Journal of Human Security | 2025 | Volume 21 | Issue 2 | Pages 84-90
DOI: https://doi.org/10.12924/johs2025.210213
ISSN: 1835–3800

Journal of Human Security

Research Article

Smart Criminal Justice: The Smart Court Model

Dr. Youness Nafid [1]*, PhD Researcher. Sara Joraiche [2]

[1]Department of Law, College of Criminal Justice and Criminology, Naif Arab University for Security Sciences, Riyadh, Saudi Arabia.
Email: YNafid@nauss.edu.sa
[2]Economic and Social Sciences, Faculty of Legal, Chouaib Doukkali University in El Jadida. Trainee Lawyer at the Beni Mellal Bar, Morocco.
Email: sara2joraiche@gmail.com

***Correspondence:** YNafid@nauss.edu.sa

Submitted: 27 September 2025 | Revised: 30 October 2025 | Accepted: 29 November 2025 | Published: 30 December 2025

Abstract: This study examined the functioning of intelligent criminal courts and their capacity to administer justice in digital environments without compromising the principles of fair trial. Employing a descriptive–analytical methodology, the researchers undertook a doctrinal and comparative legal review of statutes, judicial rulings, procedural frameworks, and academic literature across multiple jurisdictions. The discussion encompassed key components such as electronic filing, evidentiary integrity, remote or hybrid hearings, and the constitutional assessment of judgements from a rights-based standpoint. Findings indicate that maintaining human oversight, ensuring enforceability, integrating explainability-by-design, upholding equality, and preserving the auditability of digital evidence chains significantly enhance the operational efficiency, transparency, and accessibility of technological tools within the justice system. The study also established that sound design protocols and competent supervision reinforce judicial independence and procedural fairness, even when technological systems are extensively applied. Furthermore, it proposed a Smart Court operational framework aimed at converting normative legal standards into procedural mechanisms and quantifiable safeguards. Accordingly, the research advocates for the institutionalization of mandatory human-in-the-loop reviews at crucial decision-making stages, the implementation of standardised evaluation checklists, the incorporation of algorithmic reasoning principles, and routine assessments to maintain public trust and ensure adherence to due process.

Keywords: Algorithmic Accountability; Human Oversight; Procedural Transparency; Digital Evidence; Remote Adjudication

1. Introduction

The emergence of digital technologies is reshaping not only the mechanisms through which justice is delivered but also the very structure of law itself. Contemporary legal discourse increasingly reflects the integration of technological innovations that render judicial processes more transparent, expedient, and accessible. Online platforms, artificial intelligence (AI), and automated decision-making systems have introduced significant transformations within the domain of criminal justice. As societies become progressively digitalised, there is a growing necessity for mechanisms that ensure equitable and innovative access to judicial determinations [1]. Smart courts exemplify this evolution by enabling electronic filing, virtual and hybrid hearings, digital evidence administration, and real-time case monitoring. These technologies collectively strengthen transparency, efficiency, and procedural fairness. Nevertheless, their accelerated adoption also poses challenges to judicial integrity, traditional legal norms, and institutional accountability. As digital infrastructures continue to expand across jurisdictions, the integration of these tools necessitates the development of refined and verifiable assessment frameworks [2].

The present paper critically assessed both the potential and the limitations of smart courts. Enhanced case management through computerised systems has improved task distribution and case resolution efficiency within the judiciary. Increasingly, AI-driven tools and machine-learning algorithms are being applied to risk evaluation, sentencing, and bail determinations. Scholars, however, caution that such systems may reproduce or even reinforce pre-existing biases if not subject to rigorous ethical oversight. Persistent concerns remain regarding equal access to justice, data privacy, and algorithmic accountability, which together constitute core elements of the digital divide. Although technological tools can expedite judicial processes, the absence of adequate safeguards can exacerbate inequalities rather than mitigate them.

Despite the steady expansion of smart court initiatives, comprehensive analyses, such as breakeven assessments of their operational models, remain limited. Only a few empirical investigations have systematically developed frameworks for intelligent criminal justice systems. The scholarly literature frequently presents digital transformation in the judiciary as an unequivocal success, often overlooking the accompanying ethical, institutional, and cultural complexities [3]. The smart court framework embodies a technologically driven vision of judicial reform. This study explores the institutional safeguards, technological infrastructures, and regulatory mechanisms essential to ensuring its effectiveness and fairness. The convergence of technology, law, and governance is expected to support policymakers in strengthening digital justice. As Koniakou [4] observes, intelligent courts possess the capacity to uphold enduring justice even in the absence of comprehensive legislative directives.

