THE IMPACT OF TECHNOLOGY AND DIGITAL TRANSFORMATION ON INVESTMENT DISPUTE RESOLUTION

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Introduction

Investment dispute resolution traditionally reliant on in-person hearings and paper filings has undergone a profound digital transformation in recent years. The COVID-19 pandemic accelerated a shift toward ***virtual hearings***, ***electronic filings***, and ***online case management***, fundamentally reshaping how investor–state and commercial disputes are resolved. Today, nearly all major institutional forums (e.g. ICSID, UNCITRAL, ICC, LCIA, SIAC, and regional centers) have adopted new technologies to enhance efficiency, transparency, and access. As one commentator observes, while technology offers "promise of new opportunities," it also brings complex procedural and ethical challenges. This article examines these developments globally. It surveys how institutions have integrated remote hearings, ODR platforms, block chain tools, AI-driven analytics, and digital case systems into investment arbitration and related mechanisms. Drawing on recent case examples and institutional reports (2023–2025), it assesses benefits (cost savings, broader participation) and risks (cybersecurity breaches, fairness concerns) and reviews institutional responses such as new protocols and guidelines. Finally, it offers recommendations for harmonized standards and safeguards to ensure equitable, secure digital dispute resolution worldwide.

Evolution of Arbitration and the Digital Shift

Traditionally, investment arbitration has involved *ad hoc* tribunals under UNCITRAL or ICSID Rules (public ISDS under treaties) and institutional arbitration (e.g. ICC, LCIA, SIAC) under party agreements. In recent years, all these venues have systematically embraced digital tools. In 2024 ICSID reported registering 57 new cases (up from 41 in 2022), reflecting a rebound in ISDS and continued reliance on bilateral and multilateral treaties. Many of these proceedings now incorporate digital practices. For example, ICSID and UNCITRAL tribunals routinely provide for ***virtual or hybrid hearings***. Under the LCIA's 2020 Rules, email and

other electronic communication became the default means of submitting requests and documents, with remote hearings explicitly authorized. Similarly, the ICC's 2021 Arbitration Rules allow arbitrators to hold videoconferencing hearings by default after consulting parties. As a result, remote conferencing, electronic case dockets, and e-signatures are increasingly standard in new investment disputes. Institutions have even amended fundamental rules to accommodate modern needs: notably, ICSID amended its Additional Facility rules to allow ***regional economic integration organizations*** (e.g. the EU) to be parties in investment cases, leading to the first such case in 2023. In short, the arbitration *framework* has evolved: technology is now integral, making proceedings more flexible but raising novel questions about due process and equality.

Virtual Hearings and Electronic Communications

A first-order effect of digitization is the rise of ***virtual hearings***. During 2020–2022, pandemic restrictions forced tribunals and parties to adopt videoconferencing platforms (Zoom, Web-ex, etc.), and many have continued doing so post-pandemic. For instance, the Saudi Center for Commercial Arbitration (SCCA) reports that *"with very few exceptions, arbitrations under the SCCA Rules… are filed almost exclusively online,"* and that exchange of submissions, case conferences, and even evidentiary hearings are handled electronically. In practice, hearing sessions are now often fully or partially virtual: one ICSID review noted that a large majority of hearings in 2024 "included remote features". Institutions now generally provide audiovisual technology and support at no extra cost. Hybrid hearings (some participants in-person, others remote) are common. Parties frequently prepare *electronic bundles* and use real-time transcription and interpretation software.

Electronic communications are also normalized. Modern arbitration rules presuppose electronic notice and filings. The UNCITRAL Guidelines on ODR (2016) explicitly encourage electronic procedures in international disputes. Many tribunals routinely circulate emails and cloud-shared files instead of postal service. Recent ICC Commission guidance even warns that a lack of tech parity (one party's limited access) could create an imbalance or "digital divide" between participants. To mitigate this, practitioners now typically address technology use at the outset (e.g. in case management orders) to ensure all parties have the means to participate fully.

Online Case Management Platforms

Beyond hearings, many arbitral bodies have developed *digital case management systems* to streamline proceedings. These ***ODR platforms*** consolidate filings, payments, and tribunal communications in a secure portal. A prominent example is the ICC's new ***ICC Case Connect*** (launched April 2025). This cloud-based platform (built on Opus 2) provides a unified interface for all case documents, notifications, and e-payments. ICC reports that Case Connect "modernises processes with a seamless platform for document sharing, case management, and ICC Court decisions". It includes features like user-friendly e-filing, integrated fee payments, role-specific portals for parties and arbitrators, and advanced workflow tools. The ICC Case Connect image below illustrates the type of secure online environment these platforms create for global arbitration.

