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FROM E-FILING TO EVIDENCE INTEGRITY: DEVELOPING A SECURE DIGITAL CHAIN-OF-CUSTODY FRAMEWORK FOR PAKISTAN'S E-COURTS: A COMPARATIVE STUDY OF SINGAPORE AND THE UNITED KINGDOM

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Abstract

The increasing digitization of judicial processes has transformed the manner in which courts receive, store, transmit and examine documentary and electronic evidence. Pakistan is currently moving towards a more integrated national electronic filing framework. In August 2026, the Supreme Court of Pakistan initiated consultation on a Standardized National E-Filing Framework intended to create a common electronic filing approach across the Supreme Court, High Courts and District Courts. Earlier, the National Judicial Policy Making Committee had approved the initiation of e-filing in District Courts as the first phase of the national e-Court project. These developments demonstrate that Pakistan is moving from paper-based litigation towards digitally managed judicial proceedings. However, electronic filing alone does not resolve the evidentiary problems associated with authenticity, integrity, preservation, access, alteration and traceability of digital evidence.This study examined the need for a secure digital chain-of-custody framework within Pakistan's developing e-Court architecture. It comparatively analyses selected practices in Singapore and the United Kingdom, where electronic filing and digital case-management systems provide established mechanisms for the submission and management of court documents. Singapore's Integrated Case Management System provides electronic filing, electronic case records, secure e-case repositories and simultaneous access to case-related information, while the UK's CE-File system provides electronic submission, automated confirmation, acceptance or rejection

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mechanisms, categorization of documents and electronic case management.Using qualitative comparative legal research, the article identifies the distinction between electronic filing and evidentiary integrity and proposes a Digital Chain-of-Custody Framework for Pakistan. The proposed framework incorporates unique evidence identification, cryptographic hashing, timestamping, metadata preservation, role-based access, audit trails, transfer records, integrity verification and judicial certification. The article argues that Pakistan's developing e-Court system should not merely reproduce paper filing in electronic form but should establish an integrated evidentiary architecture capable of documenting the entire lifecycle of digital evidence.

1. Introduction

Digital transformation has increasingly become an important component of modern judicial administration. Courts are no longer required to depend exclusively upon physical files, handwritten applications and paper-based documentary evidence. Electronic filing, digital case-management systems, electronic service, digital court records and remote access to judicial documents have become important elements of contemporary justice systems (Ahmad et al. 2022).

The transformation, however, creates a distinction between digital filing and digital evidentiary integrity. A court may successfully receive a document electronically without having a comprehensive mechanism for establishing when the document was created, who uploaded it, whether it was subsequently modified, who accessed it, whether it was transferred to another authority, and whether the version presented during trial is identical to the version originally collected (Hameed et al. 2021).

This distinction is particularly important for Pakistan. The country is presently developing a more standardized electronic judicial infrastructure. On 12 August 2026, the Supreme Court of Pakistan initiated consultation for a Standardized National E-Filing Framework. According to the Law and Justice Commission of Pakistan (LJCP), the proposed framework is intended to establish a common and structured electronic filing system across the Supreme Court, High Courts and District Courts.

The development follows earlier judicial digitalization initiatives. In December 2025, the National Judicial Policy Making Committee approved the immediate initiation and implementation of e-filing in all District Courts as the first phase of the national e-Court project. In October 2025, the Supreme Court also launched an E-Office system and entered into an arrangement concerning a Judicial Digital Dashboard designed to consolidate judicial information and support digital institutional management.

These developments make the question of digital evidence particularly timely. Pakistan's evidentiary law already recognizes evidence produced through modern devices, and recent Pakistani scholarship has identified questions concerning authenticity, reliability, forensic examination and chain of custody. Hameed et al. (2021), for example, examined the admissibility of digital evidence within Pakistan's justice system and highlighted continuing issues relating to authenticity and evidentiary weight. Similarly, Usman (2022) examined the

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role of forensic experts in relation to digital evidence and identified difficulties surrounding collection, investigation and expert testimony.

