



Algorithmic Adjudication: Evaluating the Compatibility of Artificial Intelligence with Procedural Fairness in International Commercial Arbitration (Case Study: Iranian Legal System)

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Abstract

"The integration of Artificial Intelligence (AI) into the realm of international commercial arbitration represents a paradigm shift in dispute resolution. While AI promises increased efficiency and speed, its deployment raises fundamental questions regarding procedural fairness and the principles of due process. This paper critically examines the compatibility of AI-driven adjudication with established legal standards, focusing on the tension between algorithmic decision-making and the right to a fair trial. By employing an analytical-comparative methodology, the study investigates the regulatory challenges posed by 'black-box' algorithms and the opacity of automated reasoning. Furthermore, it explores the specific legal landscape of the Iranian jurisdiction, assessing the extent to which existing domestic legal frameworks can accommodate AI-enabled arbitration while upholding essential procedural safeguards. The research argues that unless specific regulatory mechanisms for algorithmic accountability and transparency are established, the use of AI in arbitration risks undermining the foundational legitimacy of the arbitral process. The article concludes by proposing policy recommendations for reconciling technological innovation with the rigorous requirements of procedural justice."

Keywords: Artificial Intelligence, Commercial Arbitration, Procedural Fairness, Due Process, Algorithmic Adjudication, Iranian Legal System.

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1. Introduction

The rapid advancement of emerging technologies, particularly the development of Artificial Intelligence (AI) systems, has profoundly transformed the architecture of human decision-making processes. AI has transcended its origins as a mere computational tool, becoming an instrumental technology for data analysis and decision support across diverse sectors, including medicine, economics, management, and law (Surden, 2019).

The legal domain has not been immune to this paradigm shift. The emergence of "Legal AI" has streamlined activities such as contract analysis, legal research, document discovery, and the predictive modeling of litigation outcomes. However, the interpretive and normative nature of jurisprudence ensures that the role of human agency in legal adjudication remains a central point of scholarly debate (Remus & Levy, 2017).

Among alternative dispute resolution mechanisms, international commercial arbitration-characterized by its inherent flexibility, confidentiality, procedural efficiency, and expertise-represents an ideal environment for the integration of intelligent technologies. Unlike state-run litigation, arbitration is predicated on party autonomy and the flexibility to design proceedings, creating significant capacity for the adoption of innovative technological solutions (Born, 2021).

Despite these potential advantages, the deployment of AI in arbitration raises complex queries: Can algorithms exercise an autonomous role in the adjudicative process? Does a decision informed by an intelligent system retain its legal legitimacy? Furthermore, in the event of algorithmic error, where does liability reside?

These concerns are paramount, as the legitimacy of arbitration rests not merely on the final outcome, but on the parties' confidence in the independence and impartiality of the arbitrator, as well as strict adherence to the principles of due process. Any technological implementation that compromises transparency, undermines the right to be heard, or obscures accountability threatens the very foundations of the arbitral process (Blackaby et al., 2015).

Contemporary literature on technology governance emphasizes that the use of AI in high-stakes environments must be guided by principles of transparency, accountability, human oversight, and data protection. Such imperatives are increasingly reflected in modern AI regulatory frameworks (e.g., European Union, 2024).

In the Iranian legal context, while existing arbitration statutes do not explicitly address the deployment of AI, established principles such as arbitrator independence, the right to a fair defense, and the enforceability of arbitral awards provide the requisite parameters for any technological integration (Law on International Commercial Arbitration, 1997; Civil Procedure Code, 2000).

Consequently, the core research problem addressed in this study is: What are the legal boundaries and conditions for utilizing AI in commercial arbitration within the Iranian legal system, and how can a balance be struck between technological efficiency and the mandates of procedural fairness?

The central hypothesis of this research posits that the utilization of AI in arbitration is compatible with the foundational principles of the arbitral process provided it remains a 'decision-support tool' under the effective supervision of a human arbitrator. Conversely, the complete replacement of human arbitrators with autonomous AI systems remains fraught with significant legitimacy challenges under current technological and legal paradigms.

2. Legal Challenges of AI in Arbitration: A Deep Dive

2-1. The "Black Box" Problem and the Right to a Reasoned Award

The integration of Artificial Intelligence (AI) into arbitral proceedings introduces a fundamental systemic friction between technological efficiency and the mandatory judicial requirement for "reasoned awards." In the realm of international commercial arbitration, the duty to provide a reasoned award is not merely a procedural formality; it is a substantive guarantee of legitimacy. According to Article 31(2) of the UNCITRAL Model Law a cornerstone for many national arbitration statutes, including the Iranian Law on International Commercial Arbitration (LICA) (1997) an award must state the specific grounds upon which it is based. This requirement ensures that parties can scrutinize the tribunal's legal reasoning, verify the application of the chosen law, and, most importantly, challenge any potential error in the decision-making process.

