

UTILIZING ARTIFICIAL INTELLIGENCE IN INVESTOR-STATE DISPUTE SETTLEMENT: PRESENT ISSUES AND FUTURE CHALLENGES

LU YAN*
TIE FATT HEE**

Abstract

The integration of Artificial Intelligence (AI) into Investor-State Dispute Settlement (ISDS) has emerged as a transformative force, promising to streamline complex investor-state arbitration processes and enhance the accuracy of legal determinations. However, this technological advancement also presents several challenges, necessitating a critical examination of the role of AI in shaping the future of ISDS. This paper evaluates the impact of AI on ISDS, highlighting its potential to improve investor-state arbitration by enriching efficiency, objective decision-making, and advanced evidence analysis. It acknowledges the capacity of AI in refining risk assessment and predicts dispute outcomes, providing a cutting-edge approach to ISDS. However, the analysis also addresses significant concerns, including algorithmic bias, the ethical implications of decision-making, and the overreliance on technology that may overlook the complexity of human judgment. To overcome these challenges, the paper suggests a regulatory framework that mandates transparency and accountability, ensures justice through rigorous algorithm audits, and promotes a collaborative relationship between humans and AI. By maintaining human autonomy and enhancing the role of AI as an assistive tool, especially in intricate cases, the paper advocates for a balanced integration of AI in ISDS, striving for a harmonious blend of technological innovation and human expertise in future arbitration processes.

Keywords: Artificial Intelligence, Investor-State Dispute Settlement, Algorithmic Regulation, Arbitration, Algorithmic Ethics.

Received: May 31, 2024, **Revised:** March 12, 2025, **Accepted:** June 11, 2025.

Published online: June 12, 2025

DOI: <https://doi.org/10.22452/jmcl.vol51no1.3>

* PhD Candidate, Faculty of Law, Universiti Malaya, Kuala Lumpur, Malaysia. The author can be contacted at <luyan.sara@hotmail.com>.

** Honorary Professor, Faculty of Law, Universiti Malaya, Kuala Lumpur, Malaysia. The author can be contacted at <tiefh@um.edu.my>.

The authors would like to thank the anonymous reviewers for their helpful comments and feedback.

I INTRODUCTION

Artificial intelligence (AI) is an undeniable technical force in the context of the 4.0 revolution, making an enormous influence across a wide range of sectors on a worldwide scale. The ability of AI to store vast amounts of data, process it rapidly, solve complex problems, and rival human capabilities is a result of its core principles.⁷⁷ AI, as a field, focuses on mimicking human intelligence in machines through processes like problem-solving, learning, and speech recognition.⁷⁸ The ongoing advancement of AI technology allows for the seamless integration of data-driven methodologies, enabling AI systems to learn from the patterns and characteristics in the data, thereby strengthening their problem-solving and decision-making capabilities.⁷⁹ This research is not intended to provide a full analysis of the functions of AI, but an introduction to it. Still, to put it simply, AI is a highly developed data-processing system that is furnished with huge quantities of data and algorithms. Basically, AI is the capacity of a machine to imitate human thought processes and actions, displaying characteristics like human intelligence.⁸⁰

AI is rapidly transforming different fields and replacing traditional systems quickly, including investor-state dispute arbitration.⁸¹ The use of AI in dispute resolution between investors and states marks an important phase in the evolution of technology and legal procedures.⁸² Investor-States Disputes Settlement (ISDS) has been a critical mechanism for resolving disputes that arise between foreign investors and sovereign states, a process traditionally predicated upon arbitration and facilitated by human expertise and judgment.⁸³ The development of AI technology is expected to dramatically affect the traditional system by introducing more efficiency and perhaps improving the accessibility of legal solutions.

However, these emerging technologies raise a number of new concerns, including the ability of AI to deal with complicated legal reasoning, the ethical quandaries connected with automated decision-making, and the resilience of AI to manipulation.⁸⁴

⁷⁷ Eva Falk, 'AI to Solve the Data Deluge: AI-Based Data Compression' in Patrick Glauner and Philipp Plugmann (eds), *Innovative Technologies for Market Leadership: Investing in the Future* (Springer, 2020) 271.

⁷⁸ Zorica Bogdanovic, 'Artificial Intelligence in Federal Information Processing Systems' (2021) 9(7) *American Journal of Computer Science and Information Technology* 1.

⁷⁹ O Machek, T Konečná and D Slamková, 'High Throughput 3D Volumes Data Acquisition Using AI' (2022) 28 *Microscopy and Microanalysis* 3092.

⁸⁰ Maxi Scherer, 'International Arbitration 3.0 – How Artificial Intelligence Will Change Dispute Resolution' (2019) *Austrian Yearbook of International Arbitration* 503.

⁸¹ Wasiq Dar and Boris Praštalo, 'The investor-state arbitration legitimacy crisis: Could AI be its future savior (or resurrector)?', (2023) 14(1) *Pravni zapisi* 21.

⁸² Yarik Kryvoi, 'Artificial Intelligence and the Practice of Investor-State Arbitration' *BIICL Blog* (Blog Post, 8 November 2023) <<https://www.biicl.org/blog/71/artificial-intelligence-and-the-practice-of-investor-state-arbitration?cookieset=1&ts=1748570062>>.

⁸³ Julien Chaisse, Leïla Choukroune and Sufian Jusoh, 'Investor-State Dispute Settlement: An Introduction' in Julien Chaisse, Leïla Choukroune and Sufian Jusoh (eds), *Handbook of International Investment Law and Policy* (Springer, 2021) 605.

⁸⁴ Ngo Nguyen Thao Vy, 'AI Implementation in ODR: A Game-Changer or a Troublemaker

The potential of AI to either streamline or complicate these disputes is profound, and it is necessary to examine carefully how AI tools are designed, implemented, and regulated within the ISDS framework. Furthermore, as disputes involve parties from diverse legal and cultural backgrounds, the impartiality and universality of AI-driven processes are of utmost importance.⁸⁵

AI is increasingly impacting dispute resolution processes, including investor-state disputes. The following areas are the focus of the study on using AI in investor-state dispute resolution: The beneficial use of AI in arbitration;⁸⁶ algorithmic decision-making;⁸⁷ ethical and legal considerations;⁸⁸ and predictions and AI in evidence analysis.⁸⁹ The evolving regulatory environment for AI is also expected to significantly influence alternative dispute resolution (ADR), aligning with shared goals of trustworthiness and transparency between AI and ADR regulations.⁹⁰ Despite advances in AI, there is still a substantial lack of understanding about how AI might be systematically integrated into the ISDS framework.

There is limited study on the effectiveness of AI in recognising legal documents, managing evidence, forecasting outcomes, and perhaps serving as decision-makers in investors-state disputes.⁹¹ Furthermore, the impact of AI on the fairness, transparency, and enforceability of investor-state dispute outcomes is a critical area that has not been

of Data Protection' (2023) 8(1) *Vietnamese Journal of Legal Sciences* 1.

⁸⁵ Hibah Alessa, 'The Role of Artificial Intelligence in Online Dispute Resolution: A Brief and Critical Overview' (2022) 31(3) *Information and Communications Technology Law* 319.

⁸⁶ Eoin Treacy, 'The effectiveness of artificial intelligence in simplification of arbitration proceedings: fiction or seventh seal in the world of arbitration?' (2022) 2(2) *International Journal of Law, Ethics, and Technology* 137.

⁸⁷ Kathleen Creel and Deborah Hellman, 'The Algorithmic Leviathan: Arbitrariness, Fairness, and Opportunity in Algorithmic Decision Making Systems' in *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency* (Association for Computing Machinery, 2021) 816.

⁸⁸ BM Dutta, 'The Ethics of Artificial Intelligence in Legal Decision Making: An Empirical Study' (2018) 55(1) *Psychology and Education Journal* 292, 292–302; MRV Axpe, 'Ethical Challenges from Artificial Intelligence to Legal Practice' in HS González, I Pastor López, PG Bringas, H Quintián and E Corchado (eds), *Hybrid Artificial Intelligent Systems* (Cham, Springer International Publishing, 2021) 196, 196–206; JP Davis, 'AI, Ethics, and Law: A Way Forward' in LA DiMatteo, C Poncibò and M Cannarsa (eds), *The Cambridge Handbook of Artificial Intelligence: Global Perspectives on Law and Ethics* (Cambridge University Press, 2022) 304.

⁸⁹ FP Kalalo and KC Pontoh, 'The Use of Artificial Intelligence (AI) in Legal Framework for International Arbitration Practices in Indonesia' in *Proceedings of the Arbitration and Alternative Dispute Resolution International Conference* (Atlantis Press, 2019) 6.

⁹⁰ R Abbott and BS Elliott, 'Putting the Artificial Intelligence in Alternative Dispute Resolution' (2023) 4(3) *Amicus Curiae* 685.

⁹¹ Precia Jacey and Siti Yuniarti, 'Artificial Intelligence: Implementation in Legal Services (Comparative Study on China, United States and Indonesia)' in *Proceedings of the 3rd Asia Pacific International Conference on Industrial Engineering and Operations Management* (IEOM, Society International, 2022) 2113.

extensively explored.⁹² Ethical concerns, such as algorithmic prejudice and the substitution of human judgment, also leave significant gaps for scholarly research. However, it is worth noting that the EU is at the forefront of regulating AI, with recent laws like the Digital Markets Act impacting AI models and data regulation, particularly in terms of fairness and non-discrimination.⁹³ The study employs normative legal research to analyze AI's use in ISDS, drawing from legal materials such as laws, court decisions, and scholarly opinions. It aims to assess the extent of AI application in ISDS and their challenges.

Amidst the backdrop of ISDS legitimacy crisis,⁹⁴ this paper delves into the potential role of AI within this specialized realm of dispute resolution. Through a critical examination of the current utilization of AI in broader legal systems and Investor-State Arbitration (ISA), this paper lays the groundwork for a discussion on the appropriateness of AI as a complement, or potentially a replacement, for human arbitrators in ISDS. This section outlines the methodology employed to scrutinize the capabilities and limitations of AI in this context, proposing a framework for evaluating the impact of AI on the ISDS process, and offering implications of AI integration. The subsequent analysis will be substantiated by doctrinal research, and comparative studies, addressing the important question: Can AI restore confidence in trust and efficiency within ISDS, or might it introduce new complexities that further challenge the system's credibility and functionality? The conclusion derived from this investigation aspires to provide a forward-looking perspective on the transformative potential of AI in shaping the future of international dispute resolution. By critically engaging with the intersection of technology and law, this paper aims to contribute to the ongoing dialogue on the modernization of ISDS, offering insights that balance innovation with the preservation of procedural integrity and justice.

To explore the possible integration of AI into the framework of ISDS, this doctrinal legal research has analysed primary sources like legal documents, the EU Artificial Intelligence Act, and ISDS case databases, alongside secondary sources such as academic journal articles and books. Besides, the content analysis method critically examines how AI interacts with existing legal frameworks and its potential impact on resolving disputes, addressing issues like algorithmic bias, transparency, accountability, and the erosion of human judgment.

This article is organised into six sections including the Introduction and Conclusion section. Section II addresses the application of AI in ISDS, while Section III discusses the legitimacy crisis in ISDS. Section IV evaluates the overall impact of AI on ISDS, and Section V explores the integration of AI into ISDS. The findings and discussions of this article aim to make a significant contribution to the ongoing international dialogue on modernizing ISDS mechanisms in the digital age.

⁹² Ibid.

⁹³ Urs Gasser, 'An EU landmark for AI governance' (2023) 380 *Science* 1203.

⁹⁴ Sergio Puig and Anton Strezhnev, 'The David Effect and ISDS' (2017) 28(3) *European Journal of International Law* 731.