The central argument of this article is therefore not that Pakistan requires e-filing alone. Rather, the research asks whether the country's emerging e-Court architecture should incorporate a secure digital chain-of-custody mechanism capable of preserving the integrity and traceability of electronic evidence throughout its evidentiary lifecycle.

2. Research Problem

Electronic evidence differs from traditional physical evidence in several respects. A physical document can normally be identified by its physical characteristics, while digital information may be duplicated, transmitted, altered or reproduced without obvious physical indicators of modification. The problem therefore extends beyond whether a court can receive an electronic document. It concerns whether the judicial system can demonstrate:

- where the evidence originated;
- when it was obtained;
- who collected it;
- how it was transferred;
- whether it was altered;
- who accessed it;
- whether copies were created;
- whether metadata remained intact;
- whether the evidence presented to the court corresponds with the originally preserved material; and
- whether every significant evidentiary transaction can subsequently be independently audited.

The Council of Europe Electronic Evidence Guide emphasises the importance of establishing who obtained electronic evidence, where and when it was obtained, who secured it and who subsequently controlled or possessed it. NIST's 2022 guidance similarly recognises that preservation of digital evidence presents challenges different from those associated with traditional physical evidence. Pakistan's emerging e-filing architecture therefore provides an opportunity to address a second-generation problem: ***how to move from electronic filing to demonstrable evidence integrity?***

This research employs a qualitative comparative legal methodology supported by documentary analysis. The study analyses primary and secondary legal and institutional materials relating to electronic filing, digital evidence, evidence preservation and judicial digitalization.

The Pakistani component examines official material concerning the national e-filing initiative, judicial digital transformation and existing legal treatment of electronic evidence. Particular attention is given to the developments announced by the Law and Justice Commission of Pakistan during 2025 and 2026.

The comparative component examines Singapore and the United Kingdom. Singapore is selected because its judiciary has developed an integrated electronic case-management environment containing electronic filing, electronic case records and secure repositories.The United Kingdom is selected because CE-File provides a mature electronic filing and case-

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management mechanism with defined procedures concerning submission, confirmation, acceptance, rejection, document categorisation, confidentiality and preservation of originals.

The research uses thematic comparison under five principal categories:

Category	Pakistan	Singapore	United Kingdom
Electronic filing	Developing national framework	Established electronic filing	CE-File
Digital case file	Developing	Secure e-case repository	Electronic case file
Evidence integrity	Fragmented/legal-technical challenge	Integrated electronic environment	Filing and case-management controls
Auditability	Proposed	Electronic case-management environment	Submission and processing records
Proposed reform	Digital chain of custody	Comparative benchmark	Comparative benchmark

The research does not attempt to determine that one jurisdiction is universally superior. Instead, it identifies specific institutional mechanisms that may be adapted to Pakistan's legal and administrative context.

6. Conceptualizing the Digital Chain of Custody

A chain of custody traditionally establishes the chronological history of evidence. In a digital environment, the concept must be expanded to include technical information (Jawad Abbas 2018)

A digital chain of custody should establish at least:

Identity → Collection → Authentication → Transfer → Storage → Access → Analysis → Presentation → Archiving

A digital evidence record should therefore contain:

- Unique evidence identification number;
- Case number;
- Source;
- Date and time of acquisition;
- Acquiring person or institution;
- Device/source information;
- File type;
- File size;
- Cryptographic hash;
- Metadata;
- Storage location;
- Transfer history;
- Access history;
- Analytical activity;

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- Exhibit number;
- Judicial status;
- Preservation status.

This approach is consistent with contemporary digital-evidence guidance. The Council of Europe emphasizes the chronological sequence of obtaining, securing, analyzing and presenting electronic evidence. NIST similarly treats preservation as a distinct evidentiary issue requiring consideration of digital objects, storage media and evidence-management processes.

7. Pakistan's Emerging E-Court Environment

Pakistan is presently moving towards a more integrated digital judicial infrastructure. The 2026 Supreme Court initiative is particularly relevant because it seeks to standardize electronic filing across different levels of the judicial hierarchy.

The proposed national framework is expected to address practical filing requirements and facilitate a unified electronic case record. This development may reduce procedural fragmentation and improve accessibility to judicial records.