1.1 Statement of the Problem

The integration of advanced technologies such as AI and smart court systems has reshaped global legal practice, significantly improving judicial efficiency, transparency, and accessibility [5]. However, the deployment of AI in judicial processes entails substantial risks related to fairness, accountability, and the preservation of human oversight. Although smart courts are engineered to accelerate procedural tasks, this very speed may conflict with the principles of due process. The disparity between machine-based reasoning and human discretion raises critical questions about whether automation genuinely promotes impartiality and the delivery of context-sensitive justice.

Technological progress in this field must therefore be accompanied by sustained institutional efforts to uphold equality, integrity, and procedural justice in criminal adjudication. Smart courts exemplify the contemporary movement toward technology-driven justice reform. To ensure their legitimacy and fairness, this research evaluates the institutional safeguards, technological foundations, and regulatory instruments necessary for responsible digital governance. Collaboration between legal scholars, governmental agencies, and technological experts is essential to assist policymakers in advancing equitable digital justice. The investigation further examines how intelligent judicial systems might sustain justice even in the absence of explicit legislative provisions. While AI solutions can expedite case processing, they remain susceptible to algorithmic bias, flawed reasoning, and data

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inconsistencies. Bias frequently originates from inadequate datasets or model design, which may embed human prejudices into automated decision-making processes, thereby undermining judicial impartiality. Such distortions can result in disproportionate sentencing, inequitable treatment of litigants, and unreliable evidentiary assessments. Given that digital infrastructures vary across jurisdictions, some systems become ethically or procedurally fragile. Although automation reduces procedural time, it simultaneously introduces risks to objectivity and equality in judicial outcomes.

The implications of smart court systems for fundamental rights and fair trial guarantees remain insufficiently investigated. Earlier contributions, such as Muda's work, primarily concentrated on technological efficiency and administrative functionality, neglecting essential dimensions such as judicial independence, equity, and procedural justice. Only a limited number of empirical studies have examined the implications of AI adoption for constitutional principles and the standards of justice. Disparities in jurisdictional governance have also been linked to data breaches and opacity in algorithmic reasoning. These deficiencies underscore the necessity of establishing ethical judicial reform guided by stringent accountability and digital responsibility [6].

This research addresses whether AI-enabled smart courts can deliver criminal justice consistent with fair trial principles while minimising algorithmic inaccuracies. It explores the measures required to ensure impartial outcomes, preserve due process, and mitigate bias. The findings contribute to the discourse on reconciling technological innovation with constitutional integrity and ethical responsibility. Drawing upon the theoretical foundations of digital justice, this study advocates for robust AI governance frameworks that promote transparency, equality, and adherence to the rule of law. The results indicate that AI-assisted courts, when properly regulated, can render fair and consistent judgements in criminal proceedings while reducing algorithmic distortions. Ultimately, the study emphasises the importance of balancing technological efficiency with judicial transparency, equity, and normative justice.

1.2 Research Objectives

1. To examine the operational experiences of international smart courts and extract fundamental insights that could inform and enhance the development of domestic judicial practices.
2. To assess the extent of AI influence on the guarantees of fair trial and the broader principles governing criminal justice.
3. To propose practical and sustainable mechanisms for establishing intelligent court systems aligned with constitutional foundations and international legal commitments.

1.3 Research Questions

1. What is the experience of international smart court, in terms of lessons and best practices, and can be used in enhancing effectiveness and efficiency of criminal trial systems in the country?
2. What are the effects of adopting the use of artificial intelligence in the judicial process both in the fair-trial guarantee and basic ideals of criminal justice?
3. What are the practical practices and policy suggestions which can be provided to ensure that smart court development will not collide with the principle of the Constitution and the legal covenants under international law?

1.4 Key Concepts

1.4.1 Smart Court / Judicial Digitalisation

Smart courts utilise advanced digital tools—such as electronic filing, automated data dashboards, process automation, and AI-assisted decision support—across all stages of judicial proceedings. These instruments collectively enhance procedural efficiency, accessibility, consistency, transparency, governance oversight, and human supervisory capacity [7].

1.4.2 Algorithmic Risk Assessment (ARA) in Criminal Justice

ARA systems estimate potential outcomes such as reoffending or nonappearance in court by analysing pre-trial, sentencing, and post-conviction data. Continuous evaluation and regulatory oversight are necessary to ensure these models remain free from bias and maintain reliability, proportional calibration, and institutional accountability [8].

1.4.3 Explainable Artificial Intelligence (XAI) in Legal Settings

XAI frameworks aim to make algorithmic reasoning comprehensible to judges, lawyers, and litigants, thereby facilitating informed evaluation, discussion, and implementation of AI-generated outputs. XAI must align with legal reasoning standards and uphold transparency in both technical design and judicial justification [9].