Similarly, the Singapore International Arbitration Centre launched ***SIAC Gateway*** in late 2024. This web-based platform (developed with Opus 2) allows parties to file requests and evidence electronically, pay fees, and track case progress in real time. Through SIAC Gateway, arbitrators can view and annotate documents securely. It even supports emergency arbitration's: parties can indicate an emergency request when filing the notice, enabling the SIAC to process it concurrently. The platform automates document handling (chronological storage, bundle creation) and provides instant notifications. According to practitioners, SIAC Gateway "offers streamlined and secure communication, allowing for the digitalisation of all documents from the start of the arbitration". Use of such portals is increasingly encouraged (or required) even in existing cases.

Notably, UNCITRAL has also promoted electronic dispute resolution. In 2016 UNCITRAL adopted *Technical Notes on Online Dispute Resolution* to guide states and ODR administrators in building fair, transparent online systems.More recently, UNCITRAL's Dispute Resolution in the Digital Economy (DRDE) initiative has held global forums on topics like e-notice of arbitration, electronic awards, and AI in disputes. These reflect a trend towards *online-first* case management in cross-border disputes, especially those arising from digital transactions.

Artificial Intelligence and Data Analytics

Artificial intelligence (AI) is becoming a powerful tool in investment arbitration. AI-driven research platforms (like Lexis Nexis, West law, and arbitration-specific tools) can review large

volumes of legal texts and predict relevant outcomes. Leading institutions are partnering with AI experts to harness these capabilities. Practical uses of AI in arbitration are broad. According to surveys, arbitral institutions and counsel are increasingly using AI for tasks like document review, drafting, and data analysis For instance, law firms and arbitrators apply natural-language models to sift through evidentiary documents or to identify relevant precedents. AI has also emerged in ***arbitrator selection***: algorithms can analyze large datasets of past cases to recommend candidates whose expertise and track record align with a case's facts. Further innovations like *Emotion AI* (detecting emotional cues in real time) are being explored to enhance communication and reduce bias. Generative AI (e.g. ChatGPT) is used informally for legal research summaries and drafting, though experts caution about its "black box" nature and accuracy issues.

In short, AI is enhancing efficiency and objectivity in investment disputes. However, it raises ethical and procedural concerns. The lack of transparency in many AI systems (the so-called "black box" problem) makes it hard to explain outcomes. There are also worries about data privacy and quality, and whether reliance on AI might obscure the human judgment that is often needed in complex disputes. As commentators note, these concerns call for updated rules or guidelines to govern AI use. For example, some scholars propose that arbitration rules be revised "to be more practical and pragmatic as regulatory controls over data in the advancing digital era". The Bar Associations and ICC have begun offering non-binding *Tech Guidelines* on AI in arbitration, but harmonized, enforceable standards are still emerging.

Blockchain, Smart Contracts, and New Dispute Types

Block chain technology and smart contracts are creating new layers of investment-related disputes. While block chain is often associated with cryptocurrency, it also underpins emerging supply-chain and trade documentation systems. For example, block-chain-powered "smart export documentation" platforms use distributed ledgers to authenticate bills of lading, certificates of origin, customs declarations, and other trade documents via smart contracts and immutable records. These systems involve consortia of exporters, ports, banks, and government agencies across borders. Inevitably, contractual or technical problems in such ecosystems lead to arbitrators. Common disputes include challenges over the *validity of chockablock-generated documents*, errors in smart contract execution, data oracle failures, and system downtime. For instance, if a smart contract code erroneously releases payment at the

wrong time, parties may invoke arbitral clauses in their agreements.

Investor–state cases can also touch on block chain. In one example (Caratube v. Kazakhstan), the tribunal's reasoning on the reliability of digital evidence is cited in disputes involving immutable block chain records. As investors deploy block chain in energy, mining, and infrastructure projects, new legal issues arise about code interpretation, jurisdiction over decentralized platforms, and enforcement of smart outcomes across jurisdictions. Some practitioners are even experimenting with on-chain arbitration: for example, "decentralized courts" (like Kleros or Aragon Court) use block chain tokens and code to resolve disputes. While these remain niche and often limited to low-value matters, they demonstrate the broadening interface between investment law and digital technology.