II INVESTOR-STATES DISPUTES SETTLEMENT AND APPLICATION OF ARTIFICIAL INTELLIGENCE

The utilization of AI within ISDS offers various benefits in the context of arbitration process, algorithmic decision-making, predictions, and AI in evidence analysis. AI can reduce risks, increase predictability, and speed up the resolution process.⁹⁵ An intelligent evidence prediction method for legal documents, achieving a score of 70.07%, demonstrates the effectiveness of AI in managing evidence and forecasting outcomes.⁹⁶ It provides an alternative to traditional judicial processes for smart dispute resolution and is especially well-suited for simple and recurring legal cases.⁹⁷

While software analysis may aid in decision-making, arbitrators are not able to rely exclusively on it because of several issues, such as differing legal settings and the need to exercise arbitrator discretion.⁹⁸ Legal frameworks make a distinction between AI jobs at different levels. For example, basic legal knowledge processing is classified as low-level AI, whereas tasks involving independent dispute resolution are classified as strong-level AI. The latter is less prevalent but may be important when combined with human judgment.⁹⁹ AI must be incorporated into dispute resolution procedures to adjust to changing legal environments around the world.¹⁰⁰ This adaptation ensures competitiveness, enhances efficiency, and addresses the evolving needs of parties.

AI can be used in decision-making in dispute resolution which involves utilizing algorithms to assist in resolving legal conflicts. Various levels of AI involvement exist, from low-level tasks like legal expertise and contract review to strong-level functions such as independent dispute resolution with a “robot judge”.¹⁰¹ AI systems, particularly machine learning and natural language processing, are increasingly employed in Consumer Online Dispute Resolution (CODR) to predict outcomes, manage cases, and

⁹⁵ Ibid.

⁹⁶ H Bai, ‘Evidence Prediction Method Based on Sentence Selection for Legal Documents’ (2022) 2022 *Advances in Multimedia* 1.

⁹⁷ Nineesha P and P Deepalakshmi, ‘Automated Techniques on Indian Legal Documents: A Review’ in *Proceedings of the 2022 Third International Conference on Intelligent Computing Instrumentation and Control Technologies* (IEEE,2022)172.

⁹⁸ S Chen, J Wang and Q Zhang, ‘Informetric Analysis of Researches on Application of Artificial Intelligence in Legal Practice’ in *Proceedings of the 2023 International Conference on Intelligent and Innovative Technologies in Computing, Electrical and Electronics*, (IEEE2023) 406–408.

⁹⁹ Izuoma Egeruoh Egeruoh-Adindu, ‘Technology and the Law: The Impact of Artificial Intelligence (AI) on Litigation and Dispute Resolution in Africa’ in Chile Eboe-Osuji, Emilia Emeseh and Obiora D Akinkugbe (eds), *Nigerian Yearbook of International Law 2018/2019* (Springer, 2021) 413.

¹⁰⁰ AG Shalaby, GM Abdelaziz and M E Kandeel, ‘Using Artificial Intelligence to Resolve Disputes through Online Arbitration’ in *Proceedings of the 2022 Ninth International Conference on Social Networks Analysis, Management and Security (SNAMS)*(IEEE, 2022) 1–8.

¹⁰¹ ME Lokanan, ‘Incorporating machine learning in dispute resolution and settlement process for financial fraud’ (2023) 6 *Journal of Computational Social Science* 515.

influence negotiations.¹⁰² The use of AI in justice systems aims to identify regularities, enhance the efficiency of civil cases, and ensure fair trial rights and due process standards.¹⁰³ However, concerns arise regarding the potential violation of due process standards and the need for regulation in AI's role in dispute resolution, especially in out-of-court redress scenarios.¹⁰⁴

Interest in the field of ISDS algorithmic decision-making is rising. Research indicates that although the purpose of ISDS provisions is to shield foreign investors from the opportunistic actions of host governments, AI is becoming more and more popular as a tool of settling legal disputes, including those involving investments.¹⁰⁵ Although there are restrictions because of differing legal situations and arbitrator discretion, AI can be used to forecast conflict outcomes and identify relevant legislation.¹⁰⁶ A more successful strategy is the inclusion of AI technology in dispute resolution, such as utilising AI in conjunction with human judges to help with expert opinions, document analysis, and court clerk duties.¹⁰⁷ The apprehension around algorithmic decision-making in legal environments, such as ISDS, arises from the possibility of substituting judges with algorithms.

AI significantly enhances the dispute resolution process by offering predictions and facilitating evidence analysis, thereby playing a key role in modern legal systems.¹⁰⁸ By predicting legal outcomes, AI systems not only expedite the resolution process but also encourage early settlements through improved predictability and minimized risks.¹⁰⁹ However, integrating the probabilistic forecasts of AI into the legal framework's fundamentally binary decision-making process poses a significant barrier, as there is currently no universally approved way for judges to successfully incorporate these predictions.¹¹⁰

¹⁰² Vladyslava Turkanova, 'Prospects for the Use of Artificial Intelligence and Machine Learning Algorithms for Effective Resolution of Civil Disputes' (2023) 2 *Access to Justice in Eastern Europe* 232.

¹⁰³ M Ebers, 'Chapter 8: Automating due process – the promise and challenges of AI-based techniques in consumer online dispute resolution' in Xandra Kramer JH, Betül Kas, and Erlis Themeli (eds), *Frontiers in Civil Justice: Privatisation, Monetisation and Digitisation* (Edward Elgar, 2022) 142.

¹⁰⁴ RABS Elliott, 'Putting the Artificial Intelligence in Alternative Dispute Resolution: How AI Rules Will Become ADR Rules' (2023) 4 *The Journal of the Society for Advanced Legal Studies* 685.

¹⁰⁵ F Stähler, 'An Optimal Investor-State Dispute Settlement Mechanism' (2023) 138 *Journal of Economics* 1.

¹⁰⁶ M Ayhan, Toker İ and Birgönül T, 'Comparing Performances of Machine Learning Techniques to Forecast Dispute Resolutions' (2022) 33(5) *Teknik Dergi* 12577.

¹⁰⁷ EP Ermakova and EE Frolova, 'Using Artificial Intelligence in Dispute Resolution' in Inshakova A O and Frolova EE (eds), *Smart Technologies for the Digitisation of Industry: Entrepreneurial Environment* (Springer Singapore, 2022) 131.

¹⁰⁸ *Ibid.*

¹⁰⁹ J Zeleznikow, 'The benefits and dangers of using machine learning to support making legal predictions' (2023) 13(4) *WIREs Data Mining and Knowledge Discovery* e1505 <<https://doi.org/10.1002/widm.1505>>.

¹¹⁰ *Ibid.*

The efficiency gains from using AI in commercial disputes are significant. AI technologies, such as e-document initiation systems and prediction-based coding algorithms, enhance work efficiency by facilitating communication between trade parties and arbitrators without space restrictions, streamlining dispute resolution procedures.¹¹¹ Prediction-based algorithms are adept at managing extensive document analysis, which is a common requirement in these disputes.¹¹² This capability significantly streamlines the process, reducing the time and resources needed for evidence review.

Despite these advantages, the introduction of AI, particularly in the form of robotic judges, introduces critical concerns regarding the fairness of decisions and the transfer of judicial power to technology developers.¹¹³ This shift raises ethical questions about the extent to which judicial discretion and interpretation should be automated, highlighting the need for a careful balance between leveraging AI's benefits and preserving the integrity of the judicial process. There are some ethical concerns such as fair trial rights, due process standards, transparency, bias reduction, and personal data protection, in the use of AI in dispute resolution.¹¹⁴ While AI accelerates the resolution process and enhances predictability, it also raises questions about decision-making transparency, control over algorithms, and confidentiality risks.¹¹⁵ The integration of AI in dispute resolution, particularly in out-of-court settings, necessitates a balance between efficiency and safeguarding personal data.¹¹⁶ Additionally, the integration of AI in the workplace, as demonstrated by Amazon's surveillance of delivery drivers using devices such as the Echo with Alexa,¹¹⁷ sparks heated debates about privacy and ethical consequences.¹¹⁸ This highlights the importance of strong ethical governance and active stakeholder engagement in the implementation of AI technologies. These discussions are crucial in ensuring fairness, accountability, and ethical principles in the evolving landscape of AI-driven dispute resolution.

Ethical concerns in AI investment dispute resolution arise from the potential amplification of power imbalances, biases, and the lack of transparency in decision-

¹¹¹ C Kerrigan, M Tanna and W Dunning, 'Chapter 8: Commercial Trade' in C Kerrigan, M Tanna and W Dunning (eds), *Artificial Intelligence: Law and Regulation* (Edward Elgar, 2022) 133–145.

¹¹² D Mohan and LR Nair, 'A Robust Deep Model for Improved Categorization of Legal Documents for Predictive Analytics' (2023) 11 *International Journal on Recent and Innovation Trends in Computing and Communication* 175.

¹¹³ *Ibid.*

¹¹⁴ J Barnett and P Treleaven, 'Algorithmic Dispute Resolution—The Automation of Professional Dispute Resolution Using AI and Blockchain Technologies' (2018) 61 *The Computer Journal* 399.

¹¹⁵ Yuanyu Bao et al, 'Ethical Disputes of AI Surveillance: Case Study of Amazon' in *Proceedings of the 2022 7th International Conference on Financial Innovation and Economic Development (ICFIED)* (Atlantis Press, 2022) 1339, 1343.

¹¹⁶ L Wing, 'Artificial Intelligence and Online Dispute Resolution System Design: Lack of/Access to Justice Magnified Conference Papers' (2017) 4 *International Journal of Online Dispute Resolution* 16.

¹¹⁷ E West, 'Amazon: Surveillance as a Service' (2019) 17 *Surveillance & Society* 27.

¹¹⁸ Yuanyu Bao (n 39)1339.

making.¹¹⁹ While AI can enhance the efficiency and predictability of dispute resolution,¹²⁰ it also presents challenges in terms of the ethical governance of providing AI tools to unrepresented litigants.¹²¹ For example, the use of AI in finance raises moral challenges, including ethical algorithm development, the risk of potential malpractices, and the necessity for new governance mechanisms to safeguard market efficiency.¹²² Therefore, multidisciplinary collaboration and stakeholder engagement are essential for the development of ethical principles and accountability mechanisms in AI-driven dispute resolution systems.

In summary, AI in ISDS has gained attention in recent years. However, a comprehensive analysis of the existing research literature reveals that it remains relatively scarce. While some studies have explored AI in commercial arbitration, these efforts lack systematicity and fail to provide detailed insights into the technical logic and applicable scenarios of AI in ISDS. Additionally, they have not thoroughly examined the value and challenges of AI in ISDS from a macro perspective, nor have they sufficiently addressed potential solutions.

III LEGITIMACY CRISIS IN ISDS

Impartiality, uniformity and transparency are key concerns in the ISDS process.¹²³ The preservation of equitable arbitration, uniform adjudication outcomes, and transparent procedural frameworks is critical for ISDS reform.¹²⁴ These factors, which should be taken seriously, are discussed below as essential considerations for ISDS reform.

A *Impartiality and Independence*

A significant body of criticism revolves around the appointment of arbitrators. In an ad hoc arbitration system, these adjudicators are not permanent judges but rather legal experts chosen by the parties in dispute.¹²⁵ Double-hatting, the practice of an individual serving as both arbitrator and legal counsel in separate cases, poses significant

¹¹⁹ Ngo Nguyen Thao Vy (n 8).

¹²⁰ Fernando Esteban De La Rosa and John Zeleznikow, 'Making Intelligent Online Dispute Resolution Tools Available to Self-Represented Litigants in the Public Justice System: Towards an Ethical Use of AI Technology in the Administration of Justice' in *Proceedings of the Eighteenth International Conference on Artificial Intelligence and Law (ICAAIL)* (Association for Computing Machinery, 2021) 195.