However, the deployment of advanced AI, particularly deep learning architectures, threatens this foundational principle through what is colloquially known as the "black box" problem. Unlike traditional legal reasoning, which relies on deductive logic and transparent citation of statutes and precedents, many AI systems generate conclusions through non-linear, opaque multi-layered computational processes. When an arbitrator relies on such an algorithmic output, they effectively introduce an "invisible agent" into the deliberative process.

From an Iranian legal perspective, this opacity presents a critical challenge. Under the LICA and the Iranian Code of Civil Procedure (2000), a failure to provide adequate reasoning constitutes a valid ground for setting aside an arbitral award (Article 34, LICA). If an award is predicated on a "black box" output—where the underlying rationale cannot be articulated or deconstructed by the arbitrator—it inherently fails to meet the legal standard of a reasoned decision. Consequently, the reliance on such tools risks rendering

the final award legally vulnerable to annulment, as the domestic courts would be unable to assess the validity of the decision's logical foundation. This section argues that until AI systems evolve to provide "explainable AI" (XAI) outputs, their use as a primary basis for adjudication remains legally incompatible with the standards of procedural integrity mandated by current Iranian statutes.

2-2. Algorithmic Bias and the Principle of Impartiality

The principle of arbitrator impartiality is a non-derogable cornerstone of procedural fairness in commercial arbitration. It mandates that a decision-maker must act without prejudice, ensuring that the parties' rights are adjudicated solely based on the facts and applicable law. The integration of AI into this process creates a subtle yet profound threat: algorithmic bias. AI models are trained on historical datasets that inevitably reflect existing societal, economic, and cultural biases. When an AI tool is deployed to assist in legal reasoning, there is a substantial risk that it may propagate, or even amplify, these deep-seated systemic inequities.

Unlike human arbitrators, who are bound by ethical codes and can be challenged for "justifiable doubts" concerning their independence, AI algorithms operate in an environment where bias is often encoded as "efficiency" or "optimization." In the Iranian legal system, the arbitrator's duty to maintain strict neutrality is governed by the principles of justice and equity. If an arbitrator utilizes a software tool that inherently favors certain outcomes based on biased historical data, this compromises the very essence of the "neutral and independent arbitrator." Therefore, this research argues that the Iranian regulatory framework must evolve to mandate "algorithmic auditing" as a precondition for AI use in arbitration. Arbitrators must be legally obligated to disclose the nature of their tools and provide evidence that the underlying data sets have been screened for biases that could affect the substantive outcome of the dispute.

2-3. Liability, Accountability, and the Delegation of Authority

The legal vacuum surrounding the accountability for AI-induced errors constitutes the most significant barrier to the adoption of autonomous or semi-autonomous tools in arbitration. A fundamental doctrine in arbitration law is the "non-delegable nature of adjudicative authority." Parties appoint an arbitrator based on the individual's specific expertise, reputation, and judgment. This personal mandate cannot be surreptitiously delegated to a machine.

The critical issue arises when an AI tool provides a recommendation that leads to a demonstrable legal error. Is the arbitrator liable for relying on a "sophisticated" tool that they technically cannot verify? Or is the developer of the AI system to be held accountable? Under Iranian law, the arbitrator bears full professional and civil liability for the integrity of the award. The tendency towards "automation bias"-where humans defer to the output of automated systems-threatens to dilute this responsibility. We contend that any reliance on AI that effectively shifts the burden of decision-making from the human arbitrator to the algorithm constitutes a breach of the arbitrator's duty of "personal performance". As such, any award significantly influenced by unverified algorithmic outputs would be susceptible to annulment in Iranian courts on the grounds of "procedural incompetence." Consequently, AI must be strictly classified as a "decision-support tool", with the human arbitrator retaining absolute, non-delegable control over every stage of the adjudicative reasoning process.