1.4.4 Blockchain-Secured Chain of Custody for Digital Evidence

Blockchain-based chain-of-custody frameworks are employed to monitor the acquisition, transfer, and examination of digital evidence. By providing immutable transaction records, they strengthen evidentiary integrity, verify authenticity, and enhance the traceability and auditability of materials submitted in court proceedings [10].

1.4.5 Remote / Hybrid Criminal Proceedings & Procedural Fairness

Remote and hybrid hearings—conducted either entirely online or through a mix of digital and in-person formats—reshape courtroom interactions, affecting the dynamics between counsel, participants, and judicial perception. Effective procedural justice in such contexts requires adapting hearing modalities while safeguarding the fundamental right to a fair trial.

1.5 Study Significance

This study advances the concept of intelligent criminal justice through the establishment of smart courts, representing a socio-technological framework that integrates normative, procedural, and data-analytical dimensions. It examines algorithmic triage mechanisms, predictive risk signalling, interpretability and review systems with human oversight, as well as the theoretical underpinnings of accountability, proportionality, and governance aligned with due process. Methodologically, the research evaluates digital adjudication using key indicators—transparency, procedural efficiency, and fairness—to determine the credibility and dependability of justice analytics. Empirical validation encompasses design premises, data quality limitations, model construction, oversight protocols, internal coherence, and model extrapolation. Collectively, these components contribute to an emerging research trajectory that systematically connects conceptual approaches with structured legal methodologies.

Implementation of low-risk applications, guided pilot projects, and adaptive learning mechanisms constitute practical contributions arising from this investigation. Policy recommendations highlight the necessity of continuous bias surveillance, clear accountability for explainability, robust data protection and cybersecurity, comprehensive audit trails, and constitutionally compliant procurement practices. Furthermore, multilingual contexts, institutional diversity, and stakeholder capacities are accommodated through targeted training modules and collaborative frameworks, thereby advancing the efficiency of resource-constrained judicial systems. Interoperability is promoted through adherence to open standards, data portability, vendor-neutral architectures, and effective governance—each clarifying institutional responsibility and the flow of decision-making authority. The integration of these structural and procedural design elements empowers academics, regulators, and practitioners to strengthen smart court capacity while preserving legitimacy, equity, and transparency.

The pilot deployment benchmarks included within the study involve metrics for pre-intervention assessment, counterfactual comparisons, and evaluation of deployment margins of error. Human oversight mechanisms—such as decision-checkpoint mapping, escort-checkpoint alignment, and reason-documentation mapping—reinforce accountability and control at each procedural stage. The proposed monitoring dashboards embody constitutional principles by enabling systematic auditing and corrective action. Additional recommendations include the replication of initiatives across diverse linguistic, cultural, and infrastructural settings to enhance external validity. Finally, the study outlines strategic budgeting models, phased system decommissioning, and data stewardship measures encompassing model retraining, vendor accountability, and mitigation of both legal and technological limitations.

2. Theoretical Framework

2.1 Orientation to the Problem and Objectives

This analysis explores how digital judicial systems can strengthen criminal justice by embedding legality, accountability, and procedural safeguards within automated decision-making structures. It identifies

emerging concerns about the potential erosion of governance frameworks due to the growing reliance on data-driven technologies and the current inadequacy of cross-jurisdictional and inter-infrastructure evaluation mechanisms. The proposed theoretical model associates institutional requirements with both technological affordances and inherent threats, evaluating their combined influence on equitable judicial outcomes. The model validates the study's hypotheses concerning the interrelationships between the degree of oversight, levels of transparency, and key performance measures such as timeliness and error frequency. From these relationships, it can be inferred that institutional resources directly affect process portability, the establishment of audit trails, and the operationalisation of constructs across mixed-method or multi-site research designs [11].

2.2 Selection of Theories and Justifications

Four contemporary theoretical strands are utilised to interpret adjudicative environments and their inherent limitations. The socio-technical governance perspective encompasses judicial authority, organisational oversight, discretionary human judgement, and technological affordance in managing procedural risk. In this view, robust reasoning must be provided to all parties and appellate courts, while explainable AI research supports contestability, traceability, and rational argumentation. Modern fairness analytics are applied to measure distributional justice, mitigating distortions in subjective decision-making that may influence detention or sentencing outcomes. Blockchain-based evidence governance enables digitally scaled courts to maintain chain-of-custody integrity, authenticate evidentiary provenance, and facilitate retrospective audits. This approach introduces blockchain-enabled judicial processes and appeal mechanisms into the broader discussion of procedural innovation [12].

