



The Chain Of Custody And Its Impact On The Admissibility Of Forensic Evidence In The Ecuadorian Criminal Process

La Cadena De Custodia Y Su Impacto En La Admisibilidad De La Evidencia Forense En El Proceso Penal Ecuatoriano

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Summary

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The study focused on analyzing the impact of the chain of custody on the admissibility of forensic evidence in Ecuador's criminal proceedings. To this end, 60 lawyers from the Bar Association of Bolívar province participated, selected intentionally for their expertise in criminal law. The research employed a mixed-methods approach, combining the analysis of legal norms and legislation with the application of a structured survey featuring closed-ended questions.

The results revealed that 68.3% of respondents had an in-depth understanding of chain of custody procedures, while 75% agreed that deficiencies in its application could lead to the exclusion of evidence in court. Additionally, 60% perceived that its implementation was generally correct, though 30% noted that its effectiveness depended on the case. Thus, the study demonstrates that inconsistent or deficient chain of custody practices can

undermine fundamental rights and compromise the validity of evidence.

Consequently, the study concludes that the chain of custody is a crucial tool to ensure due process, evidence integrity, and trust in the criminal justice system. Overcoming existing challenges-such as lack of training, limited resources, and interagency coordination gaps-is deemed essential.

Keywords: Custody, Criminal, Admissibility, Evidence, Proof.

Resumen

El estudio se centró en analizar el impacto de la cadena de custodia en la admisibilidad de la evidencia forense en el proceso penal ecuatoriano. Para ello, participaron 60 abogados del foro de la provincia de Bolívar, seleccionados de forma intencionada por su experiencia en derecho penal. La investigación adoptó una metodología bajo un enfoque mixto, combinando el análisis de la normativa y legislación con la aplicación de una encuesta estructurada con preguntas cerradas. Los resultados revelaron que el 68,3% de los encuestados poseía un conocimiento profundo sobre los procedimientos de cadena de custodia, mientras que el 75% coincidió en que las deficiencias en su aplicación pueden provocar la exclusión de pruebas en juicio. Asimismo, el 60% percibió que su implementación se realiza correctamente, aunque un 30% señaló que su eficacia dependía del caso. Es por ello que, se evidencia que una aplicación inconsistente o deficiente de la cadena de custodia puede vulnerar derechos fundamentales y afectar la validez de las pruebas. Por lo tanto, se ha determinado que la cadena de custodia es una herramienta esencial para garantizar el debido proceso, la integridad de la evidencia y la confianza en el sistema penal, siendo indispensable la superación de desafíos existentes como la falta de capacitación, recursos limitados y deficiencias en la coordinación interinstitucional.

Palabras clave: Custodia, Penal, Admisibilidad, Evidencia, Prueba.

Introduction

The renewed criminal justice system has based its actions in great proportion and with increasing strength, on the ability to reconstruct criminal acts based on great precision and objectivity, which is why forensic evidence is understood as the set of material elements, traces, vestiges or any evidence that can establish the existence of a crime and the participation of all those responsible, being for this reason, the reason to emerge as an essential pillar in this process (Arias & Cedeño, 2024; Flores & Sanchez, 2024). However, the mere presence of forensic evidence at a crime scene does not guarantee, *per se*, its usefulness in the judicial process.

The probative value and its admissibility during a trial are directly related to the strict compliance with a series of steps, procedures and protocols that ensure the care, integrity, authenticity and inalterability of any evidence taken from the crime scene. This procedure is known as the chain of custody, being the fundamental mechanism for the validity of evidence in criminal proceedings (Marchal, 2023).

Now, in the Ecuadorian context, the Comprehensive Organic Criminal Code (COIP) regulates the specific framework for the application of the chain of custody, among them establishes the guidelines that must be applied when the experts are going to intervene in a crime scene, since the proper collection, packaging, transport, storage and analysis of the evidence depends on it, this in order to maintain and preserve the probative value to ensure the right to due process of the interveners (Código Orgánico Integral Penal [COIP], 2014). The correct application of these guidelines not only strengthens the State's capacity to investigate and punish

criminal conduct, but also protects the rights of the accused, by ensuring that the evidence against them is reliable and has not been subject to manipulation or alteration (Flores & Sanchez, 2024).

Therefore, the analysis of the chain of custody in the Ecuadorian criminal justice system should be considered as a fundamental element in order to determine its importance in the admissibility of forensic evidence and, therefore, in the outcome of judicial proceedings. Initially, it is assumed that a solid and well-documented chain of custody substantially increases the likelihood that forensic evidence will be effectively admitted in criminal proceedings by guaranteeing the integrity, authenticity and credibility of the evidence presented in court.