At the same time, the existence of an e-filing mechanism should not automatically be treated as equivalent to a comprehensive digital evidence-management system.

An e-filing system principally answers the question:

"How can a document be electronically submitted to the court?"

A digital chain-of-custody system answers a different question:

"How can the court demonstrate the continuing integrity and history of that evidence from acquisition to final adjudication?"

This distinction constitutes the central conceptual contribution of the proposed framework.

8. Digital Evidence under Pakistani Law

Pakistan's legal framework already contains provisions relevant to electronic evidence. Article 164 of the Qanun-e-Shahadat Order, 1984 provides a legal basis for evidence produced through modern devices and techniques (Shah et al.2017; Ahmad et al. 2022);

Recent Pakistani scholarship has nevertheless identified practical issues involving authentication, reliability, forensic capacity and chain of custody. Hameed et al. (2021) examined the admissibility of digital evidence and concluded that legal recognition does not eliminate questions concerning the evidentiary value and assessment of electronic material.

Usman (2022) further examined the role of expert witnesses in digital evidence and highlighted difficulties concerning digital forensic examination and the application of existing evidentiary provisions.

More recent scholarship has continued to identify chain-of-custody and authentication as areas requiring procedural development. A 2025 study of Article 164, for example, identifies authenticity, chain of custody, forensic analysis and judicial understanding of digital technologies as practical challenges.

Accordingly, the legal problem is not necessarily the complete absence of recognition of electronic evidence. The more specific problem is the absence of a sufficiently integrated technical-procedural architecture connecting collection, preservation, authentication, transfer and judicial presentation.

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9. Singapore: Electronic Case Management

Singapore provides an important comparative model because its judiciary has developed an integrated electronic environment rather than treating electronic filing as an isolated function.

The Integrated Case Management System (ICMS) describes a transition from paper-based processes to an electronic court environment. It provides 24-hour electronic filing, real-time filing and access, electronic transmission of court outcomes and a secure e-case-file repository.

The system also facilitates access to case-related documents and provides electronic case-management functionality for different stakeholders.

Singapore's State Courts Practice Directions require documents for use at hearings to be filed through the Electronic Filing Service, subject to specified exceptions. Electronic bundles may contain documents already within the electronic case file and documents uploaded into the electronic case file by authorized persons.

The significance for Pakistan lies in the integration of:***e-filing + electronic case file + access control + document management + case management.***However, Pakistan could potentially extend this concept by adding an explicit evidence-integrity layer to the electronic case file.

10. United Kingdom: CE-File

The UK's CE-File system provides another useful comparative reference. Practice Direction 5C, which came into force in its current form on 1 October 2025, defines CE-File as an electronic filing and case-management system containing documents that the court is required to hold.CE-File requires electronic submissions to be appropriately categorized or labelled, including categories such as claim forms, witness statements and exhibits. The system generates an automated submission confirmation and court officers may accept or reject submissions according to specified criteria (Hossen, M. M. 2025).

The UK framework also provides procedures for confidential documents, electronic seals and filing dates. It distinguishes between documents that can be electronically filed and certain originals that must still be physically lodged and preserved. This distinction is significant for the proposed Pakistani framework. A sophisticated digital court does not necessarily mean that every evidentiary object can be reduced to a PDF. Original physical documents, forensic devices and other materials may continue to require special preservation procedures (Akinola, O. B. 2026).

11. Comparative Analysis

Feature	Pakistan	Singapore	United Kingdom
National e-filing development	Under standardization	Established systems	Established CE-File
Electronic case records	Developing	Secure e-case repository	CE-File case file
Electronic filing	Expanding	Established	Established
Automated submission record	Proposed area	Electronic environment	Yes
Document categorization	Developing	Electronic filing environment	Required under CE-File

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Confidential electronic material	Requires stronger framework	Electronic case environment	Specific CE-File procedure
Evidence chain of custody	Requires standardization	Relevant electronic-record infrastructure	Relevant filing/case-management infrastructure
Proposed Pakistani innovation	Integrated digital chain-of-custody layer	Comparative reference	Comparative reference

The comparison demonstrates that Pakistan does not need to replicate the entire judicial infrastructure of either jurisdiction. Instead, selected mechanisms can be adapted to Pakistani procedural law.