3. Comparative Analysis and the Iranian Legal Landscape: A Critical Assessment

3-1. International Standards and the Evolving Regulatory Paradigm

The global discourse on AI in arbitration is increasingly dominated by the tension between efficiency and the preservation of "human-in-the-loop" decision-making. International institutions, including the ICC and LCIA, have yet to issue binding rules on AI, yet emerging soft-law guidelines emphasize that technological integration must not infringe upon the procedural integrity of the arbitral process. In contrast, the European Union Artificial Intelligence Act (2024) sets a rigorous framework for high-risk AI, mandating transparency and human oversight.

A comparative analysis reveals a distinct gap: while international arbitration practitioners are moving toward an informal "best practices" model that prioritizes disclosure of AI tools, the Iranian legal framework—heavily reliant on traditional civil procedure—lacks such transitional guidance. The challenge for the Iranian system is to determine whether "procedural fairness" can accommodate automated inputs without explicit legislative intervention, or whether the current statutes are sufficient to interpret AI as a permissible auxiliary tool.

3-2. Iranian Arbitration Law: The "Human-Centric" Paradigm

Under the Law on International Commercial Arbitration (1997) and the Iranian Civil Procedure Code (2000), the legitimacy of an arbitral award is inextricably linked to the "personal performance" and cognitive independence of the arbitrator. Our doctrinal analysis highlights two primary challenges:

Article 34 of the LICA: This article establishes the obligation of the tribunal to provide the reasons for its decision. As analyzed in section, algorithmic outputs often lack this foundational requirement. If the arbitrator fails to explicitly state the logical steps that led to an AI-assisted conclusion, the award is inherently susceptible to annulment by domestic courts for lack of adequate reasoning.

The Principle of Impartiality: Iranian judicial interpretation of "impartiality" focuses on the absence of external influence. We argue that an AI tool, if programmed to prioritize certain patterns over others, functions as an "external influence." Therefore, under Iranian law, the use of AI must be subject to the same disclosure requirements as any other potential conflict of interest, ensuring that the parties retain the right to challenge the tribunal's reliance on such tools.

3-3. Hypothetical Scenarios and Judicial Application

To evaluate the practical feasibility of these principles, we examine two hypothetical scenarios within the Iranian courts:

Scenario A (The Decision-Support Case): In this scenario, an arbitrator utilizes an AI-based legal research platform to organize evidence or track jurisprudential trends. Based on current Iranian standards, this is permissible, provided the arbitrator maintains full control over the final selection and assessment of evidence. This aligns with the "human-in-the-loop" requirement.

Scenario B (The Algorithmic Arbitrator Case): If an arbitrator relies on an AI tool to suggest the quantum of damages or interpret a contractual clause, and the arbitrator adopts this suggestion without independent verification, the action constitutes an impermissible delegation of authority. Under the Iranian principle of *Mobasherat* (personal performance), such an award would be void. Our research suggests that Iranian courts, given their conservative approach to procedural formalities, would likely view this as a fundamental breach of the arbitral mandate.

3.4. Reconciling Innovation with Domestic Norms

To bridge the gap between innovation and traditional procedural mandates, we propose an "Interpretive Protocol" for the Iranian context. This protocol mandates:

Mandatory Disclosure: Arbitrators must disclose the specific AI tools utilized during the proceedings.

Rationalization Requirement: Any conclusion influenced by an AI tool must be accompanied by a human-drafted explanation that clarifies the

logic behind the decision, independent of the software's output.

Certification of Independence: The arbitrator must certify that the decision remains the product of autonomous human judgment, thereby ensuring the award withstands potential annulment challenges in Iranian courts.

4. The Future of Data-Driven Governance in Arbitration: Towards a Normative Standardization

4-1. From Descriptive Adjudication to Predictive Jurisprudence

The trajectory of AI in arbitration is transcending simple computational support and entering the realm of predictive jurisprudence. Arbitral institutions and law firms are increasingly leveraging AI to forecast case outcomes based on historical meta-data, arbitrator behavioral patterns, and cross-jurisdictional precedents. While this enhances strategic foresight, it risks creating a "stagnation loop" in legal doctrine. If arbitrators subconsciously align their reasoning with AI-predicted outcomes to ensure "consistency," the evolutionary nature of law—which thrives on interpretative dynamism is threatened. In the Iranian context, this necessitates a proactive legal theory that defines the limits of "predictive autonomy," ensuring that algorithmic predictions do not displace the normative discretion inherent in judicial reasoning.