The COIP becomes the central axis of applicability for the Ecuadorian legal context, which is why this instrument establishes all the parameters regarding the chain of custody and its correct application, conceiving it as the procedure that supports the evidence from its origin, i.e. the respective collection, until the presentation at trial, ensuring that the material collected and examined by the experts and assessed by the judges is the same as the original one from the crime scene, without alterations, contamination, substitutions or loss (COIP, 2014).

In addition, this body of law defines the responsibilities of all the actors involved, i.e., from the officials who proceed with the collection of evidence at the crime scene, to the expert, who is the person who analyzes the samples in laboratories, to finally proceed with the judges who evaluate the findings at the trial stage (Chuma & Durán, 2024). As there is a distribution of responsibilities, the intention is to look for gaps in the handling of evidence collected and thus ensure that each stage of the process is developed and justified correctly, therefore, it is fundamental and crucial to emphasize that the chain of custody is not limited only to physical evidence, but also covers digital evidence, since in recent years

computer crimes and the use of technology has been increasing considerably.

On the other hand, the influence of international standards and contemporary criminal doctrine in Ecuadorian law has allowed to recognize the chain of custody from a stronger element, and not only as a formalism, since it constitutes an essential guarantee for the validity of evidence in criminal proceedings. Its focus is on the protection of due process, enshrined in Article 76 of the Constitution of the Republic of Ecuador, which establishes the right to a fair trial, the presumption of innocence and the right to contradict evidence. The chain of custody, by ensuring the authenticity of evidence, allows the parties to exercise their right of defense, question the evidence presented against them and avoid convictions based on dubious or manipulated evidence (Constitution of the Republic of Ecuador, 2008). The Constitution, being the supreme norm in Ecuadorian territory, establishes the limits and parameters within which all criminal procedural activity must be developed, inserting the chain of custody as a mechanism to guarantee respect for the fundamental rights of the persons involved in a criminal proceeding. The correct application of the chain of custody (Brito & Muñoz, 2023), therefore, becomes a *sine qua non* requirement for the legitimacy of state action in the investigation and prosecution of crimes.

The application of chain of custody in Ecuador faces significant challenges that compromise the integrity of evidence and its admissibility in court. A critical problem is the insufficient training and specialization of personnel responsible for handling evidence, which leads to procedural errors that can invalidate crucial evidence (Saltos et al., 2024). The collection, packaging, transport and storage of indicia and evidence require specific technical knowledge that is not always mastered by the officials in charge of these tasks (Bermeo et al., 2025). This deficiency can lead to errors in the handling of evidence, such as cross-contamination, loss of relevant information or deterioration of evidentiary material.

The chain of custody manual of the Attorney General's Office establishes the different procedures for the collection, handling and analysis of evidence, but the lack of training may mean that the process is not carried out correctly. This document represents an important step forward in standardizing processes; however, incorrect implementation due to lack of resources or work overload of the different officials involved in the process makes it difficult to comply with the care of evidence (Attorney General's Office, n.d.). Therefore, it is essential to emphasize that training should not be limited to operational or frontline personnel such as police and experts (Stoykova & Franke, 2023), but to all those involved in the process, since all actors involved in the process should be properly trained to ensure a comprehensive understanding of the importance of the chain of custody and its impact on the criminal process (Pesantes et al., 2019).

In addition, a problem identified is the scarcity of adequate physical (tools) and technological (systems) resources to ensure the integrity of the chain of custody (Neira et al., 2022), therefore, the institutions that are in charge of a criminal investigation process, do not have specialized forensic laboratories that have innovative technology for the analysis of the evidence collected, much less storage systems that ensure conservation in optimal conditions, resulting in, that the people involved must seek solutions that could put at risk the integrity of the evidence, such as storage in inadequate places or transport in unconditioned vehicles (Rodriguez, 2018). The Manuals, protocols, instructions and formats of the comprehensive specialized system of Investigation Legal Medicine and Forensic Sciences detail the resources needed for the collection of evidence, but the availability of these may be limited in practice. This limitation of resources not only affects the quality of the work of investigators, but can also generate delays in the processing of evidence, which in turn can affect the effectiveness of the criminal investigation as a whole (Attorney General's Office, 2014). Investment

in infrastructure and forensic technology is, therefore, a crucial element to strengthen the chain of custody and ensure the admissibility of evidence at trial (Castelo & Hidalgo, 2024).