12. Proposed Digital Chain-of-Custody Framework for Pakistan

The proposed framework may be called the:
Pakistani Digital Evidence Integrity and Chain-of-Custody System (P-DEICCS)
The system would operate as a specialized evidentiary layer within the national e-Court system.

Stage 1: Evidence Registration

Every item receives a unique:
Digital Evidence Identification Number (DEIN).
Example:
PK-SC-2026-CR-000145-EV-001
The identification number would remain attached to the evidence throughout the proceedings.

Stage 2: Evidence Acquisition

The authorized investigator, lawyer or court officer records:

- Source;
- Date;
- Time;
- Location;
- Person responsible;
- Device/source;
- Method of acquisition.

Stage 3: Cryptographic Integrity

The system generates a cryptographic hash for the digital object.
If the file subsequently changes, its hash value will also change.
The system therefore does not merely store the evidence; it creates an independently verifiable integrity record.

Stage 4: Metadata Preservation

The system preserves available metadata, including:

- Creation date;
- Modification date;

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- Device information;
- File type;
- Size;
- Relevant technical information.

Stage 5: Secure Storage
The evidence should be stored in an encrypted repository with controlled access.

Stage 6: Role-Based Access
Different permissions should apply to:
Judge → Full judicial access
Court staff → Administrative access
Prosecution →Authorised prosecution evidence
Defence→Authorised disclosure/access
Forensic expert → Assigned analytical access
Public → No access unless legally authorised

Stage 7: Immutable Audit Trail
Every important activity should create an audit record:
Uploaded → Viewed → Downloaded → Transferred →Analysed→ Re-uploaded → Presented → Admitted/Rejected

Stage 8: Judicial Verification
Before admission, the judge should be able to view:

- Original evidence;
- Hash;
- Metadata;
- Chain-of-custody history;
- Persons who accessed it;
- Forensic report;
- Objections;
- Previous versions.

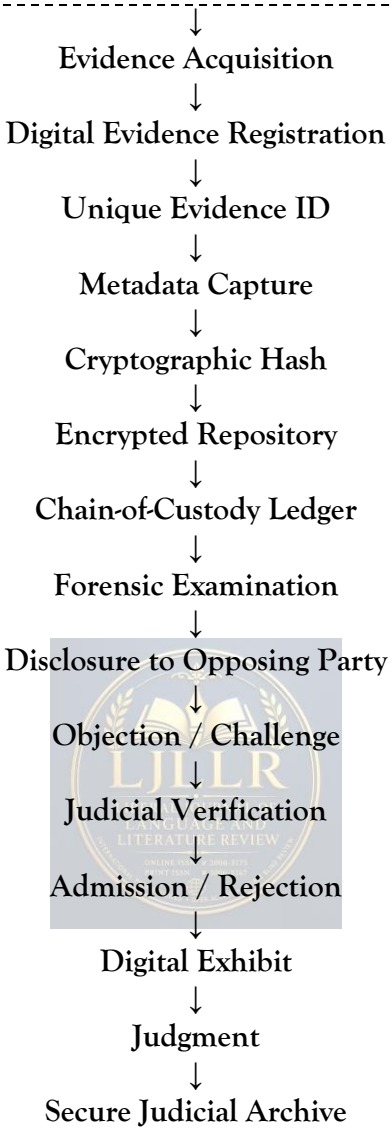
Stage 9: Digital Exhibit
Once admitted, the system should generate:

Digital Exhibit No. DE-001
The exhibit should remain linked to its chain-of-custody record.

Stage 10: Final Preservation
After judgment, the evidence should enter a legally prescribed archival period.
13. Proposed Architecture
The proposed system can be represented as follows:

Investigator / Litigant

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This architecture would allow the court to examine not merely the content of the evidence but also its history.

