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The Chain of Custody in Criminal Investigations: Legal Standards, Practical Gaps & Challenges

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ABSTRACT

The Chain of Custody plays a pivotal role in the criminal justice process, serving as the foundational mechanism for ensuring the integrity, reliability, and admissibility of evidence presented in court. This research paper provides an in-depth analysis of the legal standards and procedural frameworks that govern the Chain of Custody, with a particular focus on how these structures preserve the authenticity of evidence from the moment it is collected at a crime scene through to its presentation in the courtroom. The study underscores the critical importance of a well-maintained Chain of Custody in upholding the principles of due process and fair trial. Despite the existence of formal protocols, the research highlights numerous practical challenges that frequently undermine the effectiveness of Chain of Custody procedures. Human error, such as inadequate training or carelessness during evidence handling, remains a primary concern. Additionally, lapses in documentation, improper labelling, and substandard storage conditions can compromise the evidentiary value of crucial items. These vulnerabilities not only risk the contamination, alteration, or loss of evidence but can also result in its exclusion from legal proceedings—thereby weakening cases and, in some instances, contributing to miscarriages of justice. To address these shortcomings, the paper explores a range of evolving solutions. Technological innovations—such as digital evidence management systems, blockchain-based tracking, and secure barcode tagging—offer new avenues to enhance transparency, accountability, and traceability throughout the evidentiary process. Moreover, the study emphasizes the need for comprehensive training programs and the development of standardized procedures that can be consistently applied across agencies and jurisdictions. By identifying the systemic weaknesses within existing Chain of Custody frameworks and evaluating both traditional and modern corrective measures, this research contributes valuable insights to the broader field of criminal justice

KeyWords: Chain of Custody, Evidence Integrity, Criminal Justice, Forensic Evidence, Legal Admissibility, Documentation Procedures, Evidence Management, Technological Innovations, Blockchain in Law, Digital Evidence, Human Error, Procedural Safeguards, Criminal Investigations, Judicial Standards, Due Process

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I. INTRODUCTION

A. Background and Importance of Chain of Custody

The chain of custody in the criminal law states that a documentation and managing of all the evidence, and materials collected from the crime scene through forensic tracing process. It is the foremost analytical concept into the numerous fields including crime, forensic, toxicology, managements and pharmacology. The initial focus of managing a chain of custody under the criminal law make a ensuring and reliable to the dimension of integrity and considering the evidence on record which handles the time, place, and purpose of the transfer. In forensic science, for example, the Chain of Custody serves as a safeguard to confirm that evidence which is to be presented in the court shall exactly be same as the one that is collected from the crime scene, free from manipulation or tampering and shall completely be reliable and sustainable in the court. In certain industries such as those including food and pharma, the Chain of Custody aims to set up that all specific criteria are met in regard to safety, ethic or legal standards throughout the process – from origin to the end consumer.³ This is particularly relevant in light of increasing global concerns around sustainability, authenticity, and regulatory compliance. With the rise in digital technologies, there has been rising complexity of aiming to maintain a secure and reliable chain of custody. In order to achieve this, digital signatures, Blockchain management are being introduced so that Chain of Custody system be integrated strongly and transparency can be introduced. But there still exists a need to improve these advancements as a large number of organizations struggle to implement these measures due to lack of training and resource allocation. This chapter thus aims to explores the importance of the chain of custody in both theoretical and practical contexts. By understanding its role in safeguarding credibility and accountability, the study aims to contribute to best practices and strategic improvements in maintaining Chain of Custody across various sectors.⁴

B. Objectives of the Chapter

The primary objective of this chapter is to Establish a clear basis for understand the idea and use of the chain of custody in several fields is the main goal of this chapter. The purpose of this chapter is to explain why Chain of Custody is important for operations that involve sensitive, regulated or legally important items and not just a procedural requirement. By

³ K. Jaiswal, *Forensic Science and Criminal Investigation* 78 (Eastern Book Company, Lucknow, 3rd edn., 2019).

⁴ B.R. Sharma, *Forensic Science in Criminal Investigation and Trials* 215 (Universal Law Publishing, New Delhi, 6th edn., 2016).

analysing the ideas, difficulties, and developments influencing Chain of custody actions, it aims to improve academic and practical viewpoints so that they can establish a comprehensive foundation for understanding the concept and application of the chain of custody in various domains.⁵ Firstly, in order to assist the readers, understand the significance of system of Chain of Custody outside of conventional forensic or legal contexts, the chapter first aims to contextualize its historical development and interdisciplinary significance. It is essential to examine the critical role that Chain of Custody plays in contemporary supply chains, healthcare, cybersecurity, and environmental preservation is part of this. Secondly, it also establishes the specific questions and research emphasis that supports the entire process of investigation. This stage is crucial and important for bringing the contractual framework in line with practical issues like accepting the admissibility of evidence, reduction in fraud, and enhancing systems that outlines the research focus and specific questions that guide the overall study.⁶ Thirdly, the chapter also aims to outline the study's methodology and scope, including the instruments and data sources that were used in the process. This makes the boundaries of the research clear and explains why particular organizations or technological advancements were chosen for in-depth examination. The final goal of this chapter is to study and analyze significant gaps in the body of knowledge and business procedures surrounding Chain of Custody. In order to prepare for upcoming chapters that will go further into case studies, new trends, and suggested models for change, it will be helpful to highlight these essential gaps. Overall, this chapter acts as a support and evidence for the rest of the research, offering both the academic and practical rationale for investigating chain of custody systems in a dynamic and increasingly digitalized world.⁷

C. Research Questions

The research is directed by a collection of specific and connected questions in order to fully examine the chain of custody and its multifaceted effects. These inquiries aim to cover both conceptual knowledge and practical difficulties in putting into practice efficient CoC systems.