In addition, there is a lack of effective coordination and communication between the different institutions and actors involved in the chain of custody. Evidence may pass through several hands throughout the criminal process, from the police officers who collect it at the crime scene, to the forensic experts who analyze it in the laboratory, and finally the judges who evaluate it at trial (Duran, 2023). In each of the stages, it is essential that there is clear, direct and effective communication about the status of the evidence, the actions taken and the responsibilities that each participant must fulfill. However, in practice, there are often communication problems that generate confusion, delays and loss of valuable information, which also delays the due process.

The Specialized System of Investigation, Forensic Medicine and Forensic Sciences seeks to establish channels of communication between all participants, but its effectiveness depends on adequate implementation and follow-up. The lack of interoperability between the information systems of the different institutions also hinders the exchange of information and the traceability of the evidence throughout the process. This lack of effective communication can generate gaps in the chain of custody, where it is not possible to determine precisely who had responsibility over the evidence at a given time, which compromises its integrity (Reglamento Organización, Operación de Investigación, Medicina Legal, 2015).

The COIP indicates that the procedures involving the use of the chain of custody directly affect the validity of the evidence, being in some cases more complex, the exclusion of the criminal process (COIP, 2014). Such exclusion is intended to be seen as a protection to due process with a punitive approach to malpractices of officials involved in the process, as a result, there is impunity for those

actually responsible for a crime, especially when the evidence is the only means of proof of their guilt. Therefore, when evaluating evidence, all judges must take into consideration the integrity of the chain of custody and objectively assess whether the irregularities, which could occur, are of such magnitude as to justify the exclusion of the evidence or whether they can be corrected, but without substantially affecting the probative value of the evidence (Mendoza et al., 2024).

The decision to exclude evidence due to notable evidences in the application of the chain of custody in a criminal proceeding is a transcendental decision for the judge handling the case, since it implies an interaction between the protection of the rights of the accused with the need to guarantee justice. That is why Ecuadorian law has established the exclusion of evidence as an exceptional measure, which should be applied only in cases where the irregularities committed in the chain of custody are so serious that they generate a reasonable doubt about the authenticity of the evidence and directly affect the parties (Gandžalová, 2024).

Therefore, although still in normative changes, the legal standard has begun to establish specific criteria to determine the admissibility of evidence in cases where the application of the chain of custody can be questioned, since the courts have emphasized the need to analyze in detail the integrity of each evidence presented in a process, to consider compliance with the essential requirements to avoid reasonable doubts about the authenticity or unalterability of the same (Arnold, 2021), being necessary to differentiate between formal and substantial errors.

In this context, Ecuadorian legislation, based on all its laws, regulations and resolutions, seeks a balance between the protection of due process and the avoidance of impunity by assessing the specific circumstances of each case and applying the principle of proportionality. However, the lack of uniformity in jurisprudential

criteria remains a challenge. The existence of divergent criteria among different courts generates legal uncertainty and hinders the work of the operators of the criminal justice system. There is therefore a need for further jurisprudential development that establishes clear and uniform lines on the evaluation of evidence in cases of irregularities in the chain of custody (Rosales, 2023).

However, in the field of criminalistics in Ecuador, the influence of organized crime, drug trafficking and other highly complex crimes poses strong additional challenges involving the chain of custody in the legal system, since criminal offenses, sometimes due to their impact, often require the handling of evidence that is difficult to manipulate and store. Moreover, corruption and violence may pose additional risks to the integrity of the chain of custody, as there may be attempts to manipulate or destroy evidence to protect the perpetrators (Hurtado et al., 2024).

The presence of organized criminal groups with the capacity to influence State institutions poses a major challenge for the chain of custody, as these groups may attempt to infiltrate the institutions in charge of evidence management or exert pressure on officials to alter or destroy evidence (Tapia & Fierro, 2024). This context of complex criminality requires the strengthening of control and supervision mechanisms for the chain of custody, as well as the adoption of special measures to protect the integrity of evidence in high-risk cases.

In this scenario, international and inter-institutional cooperation is essential to strengthen corporate capacities, which is why Ecuador has received support from various countries and international organizations to improve its criminal justice systems and strengthen the chain of custody to ensure due process. This cooperation has resulted in the training of officials, the provision of equipment and technology, and the adoption of international best practices (Hurtado et al., 2024; Tapia & Fierro, 2024). However, there are still

important challenges in the effective implementation of these improvements and in adapting them to the particularities of the Ecuadorian context. International cooperation should go beyond mere technical and financial assistance, and should include a component of strengthening the culture of legality and integrity within the institutions in charge of criminal investigation. This cooperation should also be focused on the development of local capacities for the management and maintenance of the equipment and technologies acquired, in order to guarantee the sustainability of the improvements in the long term.