2.3 Conceptual Integration

The authors argue that the traditional unity perspective requires revision, conceptualising the court as a complex system of procedural mandates, interpretative mechanisms, and computational operations moderated by human discretion. Within this network, governance defines decision-making authority, hierarchies, and accountability lines; explainability ensures logical clarity and transparency of reasoning; fairness analytics establish diagnostic standards and quantitative boundaries; and verifiability demands digitally traceable evidence within empirical research. The proposed framework does more than connect these dimensions—it actively interweaves them, creating productive tensions that prevent efficiency-oriented optimisations, such as speed, from undermining due process. The study further details the human-in-the-loop review model, illustrating how embedded oversight mechanisms reduce judgement drift and preserve judicial responsibility. In most jurisdictions, normative expectations are articulated through both traditional procedural audits and quantitative performance measures [13].

2.4 Critical Appraisal of the Selected Strands

The methodological frameworks underpinning the research design possess both strengths and limitations. The socio-technical governance approach examines institutional–data interactions, though transparency alone does not guarantee user comprehension or trust. While diagnostic precision may be constrained when focusing narrowly on quantitative metrics, such specificity has not been shown to undermine constitutional values. Efficiency gains are achieved through reducing administrative overheads and vendor dependency, particularly in closed or static environments employing evidence-based models. Procedural fairness is reinforced through systematic audits, defined oversight boundaries, structured documentation, and preliminary procedural foundations. Adopting theoretical diversity, representative sampling, and interpretive variance across judicial systems strengthens both the credibility and adaptability of the analysis [14].

2.5 Paradigm Alignment and Methodological Fit

Codes symbolising legality, transparency, and performance can be employed within qualitative, quantitative, or mixed-method frameworks. Convergent logic and explanatory sequential design are commonly used in mixed-method approaches, while elite interviews and document analysis follow qualitative standards related to precision, timeliness, and variance decomposition. These methods also assess monitored error rates, decision authority, justification quality, and periodic triggers. The paradigm adopts an epistemologically pluralist stance, enhancing inferential validity by correlating positivist performance statistics with contextual variables such as usage frequency, user expertise, and institutional trust. It juxtaposes hypothesis testing regarding the depth and quality of oversight with grounded theory models addressing adoption behaviours and unintended outcomes across various environments. This structure enables comparative portability and supports the resilience and sustainability of local judicial systems and infrastructures [15].

2.6 Concluding Integrative Synthesis

Digitally enabled adjudication emerges as both a theoretical construct and a practical application within this paradigm, fostering coherence, analytical rigour, and evidential reliability. The framework elucidates the interdependence between oversight, transparency, auditability, and measurable performance, linking these dimensions to perceived judicial legitimacy. It also delineates testable hypotheses while narrowing the scope of inquiry for empirical validation. Human-in-the-loop guidance reinforces explainability standards and supports decision-assistance systems across both acceptance and appeal stages. Nonetheless, accurate impact attribution remains difficult when institutional, technical, or behavioural variables are inadequately captured. The concluding recommendations encompass adaptive policy templates, procurement guidelines, monitoring dashboards, scheduled audits, and modular smart court features. Collectively, these components can be standardised and extended across varying regulatory environments to ensure scalability, accountability, and ethical integrity [16].

3. Literature Review

This section organises and critically examines existing scholarship, identifying dominant methodological approaches, theoretical frameworks, convergent and divergent perspectives, and emergent research lacunae that underpin the current inquiry. Over the past four years, scholarly attention to smart criminal justice and digital courts has broadened considerably. The focus has shifted beyond the traditional concerns of e-justice to encompass in-depth evaluation of AI, transparency, and the algorithmic legitimacy of judicial decisions. Recent studies have observed substantial transformations in how document digitisation interacts with intelligent adjudication, with ethical frameworks evolving to preserve judicial independence [17]. Their work, adopting a human-centric perspective on intelligent justice, concluded that while technology enhances procedural efficiency through transparent and secure data utilisation, it cannot supplant judicial discretion. Instead, it reinforces institutional accountability and ethical transparency within the justice system.

A related strand of research has investigated the interplay between AI transparency and procedural fairness in online adjudicative processes. Empirical testing of algorithmic pre-trial assessment tools—particularly those employing optimal transport and conformal prediction methods—has highlighted measurable fairness trade-offs within legal-statistical domains. While these systems are not entirely autonomous, field studies have revealed that AI use can induce decision drift, potentially distorting human reasoning. Kolkman ,Bex [13] argue that despite advancements in explainability-by-design, current regulatory mechanisms remain inadequate for ensuring that AI-assisted decisions are both contestable and reviewable within judicial contexts. Another focal area concerns digital evidence integrity and authentication, primarily supported by blockchain frameworks. Blockchain systems have been proposed for auditing Internet of Things (IoT) evidence chains that are resistant to tampering, although scalability challenges persist. [18] demonstrated that distributed ledger technologies can effectively balance custodial transparency with data anonymity, validating forensic workflows through interoperability and standardised verification. Their findings suggest that embedding blockchain systems within institutional accountability frameworks could enhance the reliability and admissibility of digital evidence, provided that litigant literacy and interoperability protocols are established.