¹²¹ *Ibid* (n 40) 16.

¹²² Y Gadhoun, 'Artificial Intelligence Trends and Ethics: Issues and Alternatives for Investors' (2022) 13 *Intelligent Control and Automation* 1.

¹²³ Sophie Nappert, 'Escaping from Freedom? The Dilemma of an Improved ISDS Mechanism' (2016) 1(1) *European Investment Law and Arbitration Review Online* 171.

¹²⁴ Andrea K Bjorklund et al, 'The Diversity Deficit in International Investment Arbitration' (2020) 21(2-3) *The Journal of World Investment & Trade* 410.

¹²⁵ Thomas D Grant and F Scott Kieff, 'Appointing Arbitrators: Tenure, Public Confidence, and a Middle Road for ISDS Reform' (2022) 43(1) *Michigan Journal of International Law* 171.

challenges to the impartiality and ethical standards of the arbitration system.¹²⁶ This practice has been prevalent in international investment dispute settlement, leading to debates on its impact on the diversity of arbitrators and the overall fairness of the arbitration system.¹²⁷ In a notable instance, French arbitrator Gaillard was involved in an international investment arbitration case (*Telekom Malaysia v Ghana*)¹²⁸ as the arbitrator appointed by the claimant. Simultaneously, he served as counsel for the claimant in an International Centre for Settlement of Investment Disputes (ICSID) annulment proceeding related to a separate case (*RFCC v Morocco*). Therefore, the practice of double-hatting weakens the community's perception of impartiality in ISDS proceedings, and it is widely accepted as a key concern that must be addressed in ISDS reform efforts.¹²⁹

Research indicates a systemic bias favoring foreign investors over states in international investment arbitration. Studies reveal that arbitrators tend to rule in favor of foreign investors, particularly those from major Western capital-exporting states, and even show a preference for the U.S. as a respondent state.¹³⁰ This bias is attributed to the design of investment treaty arbitration, which lacks fair and independent adjudication, leading to concerns about the protection of sovereign authority and public funds.¹³¹ Furthermore, the current system of ISDS is criticized for perpetuating wealth-based inequality under international law, granting extraordinary protections to wealthy foreign investors while neglecting the rights of countries and their populations.¹³² These findings underscore the need for reforms in international investment agreements to address the imbalance and ensure a more equitable arbitration process.

Additionally, the broad and investor-protection-oriented interpretation of investment treaty provisions in ISDS cases contribute to a “regulatory chill”, where states may refrain from enacting legitimate regulatory measures due to concerns about ISDS repercussions.¹³³ This phenomenon has been exemplified in cases like *Bear Creek*

¹²⁶ Joshua Tayar, ‘Safeguarding the Institutional Impartiality of Arbitration in the Face of Double-Hatting’ (2018–2019) 5(5) *McGill Journal of Dispute Resolution* 107.

¹²⁷ *Telekom Malaysia Berhad v The Republic of Ghana* (Settled) (PCA Case No 2003-03, UNCITRAL).

¹²⁸ *Consortium R.F.C.C. v Kingdom of Morocco* (Decision on Annulment) (ICSID Case No ARB/00/6, , 18 January 2006).

¹²⁹ Maria Nicole Cleis, *The Independence and Impartiality of ICSID Arbitrators: Current Case Law, Alternative Approaches, and Improvement Suggestions* (Brill, 2017).

¹³⁰ George Cadillac, ‘The Appearance of Bias in International Investment Arbitrators and Analysis of Potential Impediments to Bias in the European Union’s Proposal for a Multilateral Investment Court’ (2021) 13(1) *Australian and New Zealand Journal of European Studies* 1.

¹³¹ Gus Van Harten, ‘Arbitrator Behaviour in Asymmetrical Adjudication (Part Two): An Examination of Hypotheses of Bias in Investment Treaty Arbitration’ (2016) 53(2) *Osgoode Hall Law Journal* 540.

¹³² *Ibid.*

¹³³ Rodney Neufeld, ‘Investment Law’s Monstrous Reform’ in Daniel Bethlehem et al (eds), *The Oxford Handbook of International Trade Law* (2nd ed, Oxford University Press, 2022) 838; Tanaya Thakur, ‘Reforming the investor-state dispute settlement mechanism and the host state’s right to regulate: a critical assessment’ (2021) 59(1) *Indian Journal of*

Mining v. Peru, where the host state faced a dispute after revoking a permit in response to local protests against the investor's operations, showcasing the impact of ISDS awards on state actions.¹³⁴

B Consistency in ISDS Rulings

A commonly raised criticism of the legal framework pertains to the variance in rulings by various tribunals concerning analogous legal and factual matters. The interpretation of vague terms like indirect expropriation and fair and equitable treatment in ISDS cases has been a recurring issue, as highlighted in various research papers. Scholars have noted that the lack of clear definitions and criteria for these concepts leads to inconsistent interpretations by arbitral tribunals, creating uncertainty for both investors and host states.¹³⁵ For instance, in the cases of *CME v Czech Republic* and *Lauder v Czech Republic*, arbitral tribunals rendered divergent judgments regarding expropriation despite analogous factual circumstances.¹³⁶

In the realm of investment treaty arbitration, the issue of inconsistent awards poses a significant challenge to the rule of law and legal certainty for foreign investors.¹³⁷ While investment treaties aim to provide a stable framework for foreign investment, the systemic inconsistency in interpreting and applying key rules across arbitral awards raises concerns about the effectiveness of the regime in promoting legal predictability and fairness.¹³⁸ The ability to enforce arbitration awards is crucial for foreign investors seeking redress, highlighting the importance of compliance by award-debtor States to ensure that investors can benefit from the outcomes of arbitration proceedings.¹³⁹ Moreover, the debate around the recoverability of shareholder reflective loss in investment arbitration underscores the doctrinal complexities within the system, with tribunals allowing such claims despite diverging practices in national legal systems.¹⁴⁰

International Law 173.

¹³⁴ Mustafa Alper Ener and Yulduz Akhtamova, 'The Erosion of States' Right to Regulate in ISDS' (2023) 3(1) *International Journal of Law and Criminology* 5.

¹³⁵ Güneş Ünüvar, 'The vague meaning of the fair and equitable treatment principle in investment arbitration and new generation clarifications' in Anne Lise Kjaer and Joanna Lam (eds), *Language and Legal Interpretation in International Law* (Oxford University Press, 2022) 271–292; David M Howard, 'Creating Consistency Through a World Investment Court' (2017) 41(1) *Fordham International Law Journal* 1–52; Julian Arato, Chester Brown and Federico Ortino, 'Parsing and Managing Inconsistency in Investor-State Dispute Settlement' (2020) 21(2–3) *The Journal of World Investment & Trade* 336.

¹³⁶ Julian Arato, 'Two Moralities of Consistency' in August Reinisch and Stephan W Schill (eds), *Investment Protection Standards and the Rule of Law* (Oxford University Press, 2023) 235.

¹³⁷ *Ibid.*

¹³⁸ Aniruddha Rajput, 'Non-Compliance with Investment Arbitration Awards and State Responsibility' (2022) 37(1–2) *ICSID Review – Foreign Investment Law Journal* 247.

¹³⁹ Raphael Ren, 'Shareholder reflective loss: a bogeyman in investment treaty arbitration?' (2023) 39(3) *Arbitration International* 425.

¹⁴⁰ Aiyub Kadir, M Ya Kub and Lena Farsia, 'The Inconsistency of ICSID Awards Over

Addressing these inconsistencies and enhancing the coherence of arbitral decisions is essential to uphold the integrity and credibility of the investment treaty arbitration system.

C *Transparency in ISDS Proceedings*

Transparency within the ISDS system has been a longstanding concern, sparking significant debate among legal scholars, policymakers, and stakeholders.¹⁴¹ The closed-door nature of the proceedings, along with the confidentiality clauses embedded in many investment treaties, traditionally limit the ability of non-disputing parties to access important information about arbitrations.¹⁴² This opacity raises issues of public interest, especially when disputes involve natural resources, environmental protection, or other sensitive sectors, as the outcomes may have broad societal impacts. For instance, *Chevron v. Ecuador*, involves a long-standing dispute over environmental damage caused by Texaco's oil operations in the Ecuadorian Amazon.¹⁴³ The proceedings have been complex, with multiple cases in different jurisdictions, and have raised questions about the transparency of the process and the public's right to know about the environmental and health implications of the dispute.

Besides, third-party involvement, including that of civil society, affected communities, and even non-disputing state parties, has been traditionally limited, if not entirely excluded from ISDS proceedings.¹⁴⁴ This not only restricts these stakeholders from presenting their views and concerns but also limits the ability of arbitrators to consider all relevant perspectives when making their decisions. The democratization of ISDS through enhanced third-party participation is seen as a vital step toward improving transparency and accountability.¹⁴⁵ For instance, *PacRim Cayman LLC v. El Salvador*, Pac Rim (later acquired by OceanaGold), a mining company, initiated proceedings against El Salvador after it was denied a permit for a gold mining project due to environmental and public health concerns.¹⁴⁶ Civil society organizations and local communities opposed the mine, citing potential threats to water resources.¹⁴⁷ The

Argentina Cases' (2020) 6(1) *Hasanuddin Law Review* 1.

¹⁴¹ Manjiao Chi, 'Regulatory Transparency in International Investment Law: From an Investment Protection Requirement to a Rule-of-Law Requirement' in August Reinisch and Stephan W Schill (eds), *Investment Protection Standards and the Rule of Law* (Oxford University Press 2023) 127–142.

¹⁴² Mark Feldman, 'International Arbitration and Transparency' in Stefan Kröll, Andrea K Bjorklund and Franco Ferrari (eds), *Cambridge Compendium of International Commercial and Investment Arbitration* (Cambridge University Press, 2023) 1697–1722.

¹⁴³ International Institute for Sustainable Development, '*Chevron v Ecuador*' (Web Page, April 2011) <<https://www.iisd.org/projects/chevron-v-ecuador>>.

¹⁴⁴ Victoria Shannon Sahani, 'Third-Party Funders' in Stefan Kröll, Andrea K Bjorklund and Franco Ferrari (eds), *Cambridge Compendium of International Commercial and Investment Arbitration* (Cambridge University Press, 2023) 305.

¹⁴⁵ *Ibid.*

¹⁴⁶ *Pac Rim Cayman LLC v Republic of El Salvador* (Award) (ICSID Arbitral Tribunal, Case No. ARB/09/12, 1 June 2012).

¹⁴⁷ *Ibid.*

process highlighted the tension between investor rights and public participation in environmental decision-making, with limited direct involvement for non-disputing parties.

The implementation of transparency measures, even when agreed upon, often faces practical difficulties. These can range from the lack of clear guidelines on how to apply transparency rules to the absence of enforcement mechanisms ensuring compliance by all parties involved.¹⁴⁸ The issue of balancing the need for transparency with the legitimate confidentiality concerns of the disputing parties—particularly regarding the protection of sensitive business information—adds another layer of complexity to achieving a transparent ISDS system.¹⁴⁹ Besides, recent developments in ISDS, including transparency rules and changes in decision-making processes, aim to enhance the system's effectiveness and address power imbalances between investors and states.¹⁵⁰

D *Time-consuming and expensive*

The reform of ISDS holds significant importance, particularly in mitigating the challenges associated with prolonged legal proceedings and excessive financial burdens. The inefficiency of the current dispute resolution mechanisms not only burdens states and investors with excessive costs and time delays, but also erodes the credibility and accessibility of the entire system.¹⁵¹ For example, *Philip Morris Asia v. Australia*, initiated in 2011, involved a challenge by Philip Morris Asia to Australia's tobacco plain packaging legislation.¹⁵² The arbitration took several years, and the tribunal ultimately ruled in 2015 that the case was an abuse of rights because Philip Morris Asia had strategically restructured its investments to gain access to ISDS.¹⁵³ The case highlighted the lengthy nature of ISDS proceedings and the associated costs, which can be substantial.

