Artificial Intelligence Startup DeepMind For More Than $500M' *TechCrunch* (26 January 2014) <https://techcrunch.com/2014/01/26/google-deepmind/> accessed 17 November 2025; Greg Kumparak, 'With DeepMind, Google Prepares For A Future Where We Search Less And Get More' *TechCrunch* (27 January 2014) <https://techcrunch.com/2014/01/27/why-google-bought-deepmind/> accessed 17 November 2025.

125 Dan Milmo and Callum Jones, 'Microsoft Chief Says "No OpenAI" without Tech Giant's Involvement' *The Guardian* (21 November 2023) <https://www.theguardian.com/technology/2023/nov/21/microsoft-ceo-nadella-openai-altman> accessed 17 November 2025.

126 Tallarita (n 10).

127 James Madison, 'Federalist No 51' (1788) in Alexander Hamilton, James Madison and John Jay, *The Federalist Papers* (Penguin Classics 1987).

128 Montesquieu, *De l'esprit des lois* (1748) bk III, ch III.

129 K E Francis, 'The Need for an Ethical Approach to Regulatory Sandboxes' in F Bagni and F Seferi (eds), *Regulatory Sandboxes for AI and Cybersecurity* (CINI Cybersecurity National Lab 2025) 198.

130 Jeremy Donato, 'The Impact of Tech Regulation on Innovation, Society, and Competition' *Forbes* (22 October 2024) <https://perma.cc/3HNR-T2GR> accessed 27 November 2025.

131 National Conference of State Legislatures, 'AI Legislation Database' (April 2025) <https://www.ncsl.org/financial-services/artificial-intelligence-legislation-database> accessed 17 November 2025.

132 California Senate Bill 942 (2024); California Assembly Bill 2013 (2024); California Senate Bill 1047 (2024, vetoed).

133 Colorado Senate Bill 24-205 (2024); Colorado House Bill 24-1468 (2024).

134 Washington State ESSB 5838 (2024).

5. Analysis: The Two Regulatory Paradoxes

72. This mapping of insolvency regulatory frameworks (*see supra* section 2; 3) and AI frameworks (*supra* § 4) allows us now to analyse their dysfunctional interactions and demonstrate the "Double Paradox" thesis.

5.1 The EU Paradox: "Public Mandate vs. Public Barrier"

73. The European paradox reflects an intrinsic tension in normative action, an expression of internal conflict between different but strictly interrelated public policies. On one hand (*supra* § 2), the PRD establishes a public mandate for Member States to introduce accessible and transparent early warning tools (EWTs), aimed at preventing insolvency and favouring the survival of smaller companies[135]. Empirical experience demonstrates that, to be truly effective, these tools must be sophisticated and based on complex variables, including non-financial factors beyond traditional accounting indicators[136]. Further studies have highlighted how the use of artificial intelligence and machine learning can strengthen the predictive capacity of alert models[137].
74. On the other hand (*supra* § 4.1), the AI Act creates a public barrier. If certain AI-driven EWTs are classified as HRAI systems, European legislation imposes compliance burdens (data governance, explainability, cybersecurity)[138] that prove technically complex and, in some cases, financially prohibitive. Such costs disproportionately hit innovative startups and SMEs[139]—the very actors that could develop more agile and specialised alert tools—potentially favouring large technology providers better able to absorb compliance costs.
75. The result may be a significant implementation gap. The EU legislator does not prohibit the use of AI-driven EWTs; nor does the PRD require SME debtors to bear the costs of high-risk AI compliance. The problem is more indirect. By increasing the legal, technical and organisational requirements applicable to providers and intermediaries, the AI Act may reduce the incentives to develop affordable, insolvency-specific tools for SMEs. Article 3 PRD therefore risks being weakened not by the absence of predictive technology, but by a regulatory environment that may make such technology less accessible in practice[140].

135 Directive (EU) 2019/1023 of the European Parliament and of the Council of 20 June 2019 on preventive restructuring frameworks [2019] OJ L 172/18, Article 3.