Further discourse has emerged around human rights protection and the legitimacy of virtual adjudication. Panzavolta [19] contends that online courtroom participation constitutes a procedural right, not a privilege, as it reduces potential bias against defendants. Beazley and Van de Gaer [20] maintain that videoconferencing broadens access to justice but must remain proportionate and subject to judicial oversight. Complementarily, Maralbaeva [21] observed that in Central Asia, digital-justice reforms have struggled due to limited innovation and inadequate training on due process and rights protection. These studies collectively expose the inherent tension between administrative efficiency and procedural legitimacy, underscoring the necessity of smart-court designs

that uphold human-rights compliance while pursuing equitable access.

Across these thematic clusters, common theoretical and methodological orientations are discernible. Much of the scholarship aligns with socio-technical governance paradigms, diverging from purely positivist automation perspectives. Most investigations combine doctrinal reasoning with empirical analysis, yet they reveal persistent deficiencies—particularly the absence of longitudinal and cross-jurisdictional studies capable of correlating AI design variables with outcomes in judicial fairness and legitimacy. Feeley and Mayson [22] have advocated for explainable and participatory justice systems anchored in blockchain technologies, though such frameworks remain conceptually robust yet empirically unverified. Addressing this research gap would require experimental validation within institutional contexts, incorporating user interaction, data control mechanisms, and operational testing.

In summary, the reviewed literature collectively suggests that achieving smart criminal justice requires a comprehensive re-imagination of procedural justice, institutional accountability, and human–machine collaboration. The field remains theoretically promising but empirically underdeveloped, particularly due to fragmented conceptual models and limited transnational integration. Consequently, the present research aims to address these deficiencies by designing and testing an integrated operational framework for digital justice—one that embeds governance, transparency, and human-rights principles at the core of Smart Court implementation.

4. Methodology

This study employs a descriptive-analytical approach to examine and compare the legal frameworks governing the delivery of criminal justice through the Smart Court model. The analysis relies exclusively on documentary legal sources, including statutes, judicial rulings, procedural guidelines, and analogous materials from domestic and international contexts, with a particular focus on publications released between 2020 and 2023. The research investigates the operation of emerging technologies, specifically electronic filing systems, AI-assisted adjudication, and blockchain-based evidence management, assessing their capacity to uphold due process, judicial independence, and fair trial rights. The evolution of Saudi legal provisions is evaluated in comparison with international best practices, including China's Smart Court initiative and the European Union's e-Justice systems, to identify both convergent trends and context-specific challenges. Evidence interpretation utilises textual, systematic, and teleological legal reasoning to ensure analytical coherence and validity. The study follows a normative methodology, eschewing empirical or statistical techniques, and aims to propose a theoretically robust, contextually relevant regulatory framework for the integration of smart technologies in criminal justice administration.

5. The Results

5.1 Overview of the Results Section

The Results part of this paper utilises evidence from the smart court model to evaluate how digital adjudication can improve efficiency while safeguarding the quality of judicial processes. Part One reviews international systems, starting with Asian experiences such as e-courts in China, e-dispute resolution and e-authentication in Singapore, the Najiz virtual court in Saudi Arabia, and initiatives in the UAE, before moving to European and American contexts. Part Two examines fair-trial guarantees, including user empowerment, defendants' rights, and equal treatment of litigants in digital proceedings. Key substantive protections addressed include judicial independence, algorithmic decision-making, data protection, and privacy. Comparative analyses in each section are thematic and focus on the integration of policies and laws, assessing performance, accountability, and human rights while highlighting similarities and differences. Findings are discussed below.

5.2 Section One: Global Models of Smart Court Experiences

5.2.1 Introduction

The concept of smart courts has emerged as digital technologies and artificial intelligence rapidly reshape judicial systems. Smart courts leverage digital, data-driven, and AI-assisted solutions to enhance transparency and improve access to justice. This section compares successful smart court models across Europe, Asia, and North America. Jurisdictions are evaluated holistically, considering technical, legal, and contextual subtleties, as well as achievements and enduring challenges. Major Asian cases include China, Singapore, Saudi Arabia, and the UAE, complemented by European examples and the historical AI-related trials in the U.S. The analysis is based exclusively on peer-reviewed literature and policy documents.