One of the primary objectives of ISDS reform should be to streamline the procedural aspects of arbitration.¹⁵⁴ This can be achieved by implementing stricter

¹⁴⁸ Ziad Kh Al Enizi and Waleed Fuad Mahameed, 'International Experience of Applying Transparency Rules in Arbitration Processes Between Investors and States' (2023) 13(1) *Accounting, Economics, and Law: A Convivium* 1.

¹⁴⁹ Freya Baetens, 'Transparency Across International Courts and Tribunals: Enhancing Legitimacy or Disrupting the Adjudicative Process?' (2022) 91(4) *Nordic Journal of International Law* 595.

¹⁵⁰ Marlina Harutyunyan, 'The Revised ICSID Rules: A Further Step Towards Transparency and Efficiency' (2022) 40(3) *ASA Bulletin* 529.

¹⁵¹ Steven J Hoffman et al, 'Mending Dispute Resolution under the International Health Regulations' (2022) 19(1) *International Organizations Law Review* 241.

¹⁵² *Philip Morris Asia Limited v The Commonwealth of Australia* (Award on Jurisdiction and Admissibility) (PCA Case No. 2012-12, , 17 December 2015).

¹⁵³ *Ibid.*

¹⁵⁴ Julia Richter, 'The two problem pillars of multiple proceedings in investment arbitration: why the abuse of process doctrine is a necessary remedy and requires focus in UNCITRAL's ISDS reform' (2023) 14(3) *Journal of International Dispute Settlement* 407.

timelines for each stage of the process, from the initiation of a claim to the issuance of the final award. While procedural efficiency is crucial, the broader reform goals encompass addressing concerns such as excessive costs and lengthy proceedings.¹⁵⁵ Rising costs in international dispute settlement have been linked to access to justice issues, especially affecting developing States and leading to the promotion of cost-saving strategies in litigation and arbitration.¹⁵⁶

IV THE OVERALL IMPACT OF AI ON ISDS

A *The Application Value of AI in ISDS*

AI core technologies like image and speech recognition, natural language processing, text analysis, and machine learning are crucial in dispute resolution.¹⁵⁷ By leveraging AI, the legal system can benefit from improved efficiency, accuracy, and speed in handling disputes both within and outside the judicial system. The role of AI in analyzing large datasets, identifying patterns in court decisions, and enhancing the overall functioning of the justice system is essential for promoting trustworthiness, transparency, fairness, and effectiveness in resolving conflicts.¹⁵⁸

1 *Promoting Objective and Fair Decision-Making*

AI systems have the potential to significantly enhance the objectivity and fairness of decision-making in dispute resolution processes.¹⁵⁹ By leveraging advanced technologies such as predictive analytics, decision support systems, and emotion and sentiment analysis, AI can help mitigate the influence of human biases and emotions that can impact the outcome of disputes.¹⁶⁰ This can lead to more informed and accurate decisions, which are essential for ensuring fairness in dispute resolution. AI can analyze

¹⁵⁵ Chiara Giorgetti, Margaret McGuinness and David Stewart, 'At the Intersection of Diplomacy and International Law: The ISDS Reform Process' in Chiara Giorgetti, Margaret McGuinness and David Stewart (eds), *Research Handbook on Law and Diplomacy* (Edward Elgar Publishing, 2022) 84.

¹⁵⁶ Brian McGarry, 'Cost-Efficiency in Inter-State Dispute Settlement' in Petra Butler, Eva Lein and Rhonson Salim (eds), *Integration and International Dispute Resolution in Small States* (Springer, 2018) 319.

¹⁵⁷ Gilson Jacobsen and Bruno De Macedo Dias, 'Smart dispute resolution: Artificial intelligence to reduce litigation' (2023) 3(1) *Suprema - Revista de Estudos Constitucionais* 391.

¹⁵⁸ *Ibid.*

¹⁵⁹ Abdelrahman Gehad Shalaby, Gehad Mohamed Abdelaziz, and Moustafa Elmetwaly Kandeel, 'Using Artificial Intelligence to Resolve Disputes through Online Arbitration' in *Proceedings of the 2022 Ninth International Conference on Social Networks Analysis, Management and Security (SNAMS)* (IEEE, 2022) 1.

¹⁶⁰ Murat Ayhan, İrem Dikmen Toker and M Talat Birgönül, 'Comparing Performances of Machine Learning Techniques to Forecast Dispute Resolutions' (2022) 33 *Teknik Dergi* 12577.

large amounts of data, including case histories and legal precedents, to provide insights that can inform decision-making.¹⁶¹ For instance, AI Ross, developed by IBM, has seen widespread adoption by numerous law firms globally as a tool to streamline and expedite legal research.¹⁶² Additionally, it serves to scrutinize legal contracts and efficiently summarize case laws.¹⁶³

This data-driven approach can help reduce the impact of personal opinions and emotions on the outcome, resulting in more objective and fair decisions. Moreover, AI can assist in the automation of routine tasks, freeing human mediators and arbitrators to focus on more complex disputes, where their expertise and judgment are most valuable.¹⁶⁴ This can lead to more efficient and effective decision-making processes. However, it is crucial to ensure that AI systems are designed and implemented in a way that addresses potential ethical and legal concerns. This includes considerations such as data privacy, transparency, and accountability to guarantee that AI-driven decisions are fair, unbiased, and respectful of the rights of all parties involved.

2 *Intelligent Evidence Collection and Analysis*

Intelligent Evidence Collection and Analysis in dispute resolution involves utilizing AI at different levels. AI can aid in providing legal advice, contract review, and even independent dispute resolution, potentially leading to a smart dispute resolution alternative. For example, the integration of AI in Online Dispute Resolution (ODR) can revolutionize conflict resolution by providing faster, more efficient, and cost-effective solutions.¹⁶⁵ AI technologies can assist in analyzing large datasets of court decisions to identify regularities, improve the functioning of judicial systems, and enhance the efficiency of cases.¹⁶⁶ However, challenges exist, such as ensuring fairness when AI is involved in decision-making processes.¹⁶⁷ Therefore, balancing the benefits of AI with concerns about accountability and transparency is crucial for the successful integration of AI in dispute resolution processes.

¹⁶¹ M Dokumaci, 'AI-Driven Econometric Models for Legal Issues' (2024) 8(1) *Human Computer Interaction* 137.

¹⁶² Katherine M Lowry et al, 'Investigating Attorney Trust in Machine-Enabled Legal Research: A Mixed Methods Approach' (2018) 62(1) *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 1997.

¹⁶³ Ibid.

¹⁶⁴ Ibid.

¹⁶⁵ M T Ngcobo, 'Artificial Intelligence and Blockchain Technologies in Online Dispute Resolution: A Solution to Consumer Disputes in South Africa?' (2024) 27 *Potchefstroom Electronic Law Journal* 2021.

¹⁶⁶ Florence G'sell, 'AI Judges' in Larry A DiMatteo, Cristina Poncibò and Michel Cannarsa (eds), *The Cambridge Handbook of Artificial Intelligence: Global Perspectives on Law and Ethics* (Cambridge University Press, 2022).

¹⁶⁷ E Ferrara, 'Fairness and Bias in Artificial Intelligence: A Brief Survey of Sources, Impacts, and Mitigation Strategies' (2023) 6 *Sci* 3.

Intelligent evidence collection and analysis in investor-state dispute resolution is gaining traction.¹⁶⁸ Intelligent evidence collection in ISDS involves leveraging technology like AI.¹⁶⁹ This technology can aid in streamlining the process, especially in cases of simple and repetitive litigation, enhancing efficiency and potentially leading to smart dispute resolution alternatives.¹⁷⁰ Additionally, the use of AI in law, as part of the 4th industrial revolution, is seen as inevitable and beneficial for resolving conflicts outside the judicial system.¹⁷¹ Furthermore, the diversity in the design of ISDS mechanisms, with over a thousand different combinations of rules found in bilateral treaties, highlights the complexity and variation in approaches taken by different countries.¹⁷² This diversity underscores the importance of adopting innovative technologies like AI to enhance evidence collection and streamline the resolution process in investor-state disputes.

3 *Intelligent Dispute Prediction and Risk Assessment*

Intelligent dispute prediction and risk assessment in dispute resolution involve leveraging AI technologies to enhance the efficiency and effectiveness of resolving conflicts.¹⁷³ By analyzing historical data, AI algorithms can identify patterns and trends in disputes, predict potential areas of conflict, and assess key risk factors.¹⁷⁴ This early detection of disputes allows stakeholders to take preventive measures, fostering proactive communication and collaboration to minimize the likelihood of conflicts arising in the first place.¹⁷⁵

AI systems can also be used for predicting case outcomes by analyzing relevant data, including specifics of the dispute and court decisions.¹⁷⁶ These predictive capabilities provide lawyers and clients with probabilistic assessments of potential

¹⁶⁸ A M Milena Galetin, 'Law and software analysis: A step closer to resolving investment disputes through artificial intelligence?' (2021) 59 *Law & Economy* 123.

¹⁶⁹ Seraphina Chew, Lucy Reed and J Christopher Thomas QC, 'Report: Survey on Obstacles to Settlement of Investor-State Disputes' (Working Paper No 18/01, Centre for International Law, National University of Singapore, September 2018).

¹⁷⁰ Carolina Moehlecke, Calvin Thrall and Rachel L Wellhausen, 'Global Value Chains as a Constraint on Sovereignty: Evidence from Investor-State Dispute Settlement' (2023) 67(1) *International Studies Quarterly* 1.

¹⁷¹ Joachim Pohl, Kekeletso Mashigo and Alexis Nohen, 'Dispute Settlement Provisions in International Investment Agreements' (2012) *OECD Working Papers on International Investment* 1.

¹⁷² *Ibid.*

¹⁷³ *Ibid.*

¹⁷⁴ Disha Pandey and Namita Singh Malik, 'Artificial Intelligence, Automation, and the Legal System' in Namita Singh Malik, Elizaveta A Gromova, Smita Gupta and Balamurugan Balusamy (eds), *Legal Analytics: The Future of Analytics in Law* (Chapman and Hall/CRC 2022).

¹⁷⁵ *Ibid.*

¹⁷⁶ Lakshmi Priya Gorlamudiveti and Sagee Geetha Sethu, 'Role of Artificial Intelligence in the Indian Judicial System' (2023) *International Research Journal of Modernization in Engineering Technology and Science* 1319.

verdicts, influencing legal strategies, settlement decisions, and resource allocation.¹⁷⁷ While these predictions are not definitive, they offer valuable insights that can inform decision-making processes in dispute resolution.

4 *Improving the Efficiency of ISDS Processes*

AI is a technical simulation of human intelligence and an extension of human intelligence outside the brain. Cognitive activities in the human brain, such as “thinking methods”, “cognitive diagrams”, and “cognitive models” can be converted into operation sequences expressed in algorithmic language.¹⁷⁸ AI leverages algorithmic formulas to mimic the cognitive functions of the human brain, enabling computers to exhibit memory, recognition, learning, reasoning, and decision-making akin to humans.¹⁷⁹ Computers, unlike the human brain, excel in processing data and executing instructions rapidly due to their design principles based on the Von Neumann architecture.¹⁸⁰ The Central Processing Unit (CPU) in computers acts as the brain, accepting data, executing instructions, and interpreting information efficiently.