4-2. Institutionalizing "Algorithmic Interpretability" as a Procedural Rule

The absence of global consensus on AI governance in arbitration poses a systemic risk to the enforceability of awards. We propose that Iran take a normative lead by institutionalizing Algorithmic Interpretability (AI-I) as a mandatory procedural requirement. This goes beyond mere disclosure; it requires an "Interpretability Protocol" for any AI-assisted award. Under this framework, the arbitrator must provide a "human-digestible rationale" that accounts for the AI-generated inputs, effectively anchoring the algorithmic output within the domestic legal framework. This ensures that the award remains a product of "reasoned legal judgment" rather than a byproduct of opaque data processing, thereby safeguarding its enforceability under the New York Convention.

4.3. The Evolution of the "Techno-Legal" Fiduciary Duty

The integration of AI mandates an expansion of the arbitrator's fiduciary duties. We argue for the recognition of a new Techno-Legal Fiduciary Duty, wherein the arbitrator is professionally liable for the integrity of their technological environment. This duty entails more than procedural due diligence; it requires the arbitrator to maintain "algorithmic hygiene" the active verification of data sets for bias and the ensurance of operational security. Within Iranian legal education and professional standards, ignorance of the fundamental mechanics of utilized tools should be categorized as professional negligence, as it fundamentally undermines the "personal mandate" granted by the parties.

4-4. The Challenge of Cross-Border Harmonization

Finally, the enforceability of AI-assisted awards remains the ultimate litmus test for international arbitration. If an Iranian-seated arbitration utilizes AI, it must be perceived internationally as "human-centric" to maintain legitimacy. A critical research gap exists regarding how foreign courts will perceive the "authenticity" of an award influenced by algorithmic processes. We conclude that the Iranian system must harmonize its domestic norms—specifically concerning "procedural rationality" with the emerging global standards of "trustworthy AI." By doing so, Iran can prevent its arbitral awards from being challenged on the grounds of "procedural incompetence," ensuring that technological advancement acts as a facilitator of justice rather than a disruption to the international order of arbitral recognition.

5. Concluding Remarks and Future Research Trajectories

5-1. The Synthesis of Technological Integration and Humanistic Jurisprudence

This study has critically examined the nexus between Artificial Intelligence and the foundational principles of international commercial arbitration. Our analysis confirms that the incorporation of AI into the arbitral process is an inevitable evolution, yet it remains fundamentally tethered to the "human-centric" nature of justice. We have argued that the legitimacy of an arbitral award is not merely a product of optimal data processing, but a function of procedural fairness, arbitrator independence, and the duty of personal performance (Mobasherat). As demonstrated, the role of AI must be strictly contained within the

boundaries of a decision-support utility, preventing the dilution of the human arbitrator's intellectual autonomy.

5-2. Addressing the "Legitimacy Gap" in Iranian Law

The Iranian legal system stands at a critical juncture. While current statutes—specifically the Law on International Commercial Arbitration (1997)—provide a robust framework for traditional dispute resolution, they are challenged by the opacity of algorithmic reasoning. Our findings suggest that the Iranian legislative and judicial bodies must transcend the reliance on legacy procedural concepts and adopt a forward-looking "Techno-Legal" regulatory approach. The future of Iranian commercial arbitration depends on the capacity of its legal practitioners to navigate the "legitimacy gap" created by automated tools through enhanced interpretative protocols and mandatory algorithmic disclosure.

5-3. Future Research Trajectories

This research opens several avenues for further scholarly inquiry that extend beyond the scope of this paper:

Empirical Studies on Arbitrator Behavior: Future research should investigate how the availability of predictive AI analytics influences the settlement strategies of parties and the subsequent reasoning of arbitrators in Iranian-seated disputes.

Cross-Border Enforcement of AI-Assisted Awards: Further examination is required regarding the "public policy" (*ordre public*) exception in the New York Convention and whether it can be invoked by foreign courts to resist the enforcement of awards produced with heavy reliance on non-transparent AI systems.

The Socio-Legal Impact of AI-Driven Dispute Resolution: A longitudinal study on the impact of AI on the cost, speed, and overall satisfaction of parties in commercial arbitration would provide necessary empirical grounding for the normative arguments presented herein.

5-4. Final Reflection

The trajectory of arbitration law in the age of intelligence is not a choice between technological adoption and traditional practice, but a mandate for responsible integration. By institutionalizing transparency, accountability, and the non-delegable duty of personal judgment, the Iranian legal system can safeguard the core tenets of justice while harnessing the efficiency of technological advancement. Ultimately, the survival of arbitration as a trusted mechanism for international dispute resolution rests on its ability to ensure that, despite the presence of machines, the final decision remains, as it always has been, a deeply human endeavor.

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