136 Navarro-Galera and others (n 41) 345–347.

137 Alanis, Chava and Shah (n 6) 12; Gao, Cui, Wang and Xu (n 48) 1–4.

138 AI Act, arts 6, 9–15 and Annex III.

139 Harris (n 95) 7–8; Zarra (n 108) 102–106.

140 Novelli and others (n 7) 8–9; Zarra (n 108) 102–106.

5.2 Clarifying the EU Burden: Direct Users vs. Enabling Ecosystem

76. A clarification is necessary. The EU paradox does not rest on the assumption that SME debtors must themselves bear the full cost of AI Act compliance. Article 3 PRD requires Member States to ensure access to EWTs. However, access depends on an enabling ecosystem: public authorities, software providers, professional advisors, universities, chambers of commerce and private developers. If AI-driven EWTs are treated as high-risk systems, compliance costs arise at the level of this ecosystem. Smaller providers may exit the market or avoid developing insolvency-specific tools; public bodies may prefer simpler rule-based alerts; and SMEs may ultimately receive less sophisticated, less tailored or less accessible tools. The burden is therefore indirect but legally relevant.

5.3 The US Paradox: "Market Innovation vs. Legal Trust"

77. The US paradox is subtler. It is not a conflict of mandates, but a clash between market innovation and legal reliability. On one hand (*supra* § 3; 4.2), the US system is an innovation incubator. The *laissez-faire* approach to AI regulation, characterised by voluntary standards and market incentives, encourages private development of increasingly powerful predictive tools[141]. In this framework, companies are free to create the "best algorithm" for crisis prediction or complex scenarios.
78. However, this same freedom generates a "Trust Deficit": since governance is "soft," voluntary, and unstable[142], the tools almost always result in proprietary "black boxes"[143]. This opacity generates insurmountable obstacles in the formal legal context, impacting three fundamental dimensions of the process.
79. First, an admissibility problem arises: can a debtor in *Chapter 11* proceedings truly base the entire reorganisation plan—which directly impacts creditor rights—on projections elaborated by a proprietary and impenetrable AI model? Added to this is the accountability problem: how can a judge evaluate a plan's credibility if they cannot "look inside" the algorithm that generated it? Responsibility for potential erroneous or discriminatory algorithmic decisions becomes, in this scenario, difficult to allocate and risks dispersing into a regulatory void[144].

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141 Davtyan (n 8) 226–229.

142 Matt O'Shaughnessy and Matt Sheehan, 'Lessons from the World's Two Experiments in AI Governance' *Carnegie Endowment for International Peace* (14 February 2023) <https://carnegieendowment.org/research/2023/02/lessons-from-the-worlds-two-experiments-in-ai-governance> accessed 14 November 2025; Alex Engler, 'The EU and US Diverge on AI Regulation: A Transatlantic Comparison and Steps to Alignment' *Brookings Institution* (25 April 2023) < https://www.brookings.edu/articles/the-eu-and-us-diverge-on-ai-regulation-a-transatlantic-comparison-and-steps-to-alignment/> accessed 14 November 2025.

143 Harris (n 95) 4–5; Uuk and others (n 9) 2.

144 Harris (n 95) 5–6; Uuk and others (n 9) 3.

Then arises the problem of adversarial proceedings: creditors, lacking access to assumptions, training data, and model weights, find themselves unable to effectively contest the plan, with an evident imbalance between parties and a compression of the right to defence.

80. Innovation occurs but remains "unusable" or "toxic" in the legal context for which it was created. The most powerful tools might never be brought to court for fear that their opacity causes the entire restructuring plan to collapse. The absence of minimum transparency and reliability standards—thought to favour innovation—ends up sabotaging the legal utility of that innovation, failing to effectively support the *rescue culture* of Chapter 11.