Legal professionals are increasingly using AI, data analytics, and virtual assistants to improve efficiency, optimize workflows, and further develop client services.¹⁸¹ In general terms, the utilization of AI in dispute resolution, particularly within the sphere of traditional litigation, is not an entirely new notion. Its predominant reliance has been on its utilization by legal practitioners, whether they are practising attorneys or law enforcement officials (judges, arbitrators or mediators). AI applications in legal practice include machine learning, deep learning, big data analysis, e-discovery, and documentation, which have proven beneficial in minimizing biases, improving fairness, and enhancing time and cost efficiency in judicial systems.¹⁸²

In summary, enhancing the efficacy of ISDS mechanisms can be realized through the utilization of AI technologies.¹⁸³ Furthermore, AI can accelerate the dispute

¹⁷⁷ P Baser and Jatinderkumar R Saini, ‘AI-Based Intelligent Solution in Legal Profession’ in Amit Joshi, Nishu Gupta and G R Sinha (eds), *ICT Systems and Sustainability: Proceedings of ICT4SD 2022* (Springer Nature Singapore, 2023) 75.

¹⁷⁸ Russell L Shackelford, *Introduction to Computing and Algorithms* (Addison-Wesley, 1998).

¹⁷⁹ Chellammal Surianarayanan et al, ‘Convergence of Artificial Intelligence and Neuroscience towards the Diagnosis of Neurological Disorders—A Scoping Review’ (2023) 23(6) *Sensors* 3062.

¹⁸⁰ Jesus N Abalo and Manuel L Sentillas Jr, ‘Capabilities of computer algorithm like human brain utilizing artificial neural networks: a task’ (2022) 12(1) *South Asian Journal of Engineering and Technology* 5.

¹⁸¹ Siti Yuniarti and Precia Jacey, ‘Artificial Intelligence: Implementation in Legal Services (Comparative Study on China, United States and Indonesia)’ in *Proceedings of the 3rd Asia Pacific International Conference on Industrial Engineering and Operations Management* (IEOM Society International, 2022).

¹⁸² Chengyu Fang et al, ‘“AI Am Here to Represent You”: Understanding How Institutional Logics Shape Attitudes Toward Intelligent Technologies in Legal Work’ (2023) 37 *Management Communication Quarterly* 941.

¹⁸³ *Ibid.*

resolution process, enhance predictability, and reduce risks.¹⁸⁴ ISDS mechanisms, such as arbitrators in investment treaties, play a crucial role in protecting foreign investors against opportunistic behavior of host countries.¹⁸⁵ However, concerns exist regarding transparency, control of arbitral data, and personal data protection in arbitration processes, especially in evolving legal frameworks.¹⁸⁶ The ongoing discussions at UNCITRAL on reform options for ISDS highlight the need for improvements in legitimacy, transparency, and efficiency of the current system.¹⁸⁷ By leveraging AI technologies and addressing these concerns, ISDS can become more efficient and effective in resolving international investment disputes.

B *The Dilemma of AI in ISDS*

1 *Algorithmic Ethical Issues*

Algorithmic ethical issues in ISDS are critical and multifaceted. It primarily concerns the delegation of decision-making to algorithms in dispute resolution systems.¹⁸⁸ This delegation can amplify existing biases, inaccuracies, and black-box, potentially resulting in both procedural and substantive injustices.¹⁸⁹ As traditional arbitration transitions to utilizing AI, it's crucial to maintain procedural protections to ensure that efficiency gains do not come at the expense of justice.¹⁹⁰ Furthermore, the ethical auditing of algorithms, especially in biometric systems like facial recognition, presents unique challenges.¹⁹¹ These issues underline the necessity for developing comprehensive ethical principles and regulatory frameworks to properly address the ethical dilemmas posed by algorithmic decision-making in arbitration, ensuring that advancements in technology are balanced with the principles of fairness and accountability.

¹⁸⁴ Krishna Rastogi et al, 'Technical Intercession of Artificial Intelligence in Solving Online Dispute Resolution' in *Proceedings of the 2023 International Conference on Artificial Intelligence and Machine Learning* (IEEE, 2023) 194.

¹⁸⁵ Aa'a Kopti, 'Investor-state Dispute under International Investment Law' (2022) 6 *International Journal of Economics, Business and Management Research* 95.

¹⁸⁶ Frank Stähler, 'An optimal investor-state dispute settlement mechanism' (2023) 138(1) *Journal of Economics* 1-16.

¹⁸⁷ EI—IILCC Study Group on ISDS Reform, 'Reform of Investor-State Dispute Settlement – Current State of Play at UNCITRAL' (2022) 25 *Zeitschrift für europarechtliche Studien* 15.

¹⁸⁸ *Ibid.*

¹⁸⁹ *Ibid.*

¹⁹⁰ *Ibid.*

¹⁹¹ Inioluwa Deborah Raji et al, 'Saving Face: Investigating the Ethical Concerns of Facial Recognition Auditing' in *Proceedings of the 2020 AAAI/ACM Conference on AI, Ethics, and Society* (Association for Computing Machinery, 2020) 145.

(a) *Algorithmic bias and discrimination*

Algorithmic bias refers to systematic errors in artificial intelligence systems that lead to unfair outcomes, particularly affecting marginalized groups.¹⁹² These biases stem from the data used to train AI models, reflecting existing societal prejudices and inequalities.¹⁹³ Algorithmic bias can also arise from AI developers due to lack of diversity, time pressure, integrity issues, and inadequate testing.¹⁹⁴ Lack of expertise in arbitration principles during algorithm creation can unknowingly introduce personal biases, leading to AI bias despite neutral intentions.¹⁹⁵

Algorithmic bias is an important factor that damages the neutrality principle of judgment.¹⁹⁶ In the context of ISDS, because the algorithmic program replaces part of the traditional arbitration program, algorithmic bias may lead to differential treatment of parties in arbitration proceedings. For instance, arbitrators who have experience and information advantages, typically show higher win rates than occasional participants, highlighting their economic strength and arbitration skills.¹⁹⁷ If machine learning and training are conducted based on such cases, the result is AI cannot be neutral, and its decisions are biased in favor of frequent arbitrators.¹⁹⁸

To effectively regulate algorithmic discrimination, a strategic approach that prioritizes transparency and fairness is essential.¹⁹⁹ This approach must consider various forms of bias, including original bias, learning bias, and external bias.²⁰⁰ The opacity inherent in algorithmic processes presents a formidable obstacle to litigation and enforcement, underscoring the urgent need for enhanced transparency through both judicial and legislative interventions.

AI systems are often programmed with vast amounts of data to enhance their learning capabilities.²⁰¹ The success of AI algorithms heavily relies on data representation, with ethical issues arising from unethical AI applications and biased algorithms.²⁰² This unique feature poses a tremendous challenge to the ability of AI in

¹⁹² Dong-Hee Shin and Emily Y Shin, 'Data's Impact on Algorithmic Bias' (2023) 56(6) *Computer* 90.

¹⁹³ Yves Saint James Aquino, 'Making decisions: Bias in artificial intelligence and data-driven diagnostic tools' (2023) 52(7) *Australian Journal for General Practitioners* 439.

¹⁹⁴ Khensani Xivuri and Hossana Twinomurizi, 'How AI Developers Can Assure Algorithmic Fairness' (2023) 3(1) *Discover Artificial Intelligence* 27.

¹⁹⁵ *Ibid.*

¹⁹⁶ C Stinson, 'Algorithms are not neutral' (2022) 2 *AI and Ethics* 763.

¹⁹⁷ Gary Wagner, 'Economic Analysis of Arbitration' in Stefan Kröll, Andrea K Bjorklund and Franco Ferrari (eds), *Cambridge Compendium of International Commercial and Investment Arbitration* (Cambridge University Press 2023) 1910.

¹⁹⁸ Chin Sim, 'Will Artificial Intelligence Take Over Arbitration?' (2018) *Asian International Arbitration Journal* 1.

¹⁹⁹ *Ibid.*

²⁰⁰ Wei Xue, 'Legal Governance of Discrimination Risks in Algorithmic Automated Decision Making' (2023) 5 *The Frontiers of Society, Science and Technology* 68.

²⁰¹ Parisa Kordjamshidi, Dan Roth and Kristian Kersting, 'Declarative Learning-Based Programming as an Interface to AI Systems' (2022) 5 *Frontiers in Artificial Intelligence*.

²⁰² Jens Steinhoff, 'AI ethics as subordinated innovation network' (2023) *AI & SOCIETY*.

decision-making, since it may lack the essential reference points to adeptly navigate these unknown realms.

(b) *Algorithmic “black box”*

An algorithmic “black box” refers to a model or system where the internal logic is not visible to the user, making it opaque and challenging to interpret.²⁰³ Developers and designers of AI systems may struggle to explain how algorithms transition from data information to conclusions. This lack of transparency can lead to ethical and practical issues, especially in critical areas like cyber security.²⁰⁴

A “legal black box” AI arbitration system refers to an artificial intelligence system used in legal arbitration that operates with limited transparency and explainability.²⁰⁵ This black-box mechanism will also be transferred to the ISDS procedure, making it difficult for the parties to predict the behavior of the algorithm, and also unable to understand the internal operation logic of artificial intelligence and the basis for making decisions. Lawyers and non-technical individuals often express concerns about the lack of transparency in machine learning processes, leading to decisions that may lack adequate reasoning.²⁰⁶

The presence of “black box” AI systems indeed hinders the transparency and understandability of the decision-making process, making it challenging to observe, evaluate, and control externally.²⁰⁷ This opacity stems from various issues like the opacity problem, strangeness problem, unpredictability problem, and justification problem.²⁰⁸ This algorithm can potentially compress or omit dialogue and debate links, hindering the transparency and effectiveness of the arbitration proceedings.²⁰⁹ The incorporation of advanced technologies such as artificial intelligence in arbitration raises concerns regarding constraints on human-computer interaction and decision-making processes.²¹⁰ In the realm of AI, the explainability of decisions is crucial,

²⁰³ Koteswara Rao Chennam and others, ‘Black Box Models for eXplainable Artificial Intelligence’ in Manan Mehta, Vasile Palade and Indrajit Chatterjee (eds), *Explainable AI: Foundations, Methodologies and Applications* (Springer International Publishing, 2023) 1.

²⁰⁴ Sara Beth Jordan, Shannon L Fenn and Braden B Shannon, ‘Transparency as Threat at the Intersection of Artificial Intelligence and Cyberbiosecurity’ (2020) 53 *Computer* 59.

²⁰⁵ Andrea Azzutti and others, ‘Artificial Intelligence in Finance Artificial Intelligence in Finance: Challenges, Opportunities and Regulatory Developments’, Chapter 9: Regulating AI trading from an AI lifecycle perspective (Edward Elgar Publishing 2023) 198.

²⁰⁶ Matthias Scherer, ‘International Arbitration 3.0 – How Artificial Intelligence Will Change Dispute Resolution’ (2019) *Austrian Yearbook of International Arbitration* 8.

²⁰⁷ Ibid.

²⁰⁸ Bartosz Brożek et al, ‘The black box problem revisited. Real and imaginary challenges for automated legal decision making’ (2024) 32(2) *Artificial Intelligence and Law* 427.

²⁰⁹ Anshul Malhoutra and Fozia Ahmad, ‘Artificial Intelligence and International Arbitration’ (2022) 27 *Novos Estudos Jurídicos* 258.