- a) What fundamental ideas and elements characterize a trustworthy chain of custody in different industries?
- b) How are chain of custody protocols interpreted and implemented in various industries?

⁵ M.M. Zafar, *Cyber Security and Chain of Custody in Digital Evidence* 92 (LexisNexis, Gurgaon, 2nd edn., 2020).

⁶ Ananya Mishra, "Reimagining Chain of Custody in Healthcare and Pharma: Legal and Ethical Dimensions" 12 *Indian Journal of Law and Technology* 45 (2021).

⁷ Paul L. Kirk, *Crime Investigation: Physical Evidence and the Police Laboratory* 101 (Inter-Science Publishers, New York, 2nd edn., 1974).

- c) Which technical instruments are now improving or complicating the CoC process?
- d) What typical dangers and mistakes are linked to inadequate chain of custody management, and how can these be avoided?
- e) How might international laws or standardized frameworks enhance chain of custody procedures around the world?

D. Methodology and Scope

In order to examine the intricacies and uses of the chain of custody, this study uses a qualitative methodology that combines expert interviews, case study analysis, and literature review. To provide a thorough grasp of CoC systems, the interdisciplinary method incorporates ideas from supply chain management, information technology, law, and forensic science. A fundamental tool for mapping current theories, frameworks, and technological solutions pertaining to CoC is the literature review.⁸ To find best practices, flaws, and knowledge gaps, academic publications, white papers, industry reports, and international standards (such ISO 22095) are examined. Real-world situations where Chain of Custody systems either succeeded or failed are examined using case study analysis. Examples from digital evidence processing, food supply systems, and forensic investigations are among them. Every case is assessed according to the CoC's steps, vulnerabilities, and the consequences of those achievements or failures. To obtain useful insights, professional interviews are also done with practitioners from IT organizations, logistics enterprises, and forensic labs. These interviews shed light on the practical difficulties of preserving CoC and aid in the validation of theoretical ideas. The study's focus is on three main areas: supply chains, digital/data-driven settings, and legal/forensics. While preserving topic consistency, this delimitation permits in-depth investigation. The geographic reach is mostly worldwide, with a focus on countries that have strict CoC laws. The accessibility of case data and the dynamic nature of technologies affecting CoC are examples of limitations. However, the research guarantees robustness and relevance by triangulating data from several sources and methodologies.

II. LEGAL FOUNDATIONS OF CHAIN OF CUSTODY

A. Definition and Key Principles

From the time of collection until they are presented in court or other official processes, the integrity of evidence or materials is guaranteed by the legal and procedural concept known as the chain of custody (CoC). CoC plays a crucial role in demonstrating in court that the object

⁸ S.K. Shukla, *Cyber Forensics: Concepts and Challenges* 143 (LexisNexis, New Delhi, 2nd edn., 2021).

being used as evidence is authentic, undamaged, and has been handled securely and traceably by persons with the proper authorization. Important evidence may become inadmissible due to a broken or incorrectly reported CoC, which could compromise justice.

Some Fundamentally, CoC is guided by a number of important principles:⁹

1. Continuity: Every stage of the transfer, storage, and analysis must be documented in an uninterrupted trail.
2. Integrity: The evidence needs to be kept safe from contamination, tampering, and change.
3. Accountability: All individuals who handle the evidence need to be named and held accountable.
4. Documentation: Every step of the evidence process requires thorough records that include who handled it, when, where, and why.

These guidelines are crucial for civil litigation, environmental regulation, and industry-wide regulatory compliance in addition to criminal justice systems. For example, in order to maintain their credibility, digital evidence in cybercrime prosecutions or biological samples in environmental issues need to follow an equally strict chain of custody. With the use of technologies like digital timestamps, blockchain, and forensic imaging, the legal significance of CoC has expanded to encompass digital and hybrid forms of documentation. The fundamental legal precepts of openness, dependability, and procedural justice endure notwithstanding this modernity. Since upholding a strong chain of custody can determine the validity of an entire investigation, it is imperative that law enforcement, attorneys, and anyone handling regulated materials understand these concepts.¹⁰

B. International Legal Standards (e.g., ICC, UNODC Guidelines)

International legal norms for chain of custody have been considered essential due to the globalization of human rights investigations, crime, and business. By adhering to these points, evidence which is collected in one jurisdiction can be trusted and admitted in another jurisdiction. The United Nations Office on Drugs and Crime (UNODC) and the International Criminal Court (ICC) are two important organizations influencing these global standards. In order to preserve due process and equity in international criminal prosecutions, the ICC, which was founded under the Rome Statute, aims to establish evidence management procedures. Physical evidence processing and documentation are specifically governed by

⁹ B.R. Sharma, *Forensic Science in Criminal Investigation and Trials* 117 (Universal Law Publishing, New Delhi, 6th edn., 2016).