5.4 Are Regulatory Sandboxes a (Partial) Solution?

81. The most discussed solution to mitigate the European paradox is the regulatory sandbox[145]. Provided by the AI Act (arts. 57–61)[146], sandboxes are controlled environments where developers—particularly SMEs[147]—can test innovative AI systems under competent authority supervision[148]. The goal is noble: facilitate innovation and promote *regulatory learning*[149] in a safe environment. Sandboxes offer enormous potential, allowing solutions to be tested in real conditions and managing complex data requirements, including those from GDPR[150].
82. However, their effectiveness in resolving the EU Paradox is only partial:
    - They do not resolve permanent compliance costs. Regulatory sandboxes primarily support the development and pre-certification phase, but they do not eliminate the ongoing compliance burdens—such as post-market monitoring and continuous risk management—required for high-risk AI systems throughout their lifecycle[151]. An SME can successfully exit the sandbox[152] only to face unsustainable long-term compliance costs.
    - Operational Distrust. The multi-level governance of sandboxes (national authorities, AI Office, AI Board) is complex. They risk becoming bureaucratic bottlenecks, and there is a tangible risk of regulatory capture (where large

145 Novelli and others (n 7).
146 AI Act, Chapter VI, arts 57–61.
147 Novelli and others (n 7) 5–6; AI Act, recital 143.
148 Novelli and others (n 7) 2–3.
149 *Ibid;* AI Act, recital 139.
150 AI Act, Article 59.
151 Novelli and others (n 7) 8–9.
152 *Ibid* 9, discussing graduation criteria and transition to market deployment.

players dominate the sandbox agenda)[153] or ethics-washing (using sandbox participation as a marketing badge without real ethical commitment)[154].

- They do not resolve the US Paradox. The US problem, as seen, is not the lack of innovation or test spaces, but the absence of binding standards and legal trust. Sandboxes do not resolve this deficit[155].

6. Discussion and Recommendations: Towards "Insolvency-Aware" AI Regulation

83. The analysis of the Double Paradox demonstrates that neither the EU "precautionary-horizontal" approach nor the US "permissive-vertical" approach is currently suitable for integrating AI into insolvency law. Both fail because they treat AI regulation as an exercise "in a vacuum", without considering the specific and urgent needs of other branches of law. To overcome this impasse, AI regulation is needed that is "conscious of the crisis context" (insolvency-aware).

6.1 Recommendations for the European Union

84. The EU paradox "Mandate vs. Barrier" requires an *internal* realignment of legislation.

- Proposal 1: A "Green Lane" in the AI Act. It is proposed to modify the AI Act to create a lightened compliance regime (*light-touch*) or a "green lane" for AI-driven EWTs that are demonstrably designed to serve the preventive restructuring objectives of the PRD. For example, HRAI compliance could be *presumed* (and not subject to third-party assessment) if the tool is offered free of charge or at low cost to SMEs and has successfully completed a specific sandbox.
- Proposal 2: Co-Designed and Purpose-Driven Sandboxes. Regulatory sandboxes must be more than technical laboratories. They should be co-designed and supervised not only by data protection and market authorities, but also by bankruptcy judges, insolvency practitioners, SME representatives, universities, research centres, and project developers. The involvement of academic institutions would provide independent methodological validation, interdisciplinary expertise and empirical evaluation of AI-driven early warning tools. Project developers, in turn, would ensure that the tools

153 Dirk A Zetzsche, Ross P Buckley, Douglas W Arner and Janos N Barberis, 'Regulating FinTech: Lessons from Regulatory Sandboxes' (2017) European Banking Institute Working Paper No 6/2017, 11–12.

154 Radostina Parenti, *Regulatory Sandboxes and Innovation Hubs for FinTech* (European Parliament, Policy Department for Economic, Scientific and Quality of Life Policies, 2020) 22–23.

155 Davtyan (n 8) 227–229; Harris (n 95) 4–6.

tested in the sandbox remain technically feasible, scalable and responsive to the practical needs of SMEs. The goal of the sandbox should therefore not be limited to technical accuracy, but should extend to legal conformity, transparency, explainability and practical usability in restructuring proceedings.