As there are different shortcomings, in recent years, the Ecuadorian judicial system has been reforming to include efforts to strengthen the chain of custody, therefore, there are legal modifications, which, despite having been a complex and gradual process, still require further efforts to ensure that the chain of custody is effectively implemented throughout the country. Resistance to change within institutions, lack of sustainable resources and the persistence of entrenched practices are some of the obstacles that hinder the full implementation of reforms (Benavides et al., 2024). It is essential that legal reforms are accompanied by cultural and organizational change within the institutions in charge of criminal investigation, so that the principles of chain of custody become an everyday practice and not merely a formal requirement.

One of the key aspects to improve the chain of custody is the adoption of a comprehensive approach that covers all aspects of the process, from the collection of evidence at the crime scene to its presentation at trial, complying with due process and established protocols, which implies not only strengthening personnel training and providing institutions with the necessary resources, but also improving coordination between the different agencies involved, establishing clear and detailed protocols, and ensuring effective supervision and control of the chain of custody at each stage of the process (Jaramillo, 2024). This comprehensive approach should

include the adoption of quality management systems to monitor and evaluate the performance of the institutions in charge of evidence management, as well as the implementation of accountability mechanisms to ensure that officials are responsible for their actions (Chiluiza, 2024).

On the other hand, it is essential to promote a culture of legality and integrity within the institutions in charge of criminal investigation . Officials must be aware of the importance of the chain of custody and the consequences of non-compliance, and must act professionally and ethically in the performance of their duties (Martínez, 2024). This requires not only technical training, but also training in values and ethical principles, as well as effective mechanisms to prevent and sanction corruption and other misconduct. Training in ethics and values should be a cross-cutting component of all training programs for criminal investigation officials, and should be reinforced through awareness campaigns and the adoption of clear and demanding codes of conduct. The adoption of codes of ethics and conduct, and the creation of internal control and oversight mechanisms, are fundamental tools for preventing corruption and ensuring the integrity of officials in charge of handling evidence (United Nations, n.d.).

Such training should be supported by the combined participation of civil society and academia to play an important role in strengthening the implementation of chain of custody. Non-governmental organizations, universities and other societal actors can contribute to the training of officials, research on good practices, monitoring of the criminal justice system and promotion of legal and institutional reforms (Paspuel et al., 2024). The strengthening of civil society and the promotion of a culture of transparency and accountability are key elements to ensure that state institutions act efficiently and respectfully of citizens' rights. The academy, for its part, can contribute to the research and development of new forensic techniques to improve the accuracy and reliability of evidence, as

well as to the training of highly qualified professionals in the area of criminalistics and forensic sciences (León & Guerrero, 2024).

Therefore, the research was developed based on the hypothesis: does a solid and well-documented chain of custody increase the probability that forensic evidence will be effectively admitted in trial hearings in Ecuadorian criminal proceedings by guaranteeing the integrity, authenticity and credibility of the evidence presented in court, with the aim of demonstrating that strict compliance with chain of custody procedures is a determining factor for the validity of forensic evidence and for the effectiveness of the criminal justice system in Ecuador.

Pre-trial hearing: admissibility of evidence, appropriate stage to challenge or not chain of custody

In the Ecuadorian criminal legal system, evidence is a fundamental instrument of the process, according to article 453 of the COIP, the purpose is to lead the judge to the conviction of the facts that make up the criminal offense, as well as the responsibility or not of the person prosecuted. However, the effectiveness of such evidence depends not only on its content, but also on its collection, preservation and presentation in accordance with the law, which includes, essentially, strict compliance with the chain of custody (COIP, 2014).

The chain of custody guarantees the authenticity and integrity of the material evidence from the moment of its collection until its analysis at trial. If this process is not executed in accordance with the standards established in criminal and technical regulations, its legal validity is compromised, which can substantially influence the process.

In the same body of law, Article 454 establishes the guiding principles of evidence: opportunity, immediacy, contradiction, evidentiary freedom and relevance. In this framework, it is

established that the elements of conviction must be announced in the evaluation and preparatory hearing of trial, although its practice is carried out in the trial hearing (COIP, 2014). This principle of opportunity is central, since it implies that the parties must not only present their evidence, but also formulate objections and request the exclusion of those that are illegal or violate fundamental rights, as in the case of evidence with a defective chain of custody.

In this sense, the preparatory trial hearing, regulated in articles 603 and 604 of the COIP, is the appropriate and timely procedural stage to challenge the legality of the evidence, including forensic material evidence whose chain of custody is compromised. In this hearing:

- The parties are allowed to present objections to the means of evidence (Art. 604, numeral 4, literal c).
- Exclusions may be requested on the grounds that the evidence was obtained illegally, or that it was collected in violation of rights, principles or guarantees set forth in the Constitution, international treaties or the COIP itself.
- The judge, when ruling on these objections, must declare the evidence ineffective or exclude it, if he or she finds that it has been obtained in violation of due process (COIP, 2014).