²¹⁰ Elena P Rusakova and Eric Young, ‘The Impact of Digital Technologies on Arbitration Courts’ in Svetlana G Maximova and others (eds), *Advances in Natural, Human-Made, and Coupled Human-Natural Systems Research: Volume 2* (Springer International Publishing, 2023) 445.

especially in scenarios involving disputes. The opacity, strangeness, unpredictability, and justification problems associated with black-box AI systems hinder the comprehensibility of decision rationale.²¹¹

2 *Limitation of understanding human nature*

The fundamental difference between AI and human is that although AI has powerful data processing and pattern recognition capabilities, it still has obvious shortcomings in understanding and processing human factors such as individual uniqueness, values, and emotional responses.²¹² Human factors, including cognition and critical thinking, play a crucial role in the process of Information Systems Analysis (ISA). Research emphasizes the limitations of machine learning systems in equating to human critical thinking abilities.²¹³

(a) Challenging to concentrate on individual case justice

AI in the judicial field faces challenges in achieving individual case justice due to its difficulty in considering special factors. AI's potential in legal applications lacks a well-established metric for assessing individual case quality, hindering its ability to ensure justice on a case-by-case basis.²¹⁴ AI abstracts cases into general and universal cases for processing, follows the standardized thinking path of objectivism and egalitarianism, and can usually only provide general, universal, and non-specific justice products.²¹⁵ The challenge of individualized legal phenomena and experiences not easily fitting into typed data can hinder the ability of AI to address new, unique, or extreme situations in real cases.²¹⁶ Therefore, artificial intelligence is unable to utilise the special elements that are useful in dispute resolution and cannot treat the parties differently based on the case's characteristics, limiting the realisation of substantive justice in the dispute settlement process.

²¹¹ Ibid.

²¹² Melanie Mitchell, 'Artificial Intelligence Hits the Barrier of Meaning' (2019) 10 *Information* 51.

²¹³ Vincent Danry et al, 'Don't Just Tell Me, Ask Me: AI Systems that Intelligently Frame Explanations as Questions Improve Human Logical Discernment Accuracy over Causal AI Explanations' in Albrecht Schmidt et al (eds), *CHI '23: Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems* (Association for Computing Machinery, 2023) 1.

²¹⁴ Zhong Xu, Yunjia Zhao and Zhi Deng, 'The possibilities and limits of AI in Chinese judicial judgment' (2022) 37 *AI & SOCIETY* 1601.

²¹⁵ Z Weimin, 'The Future of Computational Law in China: Reflection and Prospects' (2022) 16 *Tsinghua University Law Journal* 196.

²¹⁶ Steven A Wright 'AI in the Law: Towards Assessing Ethical Risks' in *Proceedings of the IEEE International Conference on Big Data* (IEEE, 2020) 2160.

(b) *Lack of value judgment ability*

AI systems face challenges in reflecting human values due to the complexity of programming explicit values. Value judgment is a crucial aspect influencing machine thinking and cognition.²¹⁷ While machines excel in rational evaluation, human values like ethics and common sense pose challenges for algorithms.²¹⁸ The alignment of AI values with human values is essential to prevent negative outcomes.²¹⁹ The development of machine-learning systems involves human decisions laden with values, impacting human lives significantly.

AI in dispute resolution raises concerns about the discretionary power it may wield.²²⁰ Humans possess the ability to balance conflicting values based on their material and spiritual needs, emphasizing the importance of holistic development encompassing spiritual, moral, and material dimensions.²²¹ Arbitrators have significant discretion in weighing substantive moral reasons to achieve justice in cases involving multiple value disputes and conflicts of interest. It is also proposed that emotionless judging results in an unreasonable result.²²²

While AI can analyze large amounts of data and potentially deliver more accurate decisions than humans, it lacks emotional intelligence and may struggle with nuances, potentially hindering its ability to provide fair or merit-based outcomes.²²³ The reliance of AI on data and algorithms can lead to biases and unfair inclinations, perpetuating existing biases present in training data and potentially compromising principles of equality and social justice. Therefore, the lack of human interaction in AI processes can undermine trust in its outputs, making it challenging to build relationships based on empathy.

(c) *Deficient in emotion*

In the process of dispute resolution, achieving case justice necessitates acknowledging the emotional and irrational demands of the parties involved. Emotions play a significant role in legal settings, influencing decision-making processes among jurors and judges alike.²²⁴ AI cannot understand the living world based on physical and mental

²¹⁷ Justin B Biddle, 'On Predicting Recidivism: Epistemic Risk, Tradeoffs, and Values in Machine Learning' (2022) 52 *Canadian Journal of Philosophy* 321.

²¹⁸ Sejin Paik, 'Journalism Ethics for the Algorithmic Era' (2023) 13(4) *Digital Journalism* 696.

²¹⁹ Nardine Osman and Mark d'Inverno, 'A computational framework of human values for ethical AI' (2023) *arXiv preprint arXiv :2305.02748*.

²²⁰ *Ibid.*

²²¹ Vladimir B Khanzhy and Dmitry M Lyashenko 'Good and Evil as Vectors of Free Will in the Structure of Anthropic Time' (2017) *Anthropological Measurements of Philosophical Research* 27.

²²² *Ibid.*

²²³ *Ibid.*

²²⁴ Liana C Peter-Hagene, Stephanie Bean, and Jessica M Salerno, 'Emotion and Legal Judgment' in David DeMatteo and Kyle C Scherr (eds), *The Oxford Handbook of Psychology and Law* (Oxford University Press, 2023) 726.

experience, cannot understand the subjective feelings and emotional reactions of the parties, cannot put itself in the shoes of the parties and consider the situation in which it is located, and it also lacks human touch.²²⁵ Arbitrators inevitably need to understand the subjective feelings of the parties and skillfully handle these feelings through emotion recognition and verbal communication, which highlights the importance of human emotional intelligence. Indeed, arbitrators are often expected to handle disputes in the capacity of a skilled mediator.²²⁶ AI, despite its advancements, lacks innate emotional intelligence and the ability to replicate human warmth due to its absence of biological and social experiences.²²⁷ While AI can be useful for simple and repetitive litigation, the role of arbitrators, with their wisdom and experience, is still crucial in ensuring a fair and just resolution of disputes.²²⁸ Therefore, the decision-making process in investment disputes underscores the significance of human intuition and emotion.²²⁹

3 *Technology dependence hazard*

While AI offers efficiency and convenience, the increasing reliance on AI within ISDS has raised concerns about the 'technology dependence hazard', where the intrinsic limitations and potential failures of AI could compromise the integrity of legal outcomes.²³⁰ Additionally, the increasing dependency on algorithms to mediate decisions highlights the urgent need to understand their ethical implications, which can significantly impact individuals and society.²³¹ This dependence poses significant risks, such as the underestimation of complex socio-legal contexts and the possibility of diminishing the role of human judgment, which is crucial for equitable decision-making in ISDS.

(a) *Weaken arbitrators' subjectivity*

AI in commercial arbitration is expected to transform the role of arbitrators. Initially, AI will complement human decision-making, assisting in predictive tasks. However, as

²²⁵ Derick H Lindquist and Ylli Dautaj, 'AI in International Arbitration: Need for the Human Touch' (2021) 2021(1) *Journal of Dispute Resolution* 39.

²²⁶ Gizem Halis Kasap, 'Can Artificial Intelligence ("AI") Replace Human Arbitrators? Technological Concerns and Legal Implications' (2021) 2021(2) *Journal of Dispute Resolution* 209.

²²⁷ Omafume Oritsegbemi, 'Human Intelligence versus AI: Implications for Emotional Aspects of Human Communication' (2023) 6 *Journal of Advanced Research in Social Sciences* 76.

²²⁸ *Ibid.*

²²⁹ Hao Wu, 'Intuition in Investment Decision-Making Across Cultures' (2022) 23 *Journal of Behavioral Finance* 106.

²³⁰ Maria Virvou, 'The Emerging Era of Human-AI Interaction: Keynote Address' in *Proceedings of the 2022 13th International Conference on Information, Intelligence, Systems & Applications (IISA)* (IEEE,2022) 1.

²³¹ Brent Daniel Mittelstadt et al, 'The Ethics of Algorithms: Mapping the Debate' (2016) 3(2) *Big Data & Society* 1.

AI becomes more sophisticated and cost-effective, it may gradually take on more substantial responsibilities, potentially weakening the subjectivity of arbitrators. AI technologies, such as e-document initiation systems and predictive algorithms, are already being discussed for their potential to streamline arbitration procedures.²³² While AI can enhance efficiency, there are concerns about its legal applicability and the need for significant changes in the current legal framework to accommodate AI in arbitration processes. AI will also reduce arbitrator's judgement and control of the arbitration process, and compress independent decision-making space of the layoffs, so that the arbitrator will lose dominance and subject status. Ultimately, the future may see a shift towards AI playing a more significant role in decision-making, challenging the traditional subjectivity of human arbitrators.

(b) *Compromising the Autonomy of Involved Parties*

In the scenario of technology dependence in arbitration, there is a potential shift of power from human arbitrators to AI, where the arbitrator's role may be replaced by AI systems, making the parties more reliant on AI legal services.²³³ This transition raises concerns about the extent of control and decision-making authority that AI may hold in the arbitration process, potentially leading to a more passive role for the parties involved in the dispute.²³⁴ While AI can offer efficiency and speed in resolving disputes, the necessity of human intervention is emphasized to maintain fairness and ensure that critical decisions are not solely dictated by AI algorithms.²³⁵ For instance, the arbitration secretary aids the arbitrator but cannot partake in core decision-making functions or have the arbitrator delegate the substantive dispute resolution responsibility.²³⁶

The "personal exclusivity" of the parties' delegation of power to an arbitrator implies that the arbitrator should not delegate tasks to an AI system or software. This is because arbitrators are expected to maintain their demand in the arbitration market by improving fact-finding processes themselves, rather than relying on artificial intelligence.²³⁷ Additionally, the traditional reliance on intuition in selecting international arbitrators highlights the importance of expertise and efficiency, which are qualities not easily quantifiable and are typically assessed through various sources and

²³² M A Hussain et al, 'The Potential Prospect of Artificial Intelligence (AI) in Arbitration from the International, National and Islamic Perspectives' (2023) 19 *Journal of International Studies* 95.

²³³ Amy Schmitz and John Zeleznikow, 'Intelligent Legal Tech to Empower Self-Represented Litigants' (2022) 23 *Science and Technology Law Review* 142.

²³⁴ *Ibid.*

²³⁵ *Ibid.*

²³⁶ Jan van Hooft-Hermans and Michael Stone, 'Secretaries to the Arbitral Tribunal' in Stefan Kröll, Andrea K Bjorklund and Franco Ferrari (eds), *Cambridge Compendium of International Commercial and Investment Arbitration* (Cambridge University Press, 2023) 1044.

²³⁷ Vladimir Pavić, 'Protecting and Challenging the Arbitrator's Jurisdiction' in Stefan Kröll, Andrea K Bjorklund and Franco Ferrari (eds), *Cambridge Compendium of International Commercial and Investment Arbitration* (Cambridge University Press, 2023) 738.

metrics, rather than automated systems.²³⁸ Furthermore, the power dynamics in arbitrator appointment, where party autonomy is crucial, suggest that arbitrators should uphold their role without delegating tasks to external systems, ensuring the preservation of their authority and effectiveness in the arbitration process.²³⁹

V EXPLORING THE INTEGRATION OF AI IN ISDS

A *Improving the regulation of ISDS algorithm*

The integration of AI in investor-state dispute resolution has the potential to revolutionize conflict resolution processes. AI technologies, when appropriately employed, can bring added value to arbitration, although current arbitration laws may not be fully equipped to absorb AI technologies.²⁴⁰ Despite challenges related to transparency, accountability, and ethical issues, the potential benefits of AI in dispute resolution, especially in investor-state disputes, are substantial and require careful consideration for future conflict resolution strategies. To prevent and control the risks and challenges posed by technology, a comprehensive approach is necessary.²⁴¹ This involves addressing ethical issues, implementing regulatory frameworks, and utilizing technological solutions.