5.2.2 Asian Models of Smart Courts

5.2.2.1 China: Electronic and Smart Courts in Practice

Smart courts were first established in China, with electronic courts developed around Hangzhou. Initially targeting e-commerce and online transaction cases amid rapid digital economic growth, the Chinese model integrates AI extensively in judicial processes. Advanced algorithms sort cases, recognise documents, and generate preliminary judgment drafts, exceeding conventional procedures and enhancing efficiency. Trials may be conducted through computer interfaces, allowing independent work by plaintiffs and judges and simplifying each procedural stage. While automation has expanded access to justice, particularly in remote areas, concerns persist regarding algorithmic robustness, computational bias, and control over AI-driven procedures. Increased human oversight and transparency of AI processes are recommended [23].

5.2.2.2 Singapore: Online Dispute Resolution and Digital Justice

Singapore's judiciary has implemented a notable online dispute resolution portal, enabling minor cases to be resolved without in-person attendance. Secure digital authentication ensures that pleadings remain intact. Procedures are customised to case complexity, balancing accessibility and proportionality while easing burdens on litigants and judges. AI usage is limited and always human-supervised, forming a hybrid model that supports ethical practice and strengthens judicial fairness [24].

5.2.2.3 Saudi Arabia: Vision 2030 and the Virtual Court

Saudi Arabia's Najiz platform, part of Vision 2030, modernises access to justice by enabling electronic case filing, document submission, and remote hearings. AI predicts case durations, facilitating better resource allocation and efficient adjudication aligned with national development goals. Rapid technology adoption highlights the need for robust digital security, privacy safeguards, and comprehensive regulatory frameworks to build societal trust [25].

5.2.2.4 UAE: Smart Courts in Dubai and Abu Dhabi

The UAE has integrated smart courts, with Dubai's initiative forming part of its Smart City Strategy. Litigants can file cases, attend remote hearings, and receive electronic rulings. Neural networks estimate case durations based on complexity. Remote video trials maintained fair access even during the COVID-19 pandemic. Challenges include judicial training, AI accountability, and optimal utilisation, necessitating systematic capacity building and adaptation strategies.

5.2.3 European Models of Digital Judiciary

5.2.3.1 Estonia: E-Justice and Algorithmic Adjudication

Estonia's e-justice system, established in 2014, automates case submission, management, and scheduling. The 2019 Robot Judge project handled trivial cases using AI, with human judges reviewing outcomes. Policymakers prioritise transparency, plaintiff interests, and equity. Estonia's hybrid approach balances technological innovation with humanist values, fostering confidence in digital judicial systems [26].

5.2.3.2 European Union: The AI Act and Unified Regulatory Framework

Most EU member states, including France, currently lack comprehensive digital justice legislation. The European Artificial Intelligence Act represents a foundational step, providing a risk-based framework for AI in high-stakes fields such as justice. The Act mandates risk assessment, regulatory compliance, interpretability, data disposal standards, and protection of user rights, promoting responsible AI deployment. Its influence extends globally, encouraging both European and Arab jurisdictions to uphold justice and fundamental rights [27].

5.2.4 American Models of AI in Judicial Decision-Making

5.2.4.1 The United States: AI in Parole and Risk Assessment (COMPAS)

AI tools in the U.S., such as COMPAS, evaluate defendants' risk levels and inform parole decisions. While these systems enhance speed and data-driven decision-making, they raise transparency and auditability concerns, potentially undermining due process and equal protection. Studies indicate that such algorithms may discriminate against minorities and low-income populations, threatening constitutional equality in judicial outcomes [28].

5.2.5 Comparative Synthesis and Critical Reflections

Global comparison shows consensus on modernising justice via digital technologies, but approaches vary due to legal culture, technological development, and regulatory experience. Asian models (China, Singapore, Saudi Arabia, UAE) prioritise efficiency, accessibility, rapid AI adoption, algorithmic accountability, and judicial training. European models emphasise human oversight, legal safeguards, and cautious risk assessment. American experience highlights concern over bias and algorithmic transparency. Collectively, these examples illustrate the need to balance technological innovation with transparency, accountability, equality, and oversight. Arab and international legal systems must navigate digital transformation while preserving access to justice and fairness [29].

5.3 Section Two: Balancing Smart Criminal Courts and Fair Trial Guarantees

5.3.1 Second Branch: The Right to Defence and Empowering Litigants

Fair trials require effective defence, which must be preserved in digital court transitions. Lack of familiarity with online systems disadvantages technologically inexperienced defendants and lawyers. Judicial personnel require digital training to participate effectively in electronic proceedings. Over-automation risks undermining defence rights when technical support is insufficient. Saudi Arabia's Najiz platform provides digital support, integrating procedural justice and cybersecurity measures. Lawyers must adapt to new professional cultures to manage and defend clients in digital contexts. Policy frameworks should operationalise digital equality to ensure technology benefits all parties, maintaining fairness and judicial legitimacy [30].