Article 455 reinforces this criterion by stating that all evidence must have a causal link between the offense and the person prosecuted, based on real facts and legal means of proof, which excludes any presumption without verifiable material support. If an evidence loses its traceability due to a deficient or undocumented chain of custody, such nexus is broken, compromising its admissibility (COIP, 2014).

Therefore, an incomplete, manipulated or not properly documented chain of custody constitutes sufficient grounds for one of the parties to request its exclusion at the preparatory hearing, and for the judge to declare it inadmissible. This inadmissibility is not related to the content of the evidence itself, but to the way in which it was obtained, which must be strictly subject to the legal framework.

By virtue of the foregoing, the preparatory hearing is the opportune and exclusive procedural moment to challenge the validity of evidence based on defects in the chain of custody. The omission of this challenge at such hearing may lead to a tacit validation of the evidence, making the defect lose legal relevance in later stages of the process.

Exclusion of evidence for failure to comply with proper chain of custody procedure

The exclusion of evidence is an essential procedural tool to safeguard the right to due process, the right to defense, and the principle of legality within the criminal system. In the Ecuadorian case, the COIP expressly regulates the foundations, principles and consequences of evidence that has been obtained without respecting the legally established procedures, especially with regard to the chain of custody, which constitutes the technical-legal axis of all material or digital evidence in the forensic field.

In numeral 6 of Article 454 of the COIP, it establishes with absolute clarity that any evidence or element of conviction obtained in violation of the rights established in the Constitution, international instruments or the law, lacks evidentiary effectiveness and, therefore, must be excluded from the criminal process. This rule stands as a manifestation of the principle of evidentiary exclusion, according to which no illegal evidence can be used to support a judicial decision (COIP, 2014).

Exclusion is imperative, not discretionary: once it has been established that evidence was obtained or handled in disregard of the legal requirements, i.e., the omission of the chain of custody, the judge is obliged to exclude it, without being able to make up for such illegality with subjective assessments or appreciations of good faith. This provision reinforces the notion that respect for procedures is as important as the content of the evidence itself.

In the same sense, article 456 specifically regulates the application of the chain of custody to all physical elements or digital content that may constitute evidence. It establishes as a fundamental purpose the guarantee of authenticity, through the identification of the origin, original state, conditions of collection, handling, transport and conservation, as well as the identification of each person who has intervened in such process (COIP, 2014). All operators of the system, including health personnel, transit, police, experts and judicial officials, are responsible for compliance with the chain of custody, which implies that its omission or negligent handling generates procedural, administrative or even criminal liability.

For its part, Article 457 of the COIP reinforces the analysis to support the legality, authenticity and submission to chain of custody are determining criteria to assess any evidence. The norm establishes a negative presumption with respect to evidentiary elements not subject to chain of custody: in such cases, the burden of proving its authenticity falls on the party that presents it, weakening its validity and procedural legitimacy. This reinforces the duty of the party providing the evidence to guarantee that it was obtained, transferred and preserved in accordance with the law.

The exclusion of evidence vitiated by a failure in the chain of custody is not an option, but a legal and constitutional requirement, which reaffirms that respect for form is also respect for justice. The COIP, by establishing this provision, is aligned with international human rights standards and reinforces the principle that only justice based on legally obtained evidence can be considered true justice.

Methodology

The research was developed under a mixed approach, since, by combining qualitative techniques, i.e., review of regulations and

judicial cases in which an adequate management of the chain of custody was applied, contrasted with quantitative values, it allowed to approach the subject in a comprehensive manner, by exploring the perceptions and experiences of the participants, which facilitated a holistic understanding of the phenomenon under study.

A purposive sample of 60 lawyers was selected, deliberately chosen from a total population of 2,437 registered in the forum of the province of Bolivar, Ecuador. The selection of this sample was based on criteria of representativeness and relevance, considering that these participants have relevant experience and knowledge in the handling of forensic evidence in the criminal field. The purposeful selection made it possible to focus the study on those actors who, because of their experience and specialization, could provide valuable information for the analysis.

Data collection was carried out through the application of a structured survey consisting of 10 closed questions and 1 open question. The surveys made it possible to collect quantitative information on the level of knowledge and application of chain of custody protocols. In addition, we considered analyzing criminal case No. 13284-2020-05358 issued by the Specialized Criminal, Military Criminal, Police Criminal and Transit Court of the Provincial Court of Justice of Manabí, which establishes the importance of applying the chain of custody in criminal proceedings.