Case Examples (2023–2025)

Several recent developments illustrate the trends above. In 2024, SIAC rolled out its ***Gateway*** platform, which digitized the entire arbitration process (from filing to award) for users. The platform's launch was praised for streamlining case management, enabling electronic bundle creation, and integrating emergency arbitration Likewise, in April 2025 the ICC officially launched ***ICC Case Connect powered by Opus 2***. This new version enhanced the earlier portal, adding features such as integrated payment, secure document sharing, and arbitrator expense management ICC reports that over 10,000 users (counsel and arbitrators) engage on the platform, which centralize all arbitration data in the cloud

Institutionally, 2024–2025 also saw concrete steps toward digital harmonization. In the investor-state sphere, ICSID partnered with Jus Mundi in 2024 to launch the ***ICSID Investment Arbitration Library***. This unified database (AI-enhanced) makes ICSID rules, commentary, and awards readily accessible to practitioners and governments, marking a milestone in transparency. The LCIA's 2025 collaboration with Jus Mundi similarly aims to leverage AI across its case management and research. On the public policy side, UNCITRAL has convened forums on "Dispute Resolution in the Digital Economy" (e.g. Hong Kong, November 2023) dealing with e-service of notices, online awards, and AI use. At the same time, many institutions updated rules: the LCIA's 2020 Rules and ICC's 2021 Rules both codified remote hearings and e-filing, reflecting the post-pandemic "new normal" in arbitration.

Another example is the growing inclusion of hybrid systems. In 2023, ICSID registered its first

case brought by a ***regional economic integration organization*** (a treaty party under its Additional Facility), due to 2022 rule changes. This is a structural evolution, not strictly technological, but it aligns with the digital trend of more diverse dispute actors (e.g. EU seeking ISDS under CETA). Additionally, emerging online dispute platforms in commercial (e.g. ACICA's ODR in Australia) show that the line between "investment" and "commercial" dispute tech is blurring, as technologies developed for one context migrate to the other.

Challenges: Security, Fairness, and Ethics

The digital transformation brings significant challenges. ***Cybersecurity and confidentiality*** are paramount concerns. Arbitration traditionally prides itself on privacy, but reliance on third-party platforms has exposed proceedings to new risks. Studies warn that participants "have often unconsciously… defined confidentiality and privacy expansively to promote use of email, cloud storage, and video platforms," often overlooking that these tools expose data to internet giants (Microsoft, Google, Zoom, etc.) In one high-profile case (an ICC arbitration in Brazil), enforcement of an award was stayed amid allegations that a party had ***hacked its opponent's email servers***, obtaining over 70,000 private emails. The alleged cyber-attack compromised privileged communications and even led to arrests, illustrating how digital intrusions can taint proceedings. This incident shows that hacking or malware targeting counsel or tribunal systems can undermine due process. As commentators note, an arbitral process is vulnerable to state-sponsored hackers, industrial espionage, or even opportunistic cybercriminals, since "many stakeholders might attempt to influence or taint" high-value arbitration.

Aside from overt attacks, routine data protection is a concern. Digital evidence and electronic filings must be safeguarded (encrypted, access-controlled) to prevent leaks. There is also a ***digital divide*** between participants. As one ICC report warns, disparities in technology resources (hardware, software, connectivity) across regions and parties could contribute to an "inequality of arms". For example, an investor from a developing country or a smaller firm may lack reliable broadband or sophisticated courtroom tech, placing them at a disadvantage against a well-resourced state or corporation. Language barriers are magnified online if simultaneous interpretation tools are unavailable. Moreover, virtual hearings can strain parties in inconvenient time zones or with limited resources for technology support. These access and equity issues threaten the fairness of remote arbitration if not addressed.

Ethical questions also arise with AI and automation. The use of AI in drafting and decision-making raises concerns about bias, accountability, and transparency. If a tribunal were to rely on an AI tool (or an AI arbitrator) for even "straightforward cases," critics warn of losing nuanced judgment and openness. AI vendors' commercial interests might conflict with impartiality. Thus far, no major institution has allowed an AI to issue awards, but the debate over "black-box" AI highlights the need for guidelines. In addition, privacy law issues emerge from large-scale data analytic: who owns or controls tribunal and arbitration data collected in the cloud? These challenges call for robust ethical standards and oversight.