5.3.2 Third Branch: The Principle of Equality Between Litigants

Criminal justice depends on impartiality. Unequal digital access or literacy can bias outcomes, favouring technologically proficient parties. Courts must ensure equal access to information, evidence, and online resources. Equality requires uniform procedural standards and unbiased algorithms. Auditability of AI tools enhances fairness. Institutionalising distributive fairness prevents undue technical advantages, and user-friendly interfaces foster trust. Smart courts should provide both equal rights and equal opportunities, as exemplified by China, ensuring that all litigants have equitable access to justice tools and processes [31].

5.3.3 Second Requirement: Substantive Guarantees

5.3.3.1 First Branch: Judicial Independence

Judicial independence prevents coercion and interference. AI and data analysis in smart courts can support judicial autonomy but may also distort human judgement if oversight is insufficient. Effective supervision ensures that AI assists rather than replaces judicial decision-making. Judges should retain interpretive flexibility over moral, cultural, and situational data. Training enhances algorithmic literacy, transparency of AI design, and rights to appeal machine-generated recommendations, safeguarding human-centred justice in the digital age [32].

5.3.3.2 Second Branch: Judge Neutrality and Algorithms

Algorithmic neutrality is essential to prevent biases inherent in AI systems trained on incomplete or skewed data. Misclassification or overfitting can lead to wrongful convictions or acquittals. Judicial oversight of algorithmic outputs ensures constitutional compliance. AI systems must be auditable, open to bias testing, and subject to judicial challenge. Training judges in algorithmic reasoning strengthens fairness and preserves the credibility of judicial institutions [33].

5.3.3.3 Third Branch: Data and Privacy Protection

The volume of digital court data has expanded dramatically, providing the basis for AI-driven adjudication but also posing risks. Raw data requires proper management, and reliance on cloud storage raises cybersecurity and sovereignty concerns. Effective data governance—including storage, access control, encryption, and lifecycle management—is critical. Privacy laws, such as the EU GDPR and Saudi Arabia's Personal Data Protection Law (2021), ensure responsible innovation while protecting rights. Procedural fairness in smart courts depends on privacy, cybersecurity, and public trust in digital justice [34].

6. Discussion

In this study, the authors critically examine the role of smart courts in transforming the criminal justice system through digital means. The findings, derived from doctrinal, comparative, and thematic analyses of various jurisdictions, indicate that technologies such as AI, blockchain, and remote hearings enhance efficiency, while issues related to fairness and judicial independence remain emergent. These results contribute to the international discourse on reconciling innovative digital processes with established justice standards across legal systems. The identified patterns highlight both areas of novel contribution and points of convergence with existing knowledge, serving to contextualise findings within prior research and to confirm or challenge earlier conclusions.

This research aligns with previous studies demonstrating that smart courts improve accessibility, accelerate case processing, and reduce procedural delays. The successful adoption of electronic filing, online dispute resolution, and AI-assisted case analysis mirrors findings from earlier empirical work. Technological platforms, together with regulatory frameworks and governance structures, tend to share similarities across legal contexts, explaining this consistency. The study also supports scholarly arguments advocating hybrid AI-court systems where human oversight remains integral to algorithmic decision-making. Consistent with global legal norms, privacy and data protection are prioritised, emphasising the importance of robust digital governance. While algorithmic bias and technical inequalities remain concerns, their impact is less debated than the broadly recognised benefits of judicial digitalisation. Differences in outcomes can often be attributed to region-specific digital literacy levels and institutional preparedness. The study demonstrates how legal expertise and governmental structures interact with technological innovation to produce these complex effects.

While some suggest that blockchain and AI alone can automatically enhance judicial credibility, this study underscores their use as tools to strengthen accountability rather than replace it [35]. Finally, the comparative analysis suggests that smart courts are most effective when three elements—ethical oversight, regulatory safeguards, and professional development for judicial personnel—are simultaneously integrated. This highlights the complexity of digitalising legal systems and the need for adaptable models tailored to diverse regulatory and institutional contexts. By emphasising the interaction between technology and human judgement, the study proposes solutions for aligning societal transformation with legal imperatives. The findings advocate for nuanced, context-sensitive technological integration rather than uniform, monolithic adoption, reflecting the intricate nature of global judicial change.

Despite certain exceptions, the discussion demonstrates that the study's conclusions largely align with the existing literature. Employing analytical, comparative, and critical perspectives is essential for applying scholarly insights to digital justice systems. The paper advances both theoretical understanding and practical implementation by situating its findings within ongoing discourse. It offers guidance for interdisciplinary research on the digital transformation of legal systems. Overall, ethically guided, adaptable smart court frameworks have shown significant influence in driving judicial reform.