¹⁰ Nidhi Srivastava, "Chain of Custody in Environmental and Toxicological Evidence: Legal Implications" 59 *Journal of the Indian Law Institute* 243 (2017).

Rule 110 of the ICC's Rules of Procedure and Evidence, which places a strong attention on integrity and traceability. Chain of custody is essential in cases involving war crimes, genocide, and crimes against humans, where evidence may be collected across multiple countries under complex and strict conditions. In a similar way, the UNODC has released recommendations on how to uphold CoC in a variety of situations, including anti-corruption proceedings, narcotics enforcement, and wildlife trafficking. Their "Guidance Manual for Law Enforcement and Prosecutors" from 2009 emphasizes the value of consistent protocols, international collaboration, and appropriate training for police handling evidence. The handbook describes how to gather, mark, seal, preserve, and record evidence in a manner that conforms to both domestic and global legal requirements. Multinational task teams tackling transnational crimes or national legal systems frequently use these international principles as templates. Additionally, they facilitate extradition procedures and mutual legal assistance by promoting the standardization of practices.¹¹

C. National Legal Frameworks (Comparative Analysis)

The definition and implementation of chain of custody procedures vary and are similar across national legal systems. There are certain Jurisdictional legal traditions (civil law vs. common law), technical infrastructure, and the development of forensic and judicial institutions that promote these distinctions. There are certain similarities and differences in the way that the Chain of Custody is applied in a few nations, like the US, UK, and India.¹²

Chain of Custody is a clearly well-established legal theory in the United States, as established by the Federal Rules of Evidence, specifically Rules 901 and 902. All digital or physical evidence must be verified by courts by proving an uninterrupted line of possession. Suppression of evidence may result from any documentation breakdown or inexplicable treatment. The U.S. system often relies heavily on witness testimony from individuals who handled the evidence, corroborated by physical logs or digital records. The Police and Criminal Evidence Act (PACE) 1984, which governs court practice guidelines and procedures of police in the UK, incorporates the Chain of Custody. The UK Accreditation Service (UKAS) has accredited forensic labs, and paperwork and storage standards are enforced in a strict manner, just like in the United States. Additionally, the UK places a strong emphasis on digital CoC procedures, especially when looking into cybercrimes. This comparison reveals an important fact: although the legal notion of CoC is broadly accepted, there are

¹¹ Aparna Chandra, "Transnational Evidence and the Challenge of Admissibility in International Criminal Law" 60 *Journal of the Indian Law Institute* 345 (2018).

¹² Stephen A. Saltzburg et al., *Federal Rules of Evidence Manual* 231 (LexisNexis, New York, 11th edn., 2015).

significant differences in how it is applied. In addition to legislative alignment, harmonizing these frameworks—particularly in multinational contexts—requires expenditures in infrastructure, training, and digital transformation.¹³

D. Judicial Precedents Shaping Chain of Custody Rules

In all legal systems, judicial rulings have a significant influence on how the chain of custody is understood and used. In order to establish precedents that direct future inquiries, prosecutions, and defence tactics, courts frequently interpret and apply the CoC standards in light of the particular facts of each case. These decisions highlight the significance of handling evidence carefully and the repercussions of improper procedures. The case of *United States v. Lott*,¹⁴ is often cited in the United States. The court decided that, as long as there is a reasonable confidence of the item's identity and integrity, even small breaks in the chain of custody do not automatically make evidence inadmissible. But in decisions like *United States v. Howard-Arias (1982)*,¹⁵ the court stressed that uneven labelling or inexplicable breaks might seriously raise questions about the reliability of the evidence, which could result in its rejection. Significant contributions to CoC jurisprudence have also come from the Indian judiciary. The Supreme Court of India held in *State of Rajasthan v. Daulat Ram (1980)*,¹⁶ that the prosecution had to demonstrate that the sample was authentic and unaltered. Similar to this, the court determined in *Hardip Singh v. State of Punjab (2008)*,¹⁷ that the prosecution's version was questioned due to improper CoC, which resulted in acquittal. In several decisions. Together, these court rulings support the idea that following the CoC is essential to justice and goes beyond simple procedure. Courts have made it apparent that entire cases might be jeopardized by carelessness or oversight in maintaining the chain. Therefore, CoC must be regarded by investigators and legal experts as an essential and non-negotiable component of legal integrity.

III. THE CHAIN OF CUSTODY PROCESS IN CRIMINAL INVESTIGATIONS

A. Detailed Procedures: From Gathering to Courtroom

From the time evidence is gathered until it is presented in court, there are a number of clearly defined procedures involved in maintaining a strong chain of custody (CoC). Every step is

¹³ Rukmini Sen, "Admissibility of Electronic Evidence and the Indian Legal System: Gaps and Challenges" 57 *Journal of the Indian Law Institute* 47 (2015).