1 *Algorithmic transparency*

Algorithmic transparency refers to the clarity and openness in the functioning of automated decision systems, crucial for building trust and ensuring fair outcomes.²⁴² Algorithmic transparency in dispute resolution is crucial to address concerns of bias, power imbalances, and procedural injustices.²⁴³ While algorithms promise efficiency, their application in decision-making raises issues of discrimination and exclusion.²⁴⁴ Transparency models should focus on normativity, data input, decision context, and

²³⁸ Jurate Bartkus, 'AI v. Arbitrator: How Can the Exclusion of Evidence Increase the Appointments of the Arbitrators?' (2023) 6 *Access to Justice in Eastern Europe* 1.

²³⁹ Catherine A Rogers, 'Arbitrator Intelligence: From Intuition to Data in Arbitrator Appointments' (2018) 11 *New York Dispute Resolution Lawyer* 1.

²⁴⁰ Ibid.

²⁴¹ Satyam and P Geetha, *Comprehensive Overview of the Opportunities and Challenges in AI* (Springer, 2023).

²⁴² José Pablo Lapostol Piderit, Rodrigo Garrido Iglesias and María Paz Hermosilla Cornejo, 'Algorithmic Transparency from the South: Examining the State of Algorithmic Transparency in Chile's Public Administration Algorithms' in *Proceedings of the 2023 ACM Conference on Fairness, Accountability, and Transparency* (Association for Computing Machinery, 2023) 1.

²⁴³ Erkan Bayamlioglu, 'Contesting Automated Decisions' (2018) 4 *European Data Protection Law Review* 433.

²⁴⁴ Leah Wing, 'Artificial Intelligence and Online Dispute Resolution Systems Design: Lack of/Access to Justice Magnified' (2017) 4(2) *International Journal of Online Dispute Resolution* 16.

accountable actors.²⁴⁵ In international dispute resolution, transparency is evolving, especially in investor-state arbitration, influenced by UNCITRAL and mega regional investment agreements.²⁴⁶

To address these challenges, there is a growing call to transform black-box AI models into more transparent and interpretable “glass-box” systems.²⁴⁷ Enhancing transparency in AI systems is crucial for ensuring ethical and trustworthy AI, aligning with human values and promoting stakeholder trust.²⁴⁸ The shift towards transparent AI models is essential for enabling users to comprehend and effectively interact with AI systems, fostering safer and more accountable AI utilization.²⁴⁹ Stricter regulation can help ensure fair outcomes by reducing bias and improving decision-making processes.²⁵⁰ It can also enhance transparency and accountability in the resolution of disputes, potentially increasing trust in the system.²⁵¹

2 Algorithmic accountability

Algorithmic accountability refers to the responsibility and transparency of various actors involved in the creation, deployment, and use of algorithmic systems.²⁵² The design and application of algorithms is a complex process involving multiple technical subjects and multiple data processing links, and once AI causes damage, its developer, maintainer and user are likely to become the subject of blame.²⁵³ In cases where algorithm designers and developers deviate from the design requirements and objectives set by regulatory agencies, leading to the creation of intelligent products that fail to meet agreed standards or contain maliciously embedded algorithms and data not in line with technical and ethical norms, the responsibility for product liability should fall on the

²⁴⁵ Jens Schovsbo and Olga Kokoulina, ‘Transparency of Algorithmic Decision-Making: Limits Posed by IPRs and Trade Secrets’ in Jens Schovsbo and Olga Kokoulina (eds), *The Exploitation of Intellectual Property Rights: In Search of the Right Balance* (Edward Elgar Publishing, 2023).

²⁴⁶ Rukia Baruti and Laurence Boisson, de Chazournes, ‘Transparency in Investor-State Arbitration: An Incremental Approach’ (2015) *BCCR International Arbitration Review* 59.

²⁴⁷ Valentina Franzoni, ‘From Black Box to Glass Box: Advancing Transparency in Artificial Intelligence Systems for Ethical and Trustworthy AI’ in Osvaldo Gervasi et al (eds), *Computational Science and Its Applications - ICCSA 2023 Workshops* (Springer, 2023) 118.

²⁴⁸ Nipuna Sankalpa, ‘Unlocking the Black Box: Explainable Artificial Intelligence (XAI) for Trust and Transparency in AI Systems’ (2023) 4 *Journal Digital Art & Humanities* 31.

²⁴⁹ *Ibid.*

²⁵⁰ Karen Yeung, ‘Algorithmic regulation: A critical interrogation’ (2017) 12 *Regulation & Governance* 505.

²⁵¹ Mark E Lokanan, ‘Incorporating machine learning in dispute resolution and settlement process for financial fraud’ (2023) 6 *Journal of Computational Social Science* 515.

²⁵² Jacob Metcalf et al, ‘Taking Algorithms to Courts: A Relational Approach to Algorithmic Accountability’ (2023) Proceedings of the ACM Conference on Fairness, Accountability, and Transparency 1.

²⁵³ Ernest W K Lim, ‘Law by Algorithm’ (2023) 43 *Oxford Journal of Legal Studies* 650.

legal technology enterprise or the relevant technical personnel.²⁵⁴ The evolving landscape of AI calls for a reevaluation of liability frameworks, moving towards a more unified and standardized approach to ensure accountability and address the challenges posed by AI systems.²⁵⁵

Algorithmic accountability in decision-making processes involving arbitrators can be ensured through various means. Firstly, implementing transparency measures is crucial to address concerns of biases and discrimination.²⁵⁶ Secondly, utilizing a statistical test like the input accountability test can prevent discrimination against protected groups in algorithmic decision-making.²⁵⁷ Additionally, leveraging public law tools and judicial review grounds can render decision-makers accountable and help strike a balance between effectiveness, efficiency, and fairness in algorithmic systems.²⁵⁸ By combining these approaches, algorithmic accountability can be effectively ensured in decision-making processes involving arbitrators.

B Ensure individual justice

AI algorithms in arbitration must be carefully developed to uphold individual justice.²⁵⁹ While AI can assist in legal tasks and even act as a mediator, the power of decision-making should not only lie in the hands of programmers.²⁶⁰ People favors human judges over algorithmic ones, especially in emotionally complex cases.²⁶¹ Integrating AI in arbitration can bring value if done appropriately, but current laws may not fully support this integration.²⁶² To ensure individual justice, AI algorithms in investment dispute resolution must be regulated, incorporating multidisciplinary collaboration and stakeholder engagement to establish ethical principles and maintain transparency in the process. Despite AI's advancements, achieving individual case justice remains a complex task that requires ongoing development and scrutiny.

1 Algorithm Design and audits

Designing algorithms with fairness principles in investment dispute resolution is crucial to address disparities and biases that can arise in decision-making processes. Designing

²⁵⁴ Ibid.

²⁵⁵ Teresa Rodríguez de las Heras Ballell, 'The revision of the product liability directive: a key piece in the artificial intelligence liability puzzle' (2023) 24 *ERA Forum* 247.

²⁵⁶ Ibid.

²⁵⁷ Robert P Bartlett, Nancy E Wallace and Richard H Stanton, 'Algorithmic Discrimination and Input Accountability under the Civil Rights Acts' (2020) 36 *Berkeley Technology Law Journal* 675.

²⁵⁸ Ryan Williams, 'Accountable Algorithms: Adopting the Public Law Toolbox Outside the Realm of Public Law' (2022) 75 *Current Legal Problems* 237.

²⁵⁹ Ibid.

²⁶⁰ Ibid.

²⁶¹ Gizem Yalcin et al, 'Perceptions of Justice by Algorithms' (2023) 31 *Artificial Intelligence and Law* 269.

²⁶² Ibid.

algorithms for fairness in dispute resolution involves a delicate balance between efficiency, equity, and potential biases.²⁶³ Various frameworks and methodologies, such as the Fairness in Design (FID) framework, have been proposed to assist AI designers in handling potential fairness issues during the design stage.²⁶⁴ Algorithm audits in dispute resolution involve utilizing algorithmic approaches to address legal conflicts efficiently and fairly. These audits aim to decrease bias, prevent harm caused by artificial intelligence, and ensure consensual agreements in legal procedures.²⁶⁵ Fairness in machine learning is a multifaceted concept, with different standards and ethics declarations offering diverse suggestions on how fairness should be integrated into real-world machine learning practices.²⁶⁶ By considering these principles and frameworks, algorithm designers can work towards creating more equitable and unbiased arbitration systems.

In the field of investor-state dispute resolution, algorithm creation needs interdisciplinary collaboration to ensure that the algorithm is legally sound, technically robust, and ethically consistent. It should be human-centric, taking into account the needs and perspectives of all parties involved, ensuring that the algorithm's outcomes are interpretable and transparent, allowing users to understand the decision-making process.²⁶⁷ Bias detection and mitigation strategies must be incorporated during the design phase, with testing against diverse datasets to identify and correct biases that could lead to unfair outcomes.²⁶⁸ Furthermore, the algorithm needs to be scalable and adaptable to accommodate different types of investment disputes and evolving legal landscapes.²⁶⁹

For algorithm auditing, it is essential to conduct regular, independent audits performed by qualified experts who are not involved in the algorithm's development or deployment.²⁷⁰ These audits should assess the algorithm against established

²⁶³ Alessandra Amato et al, 'Equitative Algorithms for Legal Conflict Resolution' in Leonard Barolli, Peter Hellinckx and Juggapong Natwichai (eds), *Advances on P2P, Parallel, Grid, Cloud and Internet Computing* (Springer International Publishing, 2020) 589.

²⁶⁴ Jian Zhang, Yiqiang Shu and Hong Yu, 'Fairness in Design: A Framework for Facilitating Ethical Artificial Intelligence Designs' (2023) 7 *International Journal of Crowd Science* 32.

²⁶⁵ *Ibid.*

²⁶⁶ Jesse Russell, 'Algorithmic Fairness in Applied Machine Learning Contexts' in *Proceedings of the 2021 5th International Conference on Compute and Data Analysis* (Association for Computing Machinery, 2021) 46.

²⁶⁷ Alejandro Peña and others, 'Human-Centric Multimodal Machine Learning: Recent Advances and Testbed on AI-Based Recruitment' (2023) 4 *SN Computer Science* 1.

²⁶⁸ T P Pagano and others, 'Bias and Unfairness in Machine Learning Models: A Systematic Review on Datasets, Tools, Fairness Metrics, and Identification and Mitigation Methods' (2023) 7 *Big Data and Cognitive Computing* 15.

²⁶⁹ *Ibid.*

²⁷⁰ B Rakova and R Dobbe, 'Algorithms as Social-Ecological-Technological Systems: An Environmental Justice Lens on Algorithmic Audits' in *Proceedings of the 2023 ACM Conference on Fairness, Accountability, and Transparency* (Association for Computing Machinery, 2023) 1.

performance metrics, including accuracy, fairness, and reliability.²⁷¹ Security and privacy must be audited to ensure the algorithm is free from vulnerabilities and complies with privacy regulations.²⁷² Compliance with all relevant legal and regulatory requirements should be verified, including international standards for investor-state dispute resolution and any specific guidelines set forth by arbitration institutions. Implementing feedback loops to collect user input and incorporating this feedback into the audit process helps identify issues or areas for improvement that may not be apparent through technical assessments alone.²⁷³

2 Human-AI Collaboration

In ISDS procedures, a man-machine collaborative model led by arbitrators and aided by AI is gaining traction. Human-AI collaboration in arbitration is a developing field where AI is increasingly being integrated into the arbitration process alongside human arbitrators. Human-AI collaboration in arbitration presents risks and challenges such as immaturity of the legal system in absorbing AI technologies,²⁷⁴ concerns about accountability and transparency in dispute resolution,²⁷⁵ and the potential threats an AI-compliant legal system poses to jurisdiction.²⁷⁶ To mitigate these challenges, it is crucial to enhance awareness of AI benefits in legal fora,²⁷⁷ ensure continuous training in information technology skills,²⁷⁸ and advocate for a balanced approach where AI complements rather than replaces manual processes in arbitration. In the context of ISDS, AI can positively impact processes such as arbitrator selection and issuing arbitral awards, enhancing efficiency while recognizing the necessity of human intervention in certain cases.²⁷⁹ Further research is needed to determine the optimal balance between human decision-makers and AI to achieve the most efficient outcomes in arbitration.