The data analysis was carried out using descriptive statistical techniques for the quantitative aspects and a thematic analysis for the qualitative data, making it possible to identify patterns, relationships and divergences in the information collected. This mixed methodological design made it possible to obtain a broad and deep vision of the management of forensic evidence, consolidating a significant contribution to the improvement of evidentiary processes in the Ecuadorian criminal justice system.

Results

A detailed analysis of the results obtained is presented below, complemented with tables and graphical representations that illustrate the distribution of the answers provided by the sample of 60 attorneys. The survey consisted of 11 questions focused on the level of knowledge about chain of custody protocols, their practical application, the perception of their importance and the influence of possible deficiencies in the admissibility of forensic evidence.

Descriptive statistical analysis

Table 1: Level of chain of custody knowledge

Response option	Frequency	Percentage
Get to know the procedures in depth	41	68.3%
Partially familiar with the procedures	13	21.7%
No knowledge of procedures	6	10.0%
Total	60	100%

- Of the participants, 68.3% stated that they had in-depth knowledge of the chain of custody, while 21.7% indicated that they had partial knowledge, and 10.0% acknowledged that they did not fully understand the protocols.
- The mean self-perceived knowledge (rated on a scale of 1 to 5) was 4.0, with a standard error of 0.25.

Table 2: Specific chain of custody training

Received specific training	Frequency	Percentage
Yes	33	55.0%

No	27	45.0%
Total	60	100%

A total of 55.0% of the respondents reported having received specific training in the management of the chain of custody, which reinforces the need for continuous training processes to ensure the correct application of the protocols.

The mean rating of the usefulness of this training was 3.8 (SD = 0.5), indicating a mostly positive perception of its relevance.

Table 3: Perception of the correct application of chain of custody

Reply	Frequency	Percentage
Correctly applied	36	60.0%
Depends on the case	18	30.0%
Rarely applied properly	6	10.0%
Total	60	100%

60.0% of the participants considered that the chain of custody is correctly applied in criminal proceedings, while 30.0% believe that its application may vary depending on the case, and 10.0% perceive it as inadequate on most occasions.

The mean of the perception of correct application was 3.9 (standard error = 0.3).

Table 4: Perception of the influence of the chain of custody on the admissibility of the evidence

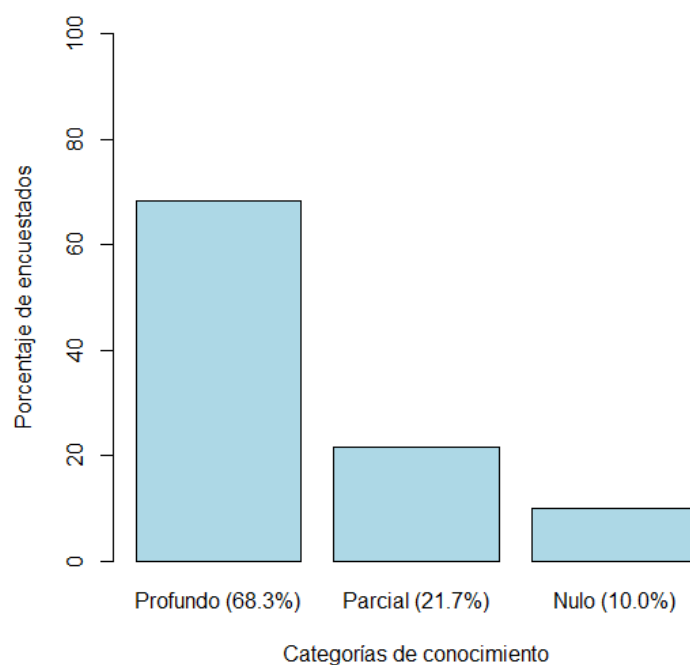
Reply	Frequency	Percentage
A deficiency may result in inadmissibility	45	75.0%
Not decisive	6	10.0%
Depends on other factors	9	15.0%
Total	60	100%

75.0% of respondents indicated that deficiencies in the chain of custody may have a direct impact on the inadmissibility of evidence, with a mean of 4.2 (SD = 0.4) in rating the importance of this factor.