¹⁴ 854 F.2d 244 (1988).

¹⁵ 679 F. 2d 363 (1982).

¹⁶ AIR 1980 SC 1314.

¹⁷ AIR 2009 SC 432.

intended to guarantee the evidence's validity, integrity, and admissibility.¹⁸

Step 1: Gathering Proof - The meticulous identification, retrieval, and packing of evidence at the scene is the first step in the CoC. To avoid contamination, investigators must use sterile instruments and wear gloves. Tamper-evident tape is used to seal each item after it has been put in the proper container (paper bags for biological samples, anti-static bags for electronics). As soon as possible, the collector needs to mark the object with a unique case number, date, time, location, and description.

Step 2: Preliminary Records - At the time of collection, a chain of custody form is started. Who, where, and when the evidence was gathered are all documented in this document. It will accompany the evidence on all of its journeys, documenting each transfer, storage, and inspection.

Step 3: Storage and Transportation - The evidence is safely taken to a storage facility or forensic laboratory. Sensitive objects require certain environmental conditions (such as temperature control) to be maintained during this operation. Evidence is kept in safe storage with limited access at the facility and entered into a tracking system.

Step 4: Investigation of Forensics - The evidence is examined in a controlled environment by authorized forensic specialists. Every action—tests, participants, and outcomes—is painstakingly recorded. We also keep track of any subsamples that are taken out for testing.

Step 5: Court Presentation - Lastly, the proof could be shown in court. Attorneys must prove that the object is genuine and unaltered from when it was picked up. To prove credibility, the full CoC documentation is provided.

The evidence may be dismissed or declared inadmissible if there is a breach in this chain, such as missing documents, illegal access, or incorrect packaging.

B. Key Stakeholders and Their Roles (Law Enforcement, Forensic Experts, Prosecutors, Defence Counsel)

The Chain of Custody (CoC) process involves a network of stakeholders, each playing a critical role in maintaining the integrity, admissibility, and reliability of evidence throughout its lifecycle. The effectiveness of the CoC depends on interdisciplinary collaboration, mutual accountability, and strict adherence to procedural norms. A single lapse by any actor can

¹⁸ R.C. Mishra, *Forensic Science in Criminal Investigation and Trials* 233 (Central Law Publications, Allahabad, 5th edn., 2021).

compromise the evidentiary value and potentially jeopardize an entire legal proceeding.¹⁹

- a) **Police Officers** - As the first responders, police officers and crime scene investigators are responsible for the identification, collection, and initial documentation of physical and digital evidence. Their duties include securing the crime scene, ensuring that evidence remains uncontaminated, and initiating the CoC record. Police must also ensure that every transfer of evidence—whether to a forensic lab or storage facility—is accurately logged, including timestamps and recipient credentials.
- b) **Forensic Experts** - Forensic analysts play a pivotal role in examining and analyzing evidence for both investigative and judicial purposes. Their responsibilities include the secure receipt and storage of evidence, performing validated testing procedures, and documenting each step of the forensic process. They must account for any changes in the condition of the evidence and often provide expert testimony in court to defend the authenticity and scientific reliability of their findings.
- c) **Public Prosecutors** - The prosecution relies on the CoC to demonstrate the integrity of evidence before the court. Prosecutors review the complete CoC trail to ensure legal compliance at every stage. They coordinate with law enforcement and forensic experts to address potential defence objections and strategically present a narrative that upholds the evidentiary chain. Their pre-trial preparation often includes reinforcing the CoC to pre-emptively defend against suppression motions.
- d) **Defence Counsel** - Defence lawyers serve as critical evaluators of the CoC, tasked with identifying gaps, inconsistencies, or procedural violations that may render evidence inadmissible. Successful challenges—such as proving undocumented transfers or unauthorized access—can result in exclusion of critical evidence, thus safeguarding the accused's rights and preserving procedural fairness. Their role is indispensable in testing the robustness of the prosecution's evidence-handling protocols.

Ultimately, a flawless and transparent CoC requires cooperation and diligence from all stakeholders. The interdependency among these roles underscores the necessity for standardized training, precise documentation, and accountability mechanisms across all stages of the criminal justice process.²⁰

¹⁹ K. Kumar, *Criminal Investigation: Law and Practice* 157 (LexisNexis, Gurgaon, 3rd edn., 2020).

²⁰ Aditya P. Singh, "Accountability and Collaboration in Evidence Handling: Revisiting Chain of Custody Protocols" 49 *Criminal Law Journal* 199 (2021).