14. Role of Blockchain

Blockchain technology could be considered as one possible technological mechanism for recording integrity events. Research has proposed blockchain-based digital evidence management to enhance traceability, integrity and security throughout the chain-of-custody process. Rao et al. (2020), for example, proposed a blockchain-based approach for managing digital evidence from retrieval through courtroom presentation.

More recent work has also examined blockchain applications in judicial processes and electronic evidence. Jain et al. (2024) discussed blockchain's potential for verifying the authenticity of electronic documents and improving judicial transparency, while also recognising that blockchain-based judicial applications require further development.

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However, blockchain should not automatically be treated as a legal requirement. The proposed Pakistani system could use a conventional secure audit database, a permissioned blockchain or another technically appropriate architecture.
The legal requirement should be:

verifiable integrity and traceability
rather than:

mandatory use of blockchain.
This distinction is important because technology should support evidentiary law rather than determine it.

15. Privacy and Data Protection

A national digital evidence system would contain highly sensitive information. Evidence may include:

- Personal communications;
- Photographs;
- Financial records;
- Medical documents;
- CCTV;
- Location information;
- Private correspondence;
- Confidential business documents.

Accordingly, a digital chain-of-custody framework must incorporate privacy-by-design principles. The system should therefore include:

1. Encryption;
2. Role-based access;
3. Multi-factor authentication;
4. Access logging;
5. Data minimization;
6. Retention schedules;
7. Controlled disclosure;
8. Secure deletion where legally permissible;
9. Judicial authorization for sensitive categories;
10. Penalties for unauthorized access.

The objective should be to balance evidence integrity, fair trial rights and privacy protection.

16. Artificial Intelligence and Future Digital Evidence

The proposed system should also be designed for emerging forms of evidence, particularly AI-generated and manipulated content.Recent Pakistani scholarship has identified difficulties surrounding authentication of AI-generated evidence under Article 164 of the Qanun-e-Shahadat Order. Shahzad et al. (2026) argue that AI-generated content creates additional challenges involving authenticity, reliability, integrity and admissibility.Consequently, the proposed system could include an:

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AI Evidence Verification Module

It could record:

- Source of digital content;
- Original file;
- Hash;
- Metadata;
- AI-detection report;
- Forensic examination;
- Expert identity;
- Verification methodology;
- Confidence limitations;
- Judicial decision.

The system should not automatically decide whether an AI-generated item is genuine. Its purpose would be to provide the judge with a transparent evidentiary history and technical record.

17. Legal Reform Required in Pakistan

Technological development alone will not establish an effective digital chain of custody. Legal and procedural reforms would also be necessary.

17.1 Evidence Identification Rules

Rules should establish minimum information required for registering digital evidence.

17.2 Authentication Rules

Procedures should clarify how authenticity and integrity can be demonstrated.

17.3 Chain-of-Custody Rules

A uniform national procedure should establish who may collect, transfer, analyse and access digital evidence.

17.4 Digital Exhibit Rules

Courts should have standard procedures for assigning digital exhibit numbers.

17.5 Preservation Rules

Rules should specify minimum preservation standards and retention periods.

17.6 Expert Evidence

The legal framework should clarify the role and responsibilities of digital forensic experts.

17.7 Judicial Training

Judges, prosecutors, defence lawyers and court staff should receive specialised training concerning digital evidence.

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18. Proposed Digital Evidence Certificate

A major component of the proposed system could be a **Digital Evidence Integrity Certificate (DEIC).**

The certificate could contain:

Field	Information
Evidence ID	Unique identification
Case No.	Judicial case number
Source	Device/person/system
Acquisition date	Date and time
Acquired by	Authorised officer/person
Hash	Cryptographic value
File type	PDF/video/audio/image etc.
File size	Technical information
Metadata	Preserved metadata
Access history	Authorised access
Transfer history	Chain of custody
Forensic report	Expert examination
Exhibit status	Admitted/rejected
Judicial order	Relevant order

Such a certificate would not itself determine admissibility. Instead, it would provide a standardized evidentiary record for judicial evaluation.

19. Advantages of the Proposed Framework

The proposed framework could contribute to:

19.1 Authenticity

The system would provide information concerning the origin and history of evidence.