²⁷¹ Linda Fernsel and Katharina Simbeck, 'Data Synthesis for Fairness Audits of Learning Analytics Algorithms' in *Angewandte Forschung in der Wirtschaftsinformatik 2022: Tagungsband zur 35. Jahrestagung des Arbeitskreises Wirtschaftsinformatik an Hochschulen für Angewandte Wissenschaften* (HTW Berlin, 2022) 316, 316-320.

²⁷² Milad Nasr et al, 'Tight Auditing of Differentially Private Machine Learning' in *Proceedings of the 32nd USENIX Security Symposium* (USENIX Association, 2023) 1631.

²⁷³ A F Khalid and J M Grimshaw, 'Preparing for audit and feedback: practical considerations' (2022) 20(2) *JBI Evidence Implementation* 111.

²⁷⁴ *Ibid.*

²⁷⁵ A Samuel, 'Artificial Intelligence and Learning about International Arbitration' (2023) 41 *Alternatives to the High Cost of Litigation* 108.

²⁷⁶ *Ibid.*

²⁷⁷ *Ibid.*

²⁷⁸ Victor Enebeli and Success Gilbert, 'Artificial Intelligence: Challenges and Opportunities for Arbitration in Nigeria' (2022) 9 *SSRN Electronic Journal* 23.

²⁷⁹ *Ibid.*

C Clarify AI's auxiliary position in ISDS

The technical limitations of AI in achieving case-by-case justice make it a technical tool to augment and complement human arbitrators rather than to replace them.²⁸⁰ AI-assisted adherence can mitigate risks like poor big data quality, “algorithm black box”, bias, and tech dependence, enhancing internal audit quality despite challenges highlighted in the study.²⁸¹ Therefore, positioning AI as an auxiliary tool alongside human arbitrators can optimize arbitration processes by combining the strengths of both human judgment and AI capabilities.

1 Human Autonomy in AI-Assisted Arbitration

Although software analysis can assist in decision-making for investment disputes, arbitrators cannot rely solely on it due to limitations such as varying legal circumstances and the exercise of arbitrator discretion.²⁸² Arbitrators must exercise caution in not excessively depending on AI technology.²⁸³ While AI can enhance efficiency and provide valuable insights, arbitrators should retain their critical thinking skills and ultimate decision-making authority when faced with AI-generated decisions or recommendations. The legal framework is not yet fully equipped to integrate AI seamlessly into arbitration, and concerns exist regarding transparency, data protection, and control over algorithms in arbitration processes. Although AI can assist in complex tasks like evidence comparison and argument crafting, arbitrators' human judgment remains crucial due to the unique complexities, inconsistencies, and confidentiality requirements in arbitration cases. Therefore, arbitrators should strike a balance between leveraging the benefits of AI and preserving their essential role in ensuring fair and just dispute resolution.

To realize human autonomy in AI-assisted arbitration, it's crucial to balance technological benefits with the preservation of human judgement and decision-making. Further, implementing human oversight ensures that AI augments rather than replaces human capabilities, with arbitrators retaining final decision authority.²⁸⁴ Transparency about the role of AI in the process and the explainability of its outputs are essential so that arbitrators understand and can critically evaluate AI-generated insights.²⁸⁵ Allowing

²⁸⁰ Ghazal Bhootra and Ishan Puranik, ‘Arbi (Traitor)?: A Case against AI Arbitrators’ (2022) 4 *Indian Arbitration Law Review* 28.

²⁸¹ Anas M Qatawneh, ‘Risks of Adopting Automated AIS Applications on the Quality of Internal Auditing’ (2021) 18 *WSEAS Transactions on Business and Economics* 763.

²⁸² Dongmei Zhang, Shi Han, Yingnong Dang, Jian-Guang Lou, Haidong Zhang and Tao Xie, ‘Software Analytics in Practice’ (2013) 30(5) *IEEE Software* 30.

²⁸³ *Ibid.*

²⁸⁴ Daria Onitiu, ‘The limits of explainability & human oversight in the EU Commission’s proposal for the Regulation on AI- a critical approach focusing on medical diagnostic systems’ (2023) 32 *Information & Communications Technology Law* 170.

²⁸⁵ Cecilia Panigutti and others, ‘The Role of Explainable AI in the Context of the AI Act’ in *Proceedings of the 2023 ACM Conference on Fairness, Accountability, and Transparency* (Association for Computing Machinery, 2023) 1139.

arbitrators to control and customize AI tools empowers them to tailor the technology to their needs, enhancing their decision-making rather than being led by it.²⁸⁶

Feedback mechanisms for arbitrators to assess AI performance facilitate continuous improvement and alignment with human-centric arbitration goals.²⁸⁷ Adhering to ethical frameworks that prioritize human autonomy ensure that AI's integration respects justice, fairness, and human agency principles. Moreover, ensuring legal and regulatory compliance with AI use safeguards the rights of all parties and maintains integrity of the arbitration process.

2 Human Judgment and AI in Complex Arbitration Cases

In complex arbitration cases, the interplay between human judgment and AI is crucial.²⁸⁸ Human judgment, often associated with concepts like individual justice and discretion, plays a vital role in assessing cases on their own merits, a task challenging for algorithmic systems.²⁸⁹ On the other hand, AI advancements primarily enhance prediction capabilities, influencing decision-making processes by complementing human judgment.²⁹⁰ However, the displacement of human judgement by AI, even in systems designed to enhance it, raises ethical and legal concerns. The need for human oversight in AI-driven decisions, especially in intricate arbitration scenarios, becomes evident to ensure a balance between individual justice, consistency, and fairness. Therefore, in complex arbitration cases, a harmonious integration of human judgement and AI is essential to navigate the intricate landscape of decision-making.

Integrating human judgement with AI in complex arbitration cases requires a strategic approach that leverages the strengths of both while mitigating potential drawbacks. To achieve this synergy, clear roles should be defined, with human arbitrators making final decisions and AI assisting in data analysis and pattern recognition.²⁹¹ AI can process vast amounts of complex data, freeing arbitrators to focus on higher-level analysis and decision-making.²⁹²

²⁸⁶ Ibid.

²⁸⁷ Thilo Hagendorff and Sarah Fabi, 'Methodological reflections for AI alignment research using human feedback' (arXiv preprint, 22 December 2022).

²⁸⁸ Reuben Binns, 'Human Judgment in Algorithmic Loops: Individual Justice and Automated Decision-Making' (2022) 16 *Regulation & Governance* 197.

²⁸⁹ Norman W Spaulding, 'Is Human Judgment Necessary?: Artificial Intelligence, Algorithmic Governance, and the Law' in Markus D Dubber, Frank Pasquale and Sunit Das (eds), *The Oxford Handbook of Ethics of AI* (Oxford University Press, 2020).

²⁹⁰ Joachim I Krueger, 'Twilight of Human Judgment' (2022) 135 *The American Journal of Psychology* 347.

²⁹¹ Ibid.

²⁹² Katharina Hödl, 'Artificial Intelligence for Decision Making' in Divya Mahajan, Santosh Kumar and Priyanka Dadhich (eds), *Decision Strategies and Artificial Intelligence: Navigating the Business Landscape* (SAN International Scientific Publications, 2023).

D *The Role of International Organizations in application of AI*

International organizations and arbitration bodies play a crucial role in shaping the landscape of ISDS and the integration of AI into dispute resolution processes.

ICSID is one of the most prominent institutions for international investment dispute arbitration. In May 2023, an agreement was reached between the ICSID and Jus Mundi, wherein a Memorandum of Understanding was signed to incorporate ICSID publications within the Jus Mundi online database.²⁹³ The integration aims to leverage Jus Mundi's AI-driven search capabilities to enhance access to ICSID resources, encompassing links to ICSID awards, expert analysis, and supplementary online materials.

The United Nations Commission on International Trade Law (UNCITRAL) has been at the forefront of efforts to modernize and improve ISDS. Its Working Group III has been engaged in a multi-year process to reform ISDS, considering issues such as transparency, third-party funding, and the introduction of an appellate mechanism.²⁹⁴ UNCITRAL's work is likely to have a significant impact on the future of ISDS, potentially leading to more standardized and streamlined procedures. UNCITRAL has also shown interest in the role of technology in dispute resolution, including AI. For example, the field of arbitration stands to gain from the consistency afforded by AI.²⁹⁵ However, UNCITRAL's approach is cautious, recognizing the need for safeguards to ensure that the use of AI does not undermine the principles of fairness and due process.²⁹⁶

The Permanent Court of Arbitration (PCA), based in The Hague, provides services for the resolution of disputes involving various combinations of states, state entities, international organizations, and private parties. PCA has been involved in ISDS cases and has adopted its procedures to accommodate the unique challenges of these disputes.²⁹⁷ The PCA has not been as vocal about AI integration as some other institutions, but it is likely to follow the broader trends in the field, considering the potential benefits of AI in streamlining administrative tasks and enhancing the accessibility of arbitration services.

²⁹³ International Centre for Settlement of Investment Disputes, *Annual Report 2023* (Report, 2023).

²⁹⁴ Jeffrey Kucik and Sergio Puig, 'Towards an Effective Appellate Mechanism for ISDS Tribunals' (2023) 22(5) *World Trade Review* 562.

²⁹⁵ United Nations Commission on International Trade Law, *Report on the UNCITRAL Academy 2023* (Report, 4 April 2023).

²⁹⁶ Jia Qing Yap and Ernest Lim, 'A Legal Framework for Artificial Intelligence Fairness Reporting' (2022) 81(3) *The Cambridge Law Journal* 610.

²⁹⁷ Gilles Cuniberti, 'Article 13: Challenge procedure' in Gilles Cuniberti (ed), *The UNCITRAL Model Law on International Commercial Arbitration* (Edward Elgar Publishing, 2022) 167.

VI CONCLUSION

In conclusion, the integration of AI into the ISDS system presents a paradigm shift with significant potential to enhance the arbitration process's efficiency, accuracy, and fairness. This article underscores the multifaceted advantages of AI, from streamlining ISDS processes and intelligent evidence analysis to fostering objective decision-making and proactive dispute prediction. These advancements, as highlighted, not only promise to refine the arbitration landscape but also address long-standing critiques regarding the timeliness and cost-effectiveness of dispute resolution.

However, the journey towards AI's full integration into ISDS is not devoid of challenges. Key among these are the ethical dilemmas posed by algorithmic decision-making, including concerns over bias, discrimination, and the overarching fear that reliance on technology may erode the human elements intrinsic to justice delivery. Furthermore, the limitations in capability of AI to comprehend the nuance of human nature and the risks associated with technological dependency underscore the need for a balanced approach to AI implementation in ISDS.

Moving forward, the pathway towards optimizing AI application in ISDS is clear. Establishing a comprehensive regulatory framework is essential to ensuring that algorithms operate transparently and are held accountable. Such a framework should not only mandate regular algorithm audits but also ensure that AI systems are designed with an intrinsic capability for fairness and impartiality. Moreover, safeguarding individual justice requires a symbiosis between human insight and the analytical prowess of AI, ensuring that the role of AI remains auxiliary, thus preserving human autonomy in decision-making processes. Particularly in complex arbitration cases, the synergy between human judgement and AI can provide a nuanced analysis that neither could achieve independently.

In essence, the future of ISDS in the context of AI integration is promising but requires a conscientious approach that balances the novel capabilities of AI with the timeless values of justice, fairness, and human oversight. By adhering to these principles, the potential of AI to revolutionize ISDS can be fully realized, marking a new era in investor-state arbitration where technology and human expertise converge to deliver justice more effectively and equitably.