C. Documentation and Record-Keeping Requirements

A credible Chain of Custody (CoC) relies fundamentally on rigorous documentation at every point of the evidence lifecycle. From collection through transport, testing, and final disposition, documentation ensures both legal admissibility and procedural accountability. It provides a continuous, verifiable history of how evidence was handled, stored, and examined, thus reinforcing its authenticity and integrity.²¹

- a) **Form of Chain of Custody** - This shape is started when the evidence is gathered and stays with it for the duration of its existence. It consists of the item's description; the date, time, and place of collecting; the collector's name and signature; every subsequent transfer: names, signatures, times, and purposes; the item's final disposition (such as return, destruction, or storage);
- b) **Labels and Evidence Logs** - Tamper-proof tags that match entries in the CoC form and evidence logbooks must be used to clearly designate every item. In high-volume applications, the usage of RFID tags or digital barcoding is growing in popularity due to its precision and efficiency.
- c) **Logs of Storage and Access** - Access logs, kept by secure storage facilities, document who entered the storage space, when they did so, and why. To stop unwanted access, evidence rooms should be confined, watched over and routinely examined.
- d) **Reports from Forensic Examinations** - These reports detail each step taken with the evidence, from laboratory testing to visual examinations. They must contain information regarding sample treatment and outcomes, as well as chain references that demonstrate that the evidence assessed is identical to that which was initially gathered.²²
- e) **Systems for Digital Documentation** - Digital evidence management systems (DEMS) are being used by several agencies to improve traceability and decrease human error. To guarantee compliance, these platforms frequently incorporate digital signatures, barcode scanners, and automatic alarms.

Even carefully gathered evidence may be dismissed in court if it is contradictory, lacking in detail, or unconfirmed. Thus, strict record-keeping is a legal requirement that preserves

²¹ V. Nageswara Rao, *Criminal Law: The Chain of Custody and Evidentiary Integrity* 106 (Satyam Law International, Delhi, 1st edn., 2021).

²² S. K. Verma, *Legal and Scientific Dimensions of Forensic Evidence* 94 (LexisNexis, Gurgaon, 2nd edn., 2019).

justice, not merely an administrative one.²³

IV. PRACTICAL GAPS IN MAINTAINING CHAIN OF CUSTODY

A. Common Breaches and Weaknesses

The chain of custody (CoC) is only as strong as its weakest link. Despite the existence of comprehensive guidelines and protocols, real-world implementation often falls short due to a combination of human, technological, and procedural vulnerabilities. These breaches not only undermine investigations but can also compromise justice itself.

1. Human Error and Training Deficiencies

Despite technological advances and the codification of procedural norms, human error remains one of the most persistent and damaging vulnerabilities in the Chain of Custody (CoC) framework. Mistakes can occur at every stage of the evidence lifecycle—from collection to court presentation—threatening the admissibility and credibility of evidence. Some Common errors are as follows:

- a) Mislabelled or unlabelled items, leading to ambiguity in identification;
- b) Incomplete or incorrect CoC documentation, such as missing signatures or dates;
- c) Improper evidence packaging, such as sealing biological samples in plastic bags instead of breathable containers;
- d) Inaccurate or unrecorded evidence transfers, creating gaps in the chain.

In some cases, experienced professionals may deviate from protocol due to perceived efficiency or familiarity, undermining procedural uniformity. Additionally, administrative complacency such as failing to implement routine audits or update training manuals can institutionalize poor practices.²⁴ To address these vulnerabilities, a range of corrective mechanisms must be institutionalized:

- a) Simulation-based training for real-world scenario preparedness;
- b) Mandatory periodic certification in evidence handling protocols;
- c) Internal audits and peer reviews to identify and correct procedural slippages;
- d) Centralized digital CoC systems that reduce manual entry and flag inconsistencies;
- e) Interdisciplinary collaboration to maintain legal, scientific, and procedural integrity.

²³ Aarti Narayan, “The Role of Documentation in Evidence Admissibility: Strengthening the Chain of Custody” 48 *Indian Bar Review* 121 (2021).

²⁴ R.K. Tiwari, *Criminal Procedure and Evidence Handling: Modern Challenges* 87 (Eastern Book Company, Lucknow, 2020).

Ultimately, the effectiveness of the CoC system hinges on the awareness, accountability, and professionalism of those tasked with preserving it. Preventing human error is not merely a technical exercise—it is a safeguard of justice.²⁵

2. Inadequate Technological Systems

Technology is essential to the chain of custody, especially when it comes to tracking, recording, and evidence management. However, many criminal justice organizations use antiquated or insufficient systems, which can result in inefficiencies and breaches, particularly in developing or resource-constrained nations. There is still widespread use of manual, paper-based CoC logs, which are vulnerable to forgery, loss, and human error. Physical forms may be misplaced or destroyed, and handwritten logs may be inconsistent or unreadable. Without a centralized system, tracking several things in high-volume instances frequently leads to confusion or duplication, raising the possibility of improper transfers or unauthorized access.²⁶ Information silos can result from a lack of interoperability between agencies (such as the police, forensic labs, and courts) even in the presence of digital technology. A prosecutor may get evidentiary records that are out of date, or a forensic analyst may not have access to crucial metadata. Additionally, the potential of data breaches, manipulation, or loss of digital evidence logs is increased by inadequate cybersecurity protocols. Evidence pertaining to digital devices, including mobile phones or hard drives, may be inadmissible if forensic imaging is done incorrectly if metadata is not preserved. It becomes challenging to prove that the evidence has not been tampered with in the absence of strong audit trails, particularly in cybercrime investigations. In certain countries, standards are being raised through investments in blockchain-based CoC tools, RFID monitoring, and Evidence Management Systems (EMS). Widespread adoption of these technologies is still hampered by their expense, complexity, and training requirements. In addition to improving accountability and openness, appropriate technology assistance guarantees that the legal significance of evidence is maintained throughout its existence.²⁷