Graphical representations

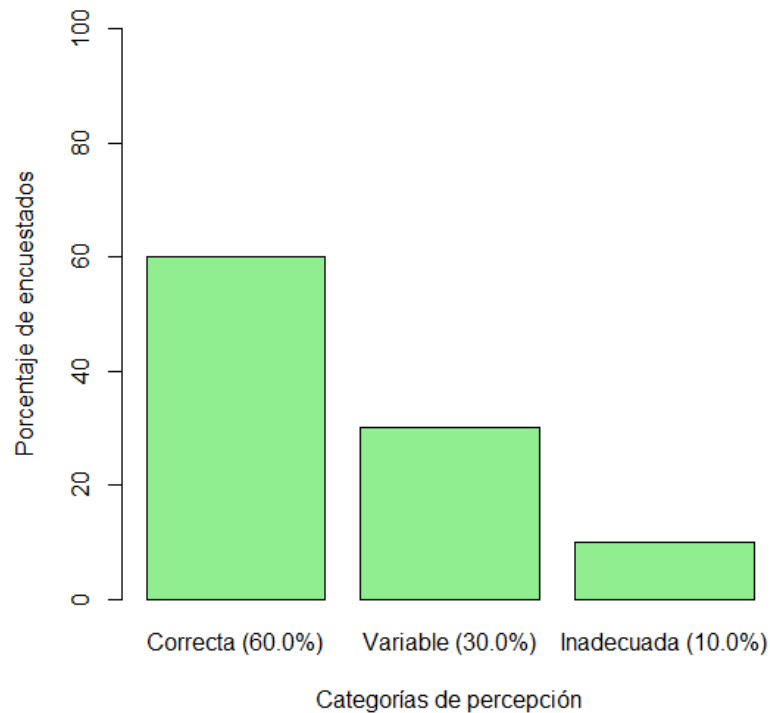
For a better visualization of the results, two graphs are presented that summarize the most relevant information related to the level of knowledge of the chain of custody and the perception of its application in the criminal field:

Figure 1: Level of chain of custody knowledge



It reflects that the majority of respondents (68.3%) fall into the category of in-depth knowledge, indicating a high degree of stated familiarity with formal procedures.

Figure 2: Perception of the correct application of the chain of custody.



60.0% believe that they are correctly applied, which suggests an optimistic view of the effectiveness of the protocols, while 30.0% believe that the application varies from case to case, showing some ambiguity in the uniformity of the processes.

Reliability Analysis (Cronbach's Alpha)

Cronbach's alpha coefficient analysis was carried out to determine the internal consistency of the instrument. The result obtained was:

Cronbach's alpha = 0.82

This value indicates good internal consistency, since the items of the questionnaire correlate adequately with each other, which supports the reliability of the instrument to evaluate the management of the chain of custody, therefore, the instrument has good internal reliability, since the items correlate positively and significantly. These results support the internal validity of the questionnaire applied to

evaluate the management of the chain of custody in the Ecuadorian criminal process.

Correlation analysis (Pearson's Coefficient)

To complement the reliability analysis, Pearson correlations were calculated between the 11 items. The correlation matrix (see Table 2) reveals that most of the items are positively related and with adequate significance levels ($p < 0.05$), which supports the internal structure of the instrument.

The average Pearson's inter-item correlation coefficient, calculated from the correlation matrix of the 11 items, was approximately 0.45 ($p < 0.05$). This value indicates that, on average, there is a moderate and statistically significant relationship between the different items of the questionnaire, which supports the internal coherence of the instrument and the consistency in measuring chain of custody management.

Table 5: Pearson's correlation analysis

Metrics	Value
Average inter-item correlation coefficient	0.45
Statistical significance	$p < 0.05$

This table indicates that, on average, the items are moderately correlated (0.45) in a statistically significant way, which supports the internal consistency of the instrument, as being positively and significantly related statistically implies that the chain of custody and its correct application in a criminal process impacts the admissibility of the forensic evidence in a process, therefore, it is one of the key elements for judges to issue a final verdict.

Analysis of the results obtained in the survey

Knowledge and training: Participants showed a high level of knowledge of chain of custody protocols (68.3%). However, 21.7%

acknowledged having a partial mastery and 10.0% admitted not knowing the procedures in depth, which highlights the need to strengthen training and the dissemination of standardized protocols.

Perception of practical application: 60.0% of respondents described that the chain of custody is correctly applied; however, 30.0% indicated that its application depends on the case. This indicates that, despite the existence of protocols, their enforcement may not be uniform in all circumstances.

Influence on the admissibility of evidence: the finding that 75.0% of attorneys are of the opinion that a deficiency in the chain of custody can lead to inadmissibility of evidence underscores the relevance of having sound procedures in place for the collection, preservation and documentation of evidence.

Specific training: 55.0% of the respondents received specific training, which translates into a positive evaluation (mean of 3.8) on the usefulness of such training. However, there is room for improvement in training coverage for the entire forum.