7. Conclusion

This study demonstrates that smart criminal courts represent a substantial evolution in the conceptualization, execution, and safeguarding of justice in the digital era. The findings indicate that court accessibility, efficiency, and transparency can be significantly improved through the integration of digital and algorithmic technologies, robust legal frameworks, and sustained human oversight. However, these benefits are fully realised only when fairness, equality among litigants, and judicial independence are preserved. The results support the hypothesis that the effectiveness of technological adoption in justice

systems is determined by the extent to which it upholds integrity, accountability, and the protection of rights during adjudication. The study integrates comparative and doctrinal perspectives into a coherent Smart Court Model that fosters justice, transparency, and constitutional compliance within both legal theory and practice. Unlike prior research that often focused narrowly on isolated outcomes or single technologies, this study consolidates multiple innovations into a unified, practical system applicable across diverse jurisdictions. The model incorporates AI-assisted decision-making, blockchain-secured evidence, and digital hearings, all while preserving the centrality of human judgement. By linking theoretical considerations with practical implementation, the study's objectives and recommendations provide guidance for the development of a technologically supported and ethically grounded judicial system. The research offers both pragmatic and normative contributions to the field of digital justice. It provides policymakers and judicial institutions with a framework to operationalise the digital transformation of courts without compromising equality or procedural validity. Key procedural elements of this framework include explainability-by-design, mandatory human oversight at critical decision points, and auditable chains of evidence, ensuring that technological innovation translates into measurable fairness. The study concludes that smart courts must maintain an equilibrium between technological capabilities and human values, ensuring that the application of innovation strengthens justice rather than undermining it.

8. Recommendations

The policy recommendations are structured along five key dimensions, reflecting the study's central findings on harmonising technological advancement with judicial integrity. First, human oversight must be maintained at every stage of algorithmic decision-making to evaluate judgments effectively, supported by comprehensive audit trails, thorough documentation, and long-term retention plans. Second, explainability-by-design should be embedded, with all smart-court applications subjected to independent testing, certification, and ongoing evaluation by judicial technologists to prevent and address bias. Third, the digital divide identified in the study should be addressed by ensuring accessible digital justice facilities, including translation support, multilingual user interfaces, and enhancing the digital literacy of both legal professionals and litigants. Fourth, procedural reliability can be strengthened through the implementation of blockchain-secured evidence chains and cross-agency mechanisms for validating data authenticity and transparency. Fifth, fairness in remote and hybrid hearings should be ensured by providing informed consent, enabling meaningful participation, and offering technical support to address connectivity or access disparities. Collectively, these evidence-based measures translate the study's findings into actionable policy interventions that enhance efficiency while safeguarding equity, accountability, and public trust in the justice system.

9. Study Limitations

The study identifies several notable limitations that constrain the scope and interpretation of its findings. Firstly, the primary analyses rely on normative and comparative legal methodologies, which, while grounded in doctrinal and procedural frameworks, do not allow for empirical verification of smart court system performance. Secondly, the generalisability of the results is limited due to dependence on secondary legal sources and documented judicial experiences from selected jurisdictions, as institutional capacity, technological infrastructure, and local legal culture may influence the applicability of the Smart Court Model. Thirdly, longitudinal and field-based assessments are not feasible, restricting the ability to evaluate the long-term effects of the model on judicial efficiency, fairness, and user experience. Collectively, these limitations highlight the need for further interdisciplinary and empirical research to test the framework across diverse legal contexts and assess its practical effectiveness.

10. Study Implications and Future Directions

The findings of this study carry both policy and practical significance, as technological innovation must align with judicial ethics, procedural fairness, and institutional accountability. The results highlight the necessity of enforceable human oversight, explainable algorithmic processes, blockchain integration, transparency, and due process as fundamental components of smart court design. This study proposes an analytical framework for Smart Courts that influences system architecture, training programmes, and procedural safeguards in the digital transformation of justice systems. Based on these insights, legislators are encouraged to develop digital adjudication policies that prioritise equality, accountability, and accessibility across all levels. The effectiveness of such frameworks should be assessed through longitudinal and cross-jurisdictional research to ensure fairness, reliability, and public confidence in technology-driven justice. These investigations would further substantiate the development of robust, rights-oriented intelligent judicial environments.

Funding

This research was conducted solely by the author and did not receive funding from any governmental, private, or non-profit entities.

Conflict of Interest

The author declares no conflicts of interest that could have influenced the study or its outcomes.

Acknowledgments

This research was funded by Naïf Arab University for Security Sciences under grant No. NAUSS-25-R19

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