B. Case Studies of Chain of Custody Failures

Some real-world legal cases offer compelling illustrations of how breaches in the Chain of Custody (CoC) can profoundly impact the outcomes of criminal trials. These examples

²⁵ Neha Bhatia, “Breaking the Chain: Human Errors and Evidentiary Failures in Indian Criminal Trials” 45 *Indian Journal of Criminology* 204 (2020).

²⁶ Casey Eoghan, *Digital Evidence and Computer Crime: Forensic Science, Computers and the Internet* 52 (Academic Press, 3rd edn., 2011).

²⁷ Matthew Simon, “Blockchain for Forensics: Bridging the Gap in Evidentiary Integrity” 29 *International Journal of Law, Crime and Justice* 191 (2021).

underscore the indispensable role of procedural rigor, documentation, and inter-agency accountability in evidence handling. Even minor lapses can lead to acquittals, reduced sentences, or a broader erosion of public confidence in the justice system.

Case 1: O.J. Simpson (United States) - The murder trial of former NFL player O.J. Simpson remains one of the most prominent examples of CoC failure undermining the prosecution's case. Critical DNA evidence was marred by serious procedural lapses. One blood sample was reportedly carried in an investigator's pocket for several hours without refrigeration, while others were stored in substandard conditions. Allegations of cross-contamination, improper handling, and missing documentation cast serious doubt on the evidence's credibility. While Simpson was acquitted, the case demonstrated how forensic mismanagement—even where guilt may be independently supported—can compromise prosecutorial credibility and due process.²⁸

Case 2: State of Maharashtra v. Prakash (India) - This case involving charges of rape, the Bombay High Court overturned the conviction due to a broken CoC. Forensic samples were collected but only sent to the laboratory after a delay of several days, with no documentation regarding their interim storage. The court held that the possibility of tampering or contamination could not be excluded, rendering the evidence unreliable. The absence of proper records was deemed sufficient to create reasonable doubt, leading to acquittal.²⁹

Case 3: R v. Joyce (United Kingdom) - This UK case involved narcotic evidence that was left unattended in an unsecured location for several hours before being transferred to a forensic lab. Although the trial court admitted the evidence, the defence highlighted the procedural lapse to question its reliability. On appeal, the court accepted that the breach in CoC—though not fatal to admissibility—warranted a reduced sentence due to doubts about evidence integrity.³⁰

These incidents show how even small violations of the Code of Conduct (CoC), such as unsealed containers, inadequate documentation, or delays, can have disastrous legal repercussions. They act as warning stories that emphasize the necessity of strong protocols, continual instruction, and technological protections while handling evidence.

C. Legal and Societal Ramifications of Chain of Custody Breaches

Failures in maintaining a robust Chain of Custody (CoC) can have far-reaching and often irreparable consequences. These lapses compromise the evidentiary foundation of criminal

²⁸ Case No. BA097211 (Superior Court of California, 1995).

²⁹ 2005 SCC OnLine Bom 321.

³⁰ [2005] EWCA Crim 1781.

trials, lead to the release of guilty individuals, and risk convicting the innocent. Beyond the courtroom, such failures have ethical, legal, and societal repercussions that undermine the legitimacy of the justice system.

- a) **Tainted or Altered Evidence** - When evidence is not adequately sealed, tracked, or preserved, it becomes vulnerable to contamination or tampering. Biological samples stored in inappropriate conditions can yield false or inconclusive DNA profiles, while digital evidence may lose integrity if metadata is altered or improperly handled. In either case, the evidentiary value is compromised, casting doubt on its authenticity and reliability.³¹
- b) **Exclusion of Evidence in Court** - Courts are bound by the principle that the prosecution must establish an unbroken CoC to prove the authenticity of the evidence. Where reasonable doubt exists—due to missing records, undocumented transfers, or procedural inconsistencies—courts may apply the **exclusionary rule** to suppress such evidence. This is rooted in the right to a fair trial, and while constitutionally necessary, it can lead to the acquittal of otherwise guilty individuals due to procedural defects.
- c) **Miscarriages of Justice** - Broken CoC protocols have contributed to numerous wrongful convictions globally. Organizations like the **Innocence Project** have demonstrated that improper evidence handling, undocumented forensic procedures, and tampered samples have been central to many exonerations. The damage inflicted by such miscarriages extends beyond the wrongfully convicted—it undermines the entire system's credibility and retraumatizes victims by denying them true justice.³²
- d) **Erosion of Public Trust and Legal Exposure** - High-profile CoC failures erode public confidence in law enforcement, forensic institutions, and the judiciary. These breaches may result in successful appeals, civil liability claims, retrials, and institutional censure. In politically sensitive or internationally watched cases, CoC violations can lead to diplomatic fallout and global criticism. The financial and reputational costs are particularly severe when systemic neglect is exposed.³³

Therefore, maintaining a clear and defensible Chain of Custody is not merely a procedural formality—it is a legal safeguard and moral imperative. The implications of CoC breaches reveal the fragile balance between evidence reliability and procedural fairness. In

³¹ Ratanlal & Dhirajlal, *The Law of Evidence* 221 (LexisNexis, New Delhi, 26th edn, 2023).