Institutional and Policy Responses

In response to these issues, arbitral institutions and policymakers are beginning to craft frameworks for safe digital proceedings. Many institutions now encourage (or require) ***technology protocols*** at the outset of cases. For instance, ICC's technology report provides sample clauses and checklists for cybersecurity (such as encrypted platforms, authentication procedures, and incident response plans). Arbitration bodies like the LCIA explicitly urge tribunals to consider data protection early on. The earlier-mentioned Linklaters analysis suggests concrete measures: comprehensive cybersecurity protocols, agreed breach-notification rules, selection of tech-savvy tribunal members, and contingency provisions for IT failures Some have even proposed updating rules to impose confidentiality duties on technology providers and to allow tribunals to penalize security non-compliance

On the global level, UNCITRAL is exploring harmonized guidance. Its DRDE project is soliciting input on key digital issues (electronic notice, AI safeguards, ODR regulation) from diverse jurisdictions. Similarly, the ICC Commission's 2020 report on technology (a leading practitioner survey) explicitly acknowledges the need to "level the technological playing field" by raising awareness of available tools and mitigation strategies in emerging markets. In 2023, institutions like the Singapore International Commercial Court (SICC) and Southern Common Court of Justice (for Mercosur) issued digital hearing protocols, setting standards for virtual sessions (e.g. ensuring participants' identities, recording options, and emergency channels). Regional initiatives include the UNCITRAL Model Law on International Commercial Arbitration (which already references confidentiality obligations) and the Singapore Convention on Mediation (which anticipates online settlements), demonstrating a legal infrastructure increasingly supportive of digital methods.

Nonetheless, many rules remain silent on these issues. A recent scholarly article notes that most institutional rules still do not specifically address ICT providers' role in confidentiality, creating "functional failure" in governing modern data flows. Recognizing this gap, experts urge arbitration stakeholders to "update the rules and their application" to explicitly cover digital technologies. Some institutions are moving in that direction: for example, SCIA (Shenzhen Court of Int'l Arbitration) published experience notes on e-notice of arbitration and online service during 2023. But a uniform global standard is lacking, and enforcement of cyber protocols depends largely on individual tribunals.

Recommendations and the Path Forward

Given these developments, a number of recommendations emerge. First, ***harmonized global standards*** are needed. We recommend that major arbitration institutions (ICDR, SIAC, ICSID, UNCITRAL Secretariat, etc.) collaborate to develop model provisions or guidelines for digital hearings, cybersecurity, and AI usage. For instance, uniform model clauses could mandate encryption, two-factor authentication, and backups for all electronic filings. Judges and arbitrators should be trained in digital best practices and advised on fair use of AI tools. Second, ***technological safeguards*** must be implemented. Platforms should use end-to-end encryption; independent audits of ODR systems should be conducted; and contingency plans (e.g. switching to telephone fallback) should be built in. Third, ***equitable access*** must be ensured. Institutions should consider providing basic tech support or funding to parties with limited resources. They could partner with local chambers of commerce or legal aid bodies to set up "hearing hubs" in under-served regions. The ICC Commission's advice—to raise awareness and share low-cost tool lists in emerging markets should be emulated.

Procedurally, arbitrators should explicitly discuss technology use at the case management conference, as recommended by ICC guidelines. Parties should be allowed to raise concerns about digital disparities, and tribunals could adjust schedules or formats (e.g. breaking long hearings into shorter virtual sessions). On AI, transparency requirements are crucial: any party using AI-generated evidence or memorandum should disclose the tool and provide data (to avoid a "black box" surprise). Data privacy laws (such as GDPR) must be observed, with data storage confined to jurisdictions with strong protections. In sum, the goal is to "integrate technology in a way that will maximise savings of time and cost with due regard for fundamental principles of fairness and equality"

Conclusion

Technology is transforming investment dispute resolution at a systemic level. Virtual hearings, online case management, and AI are not mere conveniences—they are reshaping how disputes are conducted, who can participate, and what kinds of disputes arise. The trend is irreversible: remote and digital arbitration will remain a fixture long after the pandemic, as one study predicted. The benefits are clear (efficiency, accessibility) but so are the challenges (security, fairness). The authorities have begun to respond: new rules, forums, and platforms are emerging. Going forward, the investment arbitration community must consciously craft a ***digital infrastructure*** that is secure, inclusive, and transparent. This will require cooperation among states, institutions, and practitioners to develop common protocols, leverage the best of technology while guarding against its risks, and ensure that the promise of justice is not undermined by the medium through which it is delivered.