19.2 Integrity

Hashing and controlled storage could help detect unauthorized modification.

19.3 Traceability

Every authorized movement or access could be recorded.

19.4 Transparency

Parties could be provided appropriate access to evidentiary records.

19.5 Efficiency

Digital evidence could be retrieved without repeatedly searching physical files.

19.6 Accountability

Audit trails could establish responsibility for evidence handling.

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19.7 Interoperability
A standard national system could facilitate evidence transfer between courts and authorised agencies.

20. Challenges
The framework would also present substantial challenges.

20.1 Cybersecurity
A centralized evidence repository would be an attractive target for cyberattacks.

20.2 Cost
Establishing secure infrastructure across Pakistan's judicial hierarchy would require substantial resources.

20.3 Digital Divide
Not every litigant or lawyer would have equal technological capability.

20.4 Technical Expertise
Judges, prosecutors, lawyers and court officials would require training.

20.5 Inter-agency Coordination
Police, forensic laboratories, prosecution departments and courts would need interoperable procedures.

20.6 Privacy
Sensitive evidence could create serious privacy risks if improperly disclosed.

20.7 System Failure
Courts would need contingency procedures for outages, corrupted files and cyber incidents.

21. Recommendations
Based on the comparative analysis, the following recommendations are proposed:

- Pakistan should integrate digital evidence management into its developing national e-Court architecture.
- A uniform national Digital Chain-of-Custody Protocol should be developed.
- Every digital evidence item should receive a unique Evidence Identification Number.
- Cryptographic hashing should be incorporated into evidence registration.
- Metadata should be preserved where technically and legally appropriate.
- Evidence repositories should use encryption and role-based access.
- Every access, transfer and modification attempt should be logged.
- Courts should establish standard procedures for digital exhibits.
- A Digital Evidence Integrity Certificate should accompany relevant electronic evidence.
- Digital forensic experts should follow nationally standardised procedures.

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- Judicial officers should receive specialised digital-evidence training.
- Lawyers should receive training concerning electronic evidence and chain of custody.
- Rules should establish procedures for challenging the authenticity or integrity of digital evidence.
- The framework should incorporate privacy and data-protection safeguards.
- The system should be interoperable with authorised police and forensic institutions.
- A pilot project should be conducted in selected High Courts and District Courts before national implementation.
- AI-generated and manipulated digital content should receive specific authentication procedures.
- Blockchain may be tested through a permissioned pilot rather than mandated nationally.
- Independent cybersecurity audits should be conducted periodically.
- The framework should be reviewed periodically to address emerging technologies.

22. Conclusion

Pakistan is entering an important stage in the digital transformation of its judicial system. The 2025–2026 developments concerning national e-filing, digital dashboards and judicial digitalisation demonstrate an institutional movement towards integrated electronic court processes.

The next legal and technological question concerns not merely whether evidence can be electronically filed, but whether its integrity, authenticity, provenance and chain of custody can be demonstrated throughout the judicial process.

The experiences of Singapore and the United Kingdom demonstrate that electronic case files and electronic filing can substantially transform court administration. Singapore's ICMS provides secure electronic case-file infrastructure, while the UK's CE-File establishes structured procedures for electronic submission, acceptance, rejection, categorisation and electronic case management.

For Pakistan, the comparative lesson should not be understood as a requirement to reproduce either system. Instead, Pakistan can develop a framework suited to its own evidentiary law and institutional structure. The proposed Pakistani Digital Evidence Integrity and Chain-of-Custody System (P-DEICCS) provides one possible model.

The principal contribution of this research is therefore the conceptual shift from e-filing to evidence integrity. An effective e-Court should not merely create a paperless court file; it should create a trustworthy digital evidentiary environment in which every relevant stage—from acquisition and registration to preservation, examination, disclosure, judicial admission and archival storagecan be traced and independently verified.

Such a framework could provide a legal and technological foundation for Pakistan's next stage of judicial digitalization while preserving the fundamental requirements of authenticity, procedural fairness, accountability and evidentiary reliability.

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