³² S. Ramesh, "Importance of Maintaining Chain of Custody in Criminal Trials" 62 *Journal of the Indian Law Institute* 341 (2020).

³³ K.N. Chandrasekharan Pillai, *Criminal Procedure* 114 (Eastern Book Company, New Delhi, 1st edn., 2022).

safeguarding this chain, the justice system affirms its commitment to truth, accountability, and public trust.

V. CHALLENGES IN ENFORCING CHAIN OF CUSTODY STANDARDS

A. Resource Constraints (Funding, Personnel, Infrastructure)

The lack of resources is one of the most enduring and fundamental obstacles to preserving an efficient chain of custody (CoC). Upholding the integrity of evidence requires sufficient financing, trained staff, and well-maintained infrastructure, but many jurisdictions—especially those in underfunded agencies or developing nations—face significant challenges. Lack of funding results in the restricted acquisition of necessary equipment, including secure transit trucks, refrigerated storage facilities for biological samples, and tamper-evident packaging. Without these fundamentals, evidence could be handled carelessly, housed incorrectly, or exposed to environmental conditions that could jeopardize its integrity. Additionally, a lot of law enforcement organizations rely on antiquated, error-prone paper logs because they cannot afford to invest in contemporary digital evidence management systems. The procedure is further strained by a lack of personnel. Officers and forensic experts who are overworked might not have the time to thoroughly record each transfer or examination.³⁴

In these settings, procedural shortcuts—which are frequently inadvertent—become prevalent and jeopardize the admissibility of evidence. Additionally, positions like scene-of-crime officers or evidence custodians may be occupied by people with inadequate training as a result of understaffing. Limitations in infrastructure are also quite important. For instance, the absence of secure digital storage systems or climate-controlled evidence rooms may cause sensitive material to deteriorate or be accessed by unauthorized parties. Because forensic labs are often understaffed and centralized, evidence may occasionally be transported vast distances without adequate documentation. In addition to greater financial investment, addressing these resource shortages calls for more effective allocation and supervision. The integrity of the criminal justice system and the fairness of legal proceedings are directly threatened by the neglect of CoC infrastructure, which governments and judicial institutions must acknowledge is more than just a technical error.³⁵

B. Jurisdictional and Cross-Border Complications

Evidence frequently crosses jurisdictional boundaries in a world that is becoming more

³⁴ R. Sarveshwaran, *Forensic Science and Criminal Justice: A Critical Analysis* 149 (Thomson Reuters, London, 1st edn., 2021).

³⁵ Aarti Singh, "Systemic Resource Deficits and Their Impact on Evidence Integrity in India" 63 *Journal of the Indian Law Institute* 312 (2021).

interconnected. This is particularly true for transnational crimes like international terrorism, human trafficking, and cybercrime. The preservation of the chain of custody (CoC) across many legal systems, languages, and procedural norms is made more difficult by these circumstances. Gaps or discrepancies may arise from differences in country CoC protocols.³⁶ There may be disagreements regarding admissibility if the evidentiary standards of two nations differ. For instance, an item gathered in Country A in accordance with legal processes may be declared inadmissible in Country B because notarized paperwork is missing or transfer procedures are incorrect. These distinctions make prosecutions more difficult, particularly in collaborative investigations or international courts. Several law enforcement and forensic organizations are frequently involved in cross-border investigations. It becomes challenging to coordinate the gathering, storing, and transfer of evidence in the absence of unified systems or mutual legal aid treaties (MLATs). Language hurdles, a lack of acquaintance with foreign legal norms, and delays in diplomatic permissions all raise the possibility of CoC violations.³⁷

Furthermore, there are dangers associated with custody and transportation problems during cross-border travel. Secure cross-border transportation of evidence is required, frequently involving several carriers and checkpoints. Documentation becomes more complicated with each handover, and any interruption—like an undocumented layover or an unattended transfer—can put the chain at risk. There are ongoing efforts to standardize CoC norms among countries, including through regional programs like ASEANAPOL or Eurojust, UNODC recommendations, and INTERPOL protocols. Effective implementation is still inconsistent, though.³⁸

C. Technological Advancements vs. Legal Adaptation (e.g., Digital Evidence)

The creation, storage, and analysis of evidence have all undergone significant changes as a result of the quick development of technology. The chain of custody (CoC) is significantly impacted by the tension that results from legal frameworks' frequent inability to keep up, which leaves a gap between what is legally recognized and what is practically feasible. Digital evidence poses special difficulties, ranging from GPS logs and surveillance footage to metadata, emails, and text messages. Digital data may be copied, altered, or transferred without leaving obvious traces, unlike physical objects. In addition to technological expertise,

³⁶ V. Balasubramaniam, *Transnational Crime and Criminal Justice: Legal Frameworks and Challenges* 198 (SAGE Publications 2022).