These results show the correlation between adequate training in chain of custody protocols and the perception that it is effectively applied in the Ecuadorian criminal justice system. Furthermore, they highlight the importance of uniformity in the application of procedures, given that even a significant minority (30.0%) consider that the application of chain of custody varies depending on the case, which could impact the validity of evidence during trial.

Taking as reference the criminal case No. 13284-2020-05358, and after a thorough analysis to demonstrate whether the sentence issued fully complied with due process, especially regarding the handling of forensic evidence with a correct application of the chain of custody, in strict compliance with the Constitution and the Comprehensive Organic Criminal Code (COIP).

In the first instance, the Constitution of the Republic of Ecuador, being the magna carta in Ecuadorian territory, in its articles enshrines the right to a fair trial and effective defense, requiring that all judicial decisions be based on criteria of motivation and transparency. The judgment under analysis was based on these principles by setting out in detail the factual and legal grounds that supported the evaluation of the evidence. However, certain deficiencies were detected in practice, such as: the insufficient reconstruction of the crime scene and some omissions in the documentation of the expert proceedings related to the chain of custody, which are fundamental to guarantee its strict compliance. These deficiencies, although recognized by the parties in the appeal, were evaluated by the Court and considered not to be decisive for violating the due process, since, as a whole, the documentary records allowed evidencing a reasonable path of the evidence from its collection to its presentation in the trial.

Therefore, the COIP clearly establishes that forensic evidence must be subjected to rigorous protocols to ensure its care, integrity, authenticity and inalterability. In the criminal case under analysis, despite the deficiencies presented in the process, the Court concluded that the evidentiary elements were kept in a sufficiently adequate framework to support the assessment of the guilt of the defendants. This criterion is based on the jurisprudential distinction between formal errors and substantial defects: while the former can be corrected without affecting the overall probative value, the latter would compromise the authenticity of the evidence in a decisive manner. Thus, the Court determined that the chain of custody, although it presented areas of opportunity, remained in line with the requirements of the law, allowing the evidence to be admitted and valued in the process.

Therefore, the chain of custody is not limited to being a mere formal requirement, but constitutes an essential instrument for the protection of the fundamental rights of the parties involved in a

process. The motivation of the sentence is based on the need for the forensic evidence to be evaluated in terms of its integrity and reliability, which is absolute in order to guarantee the right to defense and due process. Thorough documentation of each evidentiary phase helps the judge to form a conviction based on proven facts, consistent with the provisions of the Constitution and the COIP.

A comparison of these findings with the results of the survey applied to a purposive sample of 60 lawyers from the Bolivar province forum shows a significant concordance. The survey data indicate that 68.3% of the respondents stated that they have a thorough knowledge of chain of custody protocols, while 60% consider that their application in the criminal area is generally adequate, although 30% believe that their execution varies from case to case. Furthermore, 75% of the participants stated that deficiencies in the chain of custody can lead to the inadmissibility of evidence. These results reinforce the importance of having a uniform and documented handling of evidence, as required by constitutional precepts and the COIP.

Conclusions

The results of the investigation confirm that strict respect for chain of custody procedures guarantees the authenticity, integrity and traceability of forensic evidence, which is indispensable for its admission at trial. Ecuadorian law, in strict compliance with the COIP, establishes that any evidence collected without complying with these parameters will be excluded for violating fundamental rights, in accordance with the principle of procedural legality. In this sense, the chain of custody not only has a technical value, but is configured as a constitutional guarantee of due process and the right to defense, especially when the evidence is the main support of the criminal charge.

In addition, several factors were identified that hinder the uniform application of chain of custody protocols in Ecuador. Among them are: the lack of specialized training, the scarcity of technological and logistical resources, and the weakness of inter-institutional coordination. These shortcomings lead to errors in the collection, packaging, transport and storage of evidence, which can lead to the exclusion of essential evidence at trial, as they represent direct risks for the administration of justice, given that they compromise the validity of the evidence and increase the likelihood of impunity or injustice.

The mixed approach adopted in the study, which includes the analysis of an emblematic criminal case and the results of surveys of 60 lawyers, confirms that strengthening the chain of custody requires a comprehensive strategy. This should range from continuous training of the personnel involved, investment in forensic and technological infrastructure, to the formulation of public policies aimed at establishing uniform criteria for the evaluation of evidence. In addition, the need to consolidate a culture of legality and institutional ethics is an indispensable condition for guaranteeing transparency in the handling of evidence and public confidence in the criminal justice system. Cooperation between the State, civil society and academia is emerging as a strategic axis for the improvement of the evidentiary model in Ecuador.

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