6.2 Recommendations for the United States

85. The US paradox "Innovation vs. Trust" requires creating trust through standardisation.
    - Proposal 1: Make NIST RMF Binding for Legal Proceedings. The federal administration should go beyond EOs and promote bipartisan legislation making compliance with NIST AI RMF a minimum binding requirement for the use of predictive AI tools as evidence or basis for plans in federal proceedings (including the Bankruptcy Code).
    - Proposal 2: "Court-Admissible AI" Standards. The goal is not to stifle innovation, but to make it usable in court. The Department of Justice (DOJ) and the Judicial Conference of the United States should develop standards (similar to *Daubert* standards for scientific testimony)[156] for predictive AI admissibility, focusing on auditability, explainability, and training data validation. This would create a market incentive for developers to build "transparent" AI to solve the *trust deficit*.

7. Conclusion

86. This article explored the delicate and problematic intersection between the growing "rescue culture" in insolvency law and the emergence of artificial intelligence regulation. The investigation has highlighted a true Double Regulatory Paradox, risking compromising the adoption of the most promising technology for business crisis prevention. Despite the shared goal of favouring business rescue, the two legal systems analysed fail to integrate AI for opposite reasons, but with equally unsatisfactory outcomes.
87. In Europe, the PRD requires Member States to make effective EWTs accessible, while the AI Act may increase the regulatory costs borne by the providers, public

156 *Daubert v Merrell Dow Pharmaceuticals Inc*, 509 US 579, 589–595 (1993); *Frye v United States*, 293 F 1013, 1014 (DC Cir 1923); Edward K Cheng and Albert H Yoon, 'Does Frye or Daubert Matter? A Study of Scientific Admissibility Standards' (2005) 91 *Virginia Law Review* 471, 471–514 <https://scholarship.law.vanderbilt.edu/context/faculty-publications/article/1054/viewcontent/Does_Frye_or_Daubert_Matter__Cheng.pdf> accessed 17 November 2025; 'Admitting Doubt: A New Standard for Scientific Evidence' (2010) 123 *Harvard Law Review* 2021, 2021–2028 <https://harvardlawreview.org/wp-content/uploads/2010/06/vol123_admitting_doubt.pdf> accessed 17 November 2025.

bodies and intermediaries needed to develop AI-driven versions of those tools. The risk is not a direct financial burden on SME debtors, but an indirect reduction in the availability of affordable, trustworthy and insolvency-specific tools for them (Mandate-Barrier Paradox).

88. In the United States, conversely, excessive trust in the market generates powerful but opaque tools, devoid of legal reliability and thus unusable in formal proceedings like *Chapter 11* or *SBRA* (Innovation-Trust Paradox). The result is a regulatory dead end: two divergent approaches that, paradoxically, converge in producing inefficiency and nullifying AI's potential as an ally of economic justice.
89. The lesson that emerges is unambiguous: what undermines the effectiveness of AI is not the illusion of uniform regulation, but the rigidity of regulatory approaches that, though moving in opposite directions, ultimately converge in the same impasse. If AI is to be harnessed to avert corporate distress, protect employment, and reinforce economic resilience, a genuine paradigm shift is required. Regulation must be context-attuned, capable of adapting to diverse legal architectures and responsive to the social urgency that permeates crisis law. It must also ensure that 'insolvency-aware' reforms integrate minimum standards of data quality and interoperability (across judicial portals, advisors, and companies) with stringent requirements of auditability and transparency for models; only under these conditions can AI be deemed truly admissible and effective in rescue proceedings[157]. A flexible and proportionate framework is what transforms AI from an unfulfilled promise into a tangible instrument of economic justice. In the end, what is needed are not new barriers, but bridges—bridges between innovation and law, between technology and society, between markets and collective protection.

157 Aurelio Gurrea Martínez, 'The Digitalization of Insolvency Proceedings' (2025) 34(2) *International Insolvency Review* 475, 475–491.