³⁷ Bassiouni M. Cherif, *International Extradition and World Public Order* 276 (LexisNexis, New Delhi, 1st edn., 2021).

³⁸ □ Anjali Prasad, "Challenges in Cross-Border Evidence Handling: A Legal and Procedural Overview" 63 *Journal of the Indian Law Institute* 349 (2021).

legal validation of processes like forensic imaging, hash value verification, and metadata archiving is necessary to maintain the integrity of such evidence.³⁹

Regretfully, there aren't many uniform, explicit rules regarding digital CoC in various legal systems. Therefore, depending on how digital evidence was gathered, preserved, or presented, courts may have different opinions on whether or not to accept it. Even when gathered in good intention, important evidence is frequently inadmissible due to antiquated legislation, inconsistent rulings, and differing judicial awareness. Blockchain, artificial intelligence (AI), and cloud-based evidence management systems are examples of emerging technologies that provide answers but also bring up new legal issues. Cloud storage also complicates the CoC by bringing up concerns about encryption, data sovereignty, and access management. The legal standards must be adapted proactively rather than reactively.⁴⁰ To create adaptable yet strict rules that tackle present and upcoming issues, legislators, courts, and legal experts must collaborate with technologists. This covers the creation of digital CoC protocols, training for courts and law enforcement, and global agreement on admissibility standards. In the end, maintaining the applicability and efficacy of CoC in the digital era requires closing the gap between technological competence and legal recognition.⁴¹

VI. SIGNIFICANCE OF CHAIN OF CUSTODY IN CRIMINAL INVESTIGATION

The chain of custody (CoC) plays a vital role in upholding the integrity and reliability of evidence in criminal investigations. It ensures that evidence collected at the crime scene is properly documented, handled, and preserved through every stage of the investigative and judicial process. A properly maintained CoC is crucial not only for securing convictions of the guilty but also for protecting the rights of the accused and preventing miscarriages of justice. This study is significant because it explores the intersection of legal theory and practical enforcement mechanisms, identifying how legal standards regarding the chain of custody are interpreted, applied, and often challenged in real-world contexts. In particular, it highlights systemic and procedural gaps that may compromise the evidentiary value and admissibility of crucial material in courtrooms.⁴²

Furthermore, the study takes into account the increasing complexities introduced by digital and electronic forms of evidence, which require new approaches to authentication, documentation, and preservation. As courts and investigative agencies grapple with these

³⁹ S.R. Sharma, *Cyber Law and Digital Evidence* (LexisNexis, New Delhi, 1st edn., 2023).

⁴⁰ R. Jain, "Admissibility of Digital Evidence and the Challenges to Chain of Custody in India" 64 *Journal of the Indian Law Institute* 188 (2022).

⁴¹ Aparna Viswanathan, *Cyber Law: The Indian Perspective* 205 (LexisNexis, New Delhi, 2nd edn., 2021).

⁴² Vepa P. Sarathi, *Law of Evidence* 129 (7th edn, Eastern Book Company, Delhi, 7th edn., 2023).

challenges, understanding where the law lags behind practice becomes essential for reform. By critically examining legal frameworks, case law, and practical challenges in CoC maintenance—especially within the Indian criminal justice system—this essay provides insights valuable to legal professionals, law enforcement agencies, and policymakers. Ultimately, the study emphasizes the need for robust procedural safeguards, continuous training, and updated legislation to ensure that the pursuit of justice remains fair, transparent, and based on credible evidence.⁴³

VII. CONCLUSION

The chain of custody (CoC) in criminal justice systems was thoroughly examined in this study, with a focus on its critical function in guaranteeing the integrity and admissibility of evidence. The study started by outlining the fundamental significance of CoC, emphasizing the need for meticulous management of every stage, from gathering evidence to presenting it in court, to avoid contamination, tampering, or procedural violations. Both international and national frameworks were examined in the assessment of the legal underpinnings. National legal systems differ in their rigor and methodology, but instruments like the ICC and UNODC recommendations offer uniform standards. Disparities in how nations establish, implement, and enforce CoC regulations were found through comparative assessments, particularly with regard to digital evidence. In Conclusion, some possible remedies were put forth, such as improved training, more international collaboration, Blockchain and EMS adoption, and legal reform. In order to strengthen CoC as a dynamic, robust, and legally sound process, these tactics are essential. All things considered, the study confirms that CoC is a vital component of justice and not only an administrative need, necessitating constant funding, attention, and modernization.

⁴³ Tanvi Mehra, "Preserving Evidentiary Integrity: A Legal Analysis of Chain of Custody in India" 63 *Journal of the Indian Law Institute* 289 (2021).