

ANALYSIS OF THE APPLICATION OF ARTIFICIAL INTELLIGENCE-BASED DNA TESTS IN THE INVESTIGATION OF GENERAL CRIMES IN INDONESIA

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ABSTRACT

Investigating common crimes in Indonesia often faces challenges in proving them. DNA testing is internationally recognized as an accurate method of proof. However, its implementation in Indonesia is still hampered by limited health facilities and human resources, especially experts such as forensic scientists and law enforcement officials who are skilled in the use of forensic technology and analysis. With technological advancements, especially artificial intelligence, there is potential to improve the effectiveness of DNA testing in investigations. The purpose of this study is to evaluate the challenges in implementing artificial intelligence-based DNA tests in the investigation of common crimes in Indonesia and to identify strategic measures to overcome these barriers while maximizing the potential of this technology in law enforcement. The research method used is normative juridical, using a legal approach and an analytical approach. The findings of the study suggest that while artificial intelligence-based DNA testing has the potential to improve the effectiveness of investigations, significant challenges remain, including inadequate infrastructure, a lack of understanding among law enforcement officials, and the need for specialized training for forensic personnel. Furthermore, although Article 75 letter l of Law Number 35 of 2009 regulates the use of DNA tests, more detailed regulations are needed for the application of artificial intelligence in forensic analysis and evidence collection. AI-based DNA tests can improve the accuracy and efficiency of criminal investigations in Indonesia. Regulatory reform and collaboration between governments, educational institutions, and the private sector are needed to address the challenges and develop guidelines for their use.

INTRODUCTION

Information and Communication Technology (ICT) and digital transformation have fundamentally changed the balance of the world. Today, the presence of technology makes it possible to track patterns of human behaviour. The advent of information technology has resulted in the dissolution of traditional boundaries and has had a major impact on social change. This has led to the development of information technology becoming a double-edged sword, with the potential to improve people's welfare and the progress of human civilization. However, it can also be utilized as a means to facilitate illicit activities. One of the most significant challenges associated with digital transformation is the issue of privacy. In reality, humans are now engaged in sharing information and data as a fundamental aspect of big data connectivity, including activities such as searching, collecting, investigating, and analysing behaviours. This has implications for expanding the scope of privacy rights

protection, which was initially limited to the real world, now also includes the cyber and electronic realms (Ahmad M. Ramli, 2006).

In the digital era, the development of information and communication technology has brought significant changes to people's lives. In the process, personal data is becoming increasingly important and sensitive, as many activities are carried out online. Personal data includes information such as names, addresses, identification numbers, financial information, medical history, and other sensitive information relating to individuals (Anggen Suari & Sarjana, 2023). Most devices are now connected to the internet, allowing for remote management from any location. As people increasingly utilize digital technology in their daily lives to improve work efficiency, foster socio-economic relationships, and facilitate other activities, the consequences of this period are considerable. The development of computer-based technology for information and communication has occurred rapidly in society. These technological advances then facilitate individual activities (Anggen Suari & Sarjana, 2023)

Technological developments in the field of forensics are increasingly advanced, one of which is the application of DNA tests based on artificial intelligence (AI). In Indonesia, DNA testing has long been used as a tool to identify criminal offenders with high accuracy. However, advances in AI-based technology offer greater potential in improving the effectiveness of DNA tests, especially in terms of the speed of analysis and data accuracy. AI technology is able to process large amounts of genetic data efficiently and minimize the risk of human error. This innovation promises solutions to accelerate the resolution of criminal cases, especially in the context of general criminal investigations. The use of this technology has been widely recognized in various developed countries, but Indonesia still faces various implementation challenges (Gunawan D, 2019).

One of the key benefits of AI-based DNA testing is its ability to speed up the forensic analysis process. In many cases of general crimes, time is a very critical factor in the investigation process. A time-consuming manual process can affect the speed of law enforcement and cause delays in identifying perpetrators. With AI, DNA analysis that would normally take weeks or months can be completed in a matter of days or even hours. This speed is expected to increase the effectiveness of investigations and provide justice faster to victims and the community (R. . Sari, 2021).

In addition, AI-based DNA tests also offer higher accuracy in processing genetic data. This technology is capable of detecting complex and difficult-to-identify DNA patterns through conventional methods. This is especially important in complex cases, such as criminal cases involving multiple perpetrators or cases involving damaged or contaminated DNA samples. With AI, the risk of errors in data analysis can be minimized, so that the results produced are more reliable as evidence in court (A. Susanto, 2018)

However, the application of this technology in Indonesia still faces considerable challenges. One of them is legal regulations that have not fully supported the use of AI technology in criminal investigations. Law No. 11 of 2008 concerning Electronic Information and Transactions (UU ITE) has not specifically regulated the use of AI in the forensic context, thus creating a legal vacuum that can hinder the implementation of this technology (M. Assegaf, 2020). On the other hand, regulations related to DNA forensics in Indonesia are still limited to conventional methods, and have not anticipated the development of modern technology such as AI.

In addition to regulatory issues, another challenge is the infrastructure and readiness of law enforcement agencies in implementing this technology. The implementation of AI in investigations requires sophisticated technological devices and competent experts in operating them. In Indonesia, not all forensic laboratories have the ability to utilize this technology, especially in remote areas. This shortcoming creates a gap between the central and regional governments in terms of access to modern forensic technology (Muladi, 2022)

Regarding ethical aspects, the use of AI in DNA testing has also raised concerns about potential human rights violations, especially regarding the privacy of genetic data. DNA data is highly sensitive personal information, and the use of AI technology capable of massively accessing and analysing this data poses a risk of data misuse. Therefore, regulations related to the protection of genetic data need to be strengthened to ensure that the use of this technology does not violate the privacy rights of individuals (Gunawan, 2019).

In the context of law enforcement, AI-based DNA tests are also expected to be able to provide stronger evidence in court. The accuracy and speed offered by this technology can strengthen the position of forensic evidence in legal proceedings. However, deeper awareness and understanding is needed from law enforcement, such as prosecutors and judges, about how this technology works and

how the results can be integrated into the trial process. Education for these stakeholders is very important so that this technology can be accepted and used optimally in the criminal justice system (R. Sari, 2021)

With all the potential and challenges that exist, the application of AI-based DNA testing in the investigation of general crimes in Indonesia requires synergy between various stakeholders, including the government, law enforcement, technology experts, and the public. Comprehensive policies are needed to integrate these technologies into law enforcement systems, while maintaining the principles of justice, transparency, and respect for human rights. The implementation of this technology is expected not only to increase efficiency in solving criminal cases, but also to encourage modernization in the criminal justice system in Indonesia.

In this context, research on the application of AI-based DNA tests is very relevant to evaluate the extent to which this technology can be applied in Indonesia. This research aims to analyse the benefits, challenges, and opportunities of the application of this technology, as well as provide policy recommendations that can support the development of AI technology in the investigation of general crimes. Thus, it is hoped that this research can contribute to the development of a more modern and efficient criminal justice system in Indonesia.

METHODS

This study used a normative juridical method by analysing laws and regulations related to the application of artificial intelligence (AI)-based DNA tests in the investigation of general crimes in Indonesia. The data used is secondary data, which includes primary legal materials such as the Criminal Procedure Code and Law No. 11 of 2008 concerning Information and Electronic Transactions, as well as secondary legal materials in the form of literature, scientific journals, and related articles. Data collection was carried out through literature studies, with qualitative analysis techniques to review the conformity of applicable legal norms with the use of AI in criminal investigations. This study aims to evaluate the legal aspects of the application of the technology in the Indonesian legal system.

RESULTS

Evaluation of the Challenges in Implementing Artificial Intelligence-Based DNA Tests in the Investigation of Common Crimes in Indonesia

One of the important elements of an objective criminal act is the existence of an element of illegality. This concept is related to the principle of legality implied in Article 1 paragraph 1 of the Criminal Code (KUHP). In Dutch, against the law is referred to as "*illegal*" (*Weder*: to oppose, against; *Recht*: law). In determining that an act can be used as a basis for criminal prosecution, lawmakers determine the unlawfulness as an element that must exist in writing. Without this element, the formulation of laws will be too broad. In addition, elements of reprehensible behaviour are sometimes included in the formulation of a *delik* (Prasetyo, 2017) Based on the understandings of unlawful nature, the doctrine distinguishes unlawful acts on:

- 1) Acts against formal law, namely acts against the law if the act has been regulated in the law, so the guideline is a written law.
- 2) Material unlawful acts, namely there may be an unlawful act even though it has not been regulated in the law. Guidelines for general principles found in the legal field (Prasetyo, 2017).

The difference between an act that violates criminal law, and a violation of civil law is that in criminal law, there is a violation of the public interest (as well as the possible interest of individuals), because of its public nature. Meanwhile, in acts that violate civil law, only personal interests are violated (Irsan Arief, 2022). In addition, the difference also lies in the elements of Unlawful Acts. In the context of criminal law, the elements of Unlawful Acts are acts that violate the law, acts that are carried out outside the limits of authority or power, and acts that violate general principles of law. An unlawful act is an act that violates the (subjective) rights of another person or an act (or does not do) that is contrary to the obligation under the law or contrary to what according to the law is not written should be carried out by a person in his association with fellow citizens by considering the existence of justifying reasons according to the law (Amelia, 2023) Then, the elements of an unlawful act in the context of civil law are the existence of an unlawful act, the fault of the perpetrator, the loss to the victim, and the causal relationship between the act and the loss (I. Sari, 2020)

The rapid development of technology allows the police as one of the law enforcers to be able to solve a case faster, this is due to the application of DNA technology or *deoxyribonucleic acid* are nucleic

acids that compose genetic information in living things. DNA exists as a double chain (*double helix*) is very long, containing pieces of genes as the smallest unit that controls traits and morphological characteristics such as skin colour, hair type, finger shape and special traits in humans. Forensic identification examination is the first examination carried out, especially in cases of crimes where the victim is unknown, although identification can also be carried out in non-criminal cases such as accidents, victims of natural disasters and wars, as well as paternity cases (determining parents). Biologically, the identification examination of the victim can be carried out by odontology (teeth-geligi), anthropology (body characteristics), blood type and DNA fingerprints. DNA fingerprints are a description of the pattern of DNA fragments of each individual. (Suryo, 2001)

The first step to identifying DNA is to isolate the DNA which aims to find the structure and type of DNA to then match the DNA contained in the defendant who is considered the perpetrator. DNA identification is also known as the DNA method *profiling* or *Fingerprinting* (Saukko & Knight, 2012). After the discovery of DNA technology, the development carried out and the accuracy of the results obtained are equivalent to the accuracy of identification with fingerprints. If the DNA samples found at the crime scene are few, it can be handled with DNA duplication or DNA duplication techniques *Amplification* (Wildan Yatim, 1986).

The use of DNA tests in an investigation has often been carried out both in criminal and civil cases or outside the law, such as in identifying fire victims, victims who have been charred and can no longer be identified. Currently, the term DNA test is very familiar in Indonesian society. In the context of positive law, DNA testing is covered in the process of *Visum et Repertum*, which in the structure of legal evidence, is categorized as letter evidence. However, in its development, *Visum et Repertum* can act as evidence of clues, in accordance with the provisions stipulated in Article 188 paragraphs (1) and (2) of the Criminal Code. If you consider that initially *Visum et Repertum* Based on the doctor's testimony against a person, it can be concluded that in the process there is an element of evidence in the form of witness statements. Thus, *Visum et Repertum*, which is part of the letter evidence, can be an additional source of evidence in the form of clues (Soerjono Soekanto, 1987).

Article 188 paragraph 1 of the Criminal Procedure Code emphasizes that a clue is an act or circumstance, both between one and another, as well as with the criminal act itself, indicating that a criminal act has occurred and who the perpetrator is. Then in the next paragraph it is emphasized that the clues as referred to in paragraph 1 can only be obtained from witness statements, letters, and statements of the defendant. Based on this article, whether then the results of DNA tests can be classified as clue evidence. Munir Fuady classed it as evidence of clues. Furthermore, Munir Fuady stated (Munir Fuady, 2012):

"The use of DNA test evidence as evidence in criminal procedure law in Indonesia can be done with versatile evidence in the form of clue evidence, although with its various weaknesses that can be used as a breakthrough for judges in criminal cases. In this case, the existence of the DNA results can be evidence of clues for the judge in making his decision in these criminal cases. The evidence of the clue itself can be obtained by the judge through witness statements, letters, or statements of the defendant. Thus, in witness statements, in letter evidence or in the defendant's statement in a case, the judge can use it as evidence of clues. What the judge must also remember is that DNA evidence has been proven to be accurate, even much more accurate than conventional evidentiary models, such as witness evidence. Therefore, judges no longer need to look down on this DNA test evidence. The use of DNA evidence tests as evidence is indeed in accordance with the Criminal Procedure Code system, which wants the judge's wisdom and judge's prudence based on his conscience in assessing clue evidence, as determined by Article 183 paragraph 3 of the Criminal Procedure Code."

The National Police of the Republic of Indonesia is one of the institutions that plays an important role in handling criminal cases, of course, in exercising its authority, it needs regulations that regulate things, including the use of DNA tests. Regulations regarding the implementation of the use of DNA evidence in the investigation process of general crimes in Indonesia must be based on the principle of legal certainty. This includes the provision of clear legal provisions regarding sampling procedures, DNA analysis, data storage, and the granting of strict authority to law enforcement officials. Proper operational standards, regulation of the use of DNA data, and sanctions for violations also need to be clearly regulated in the regulation. Thus, regulations that are in accordance with the principle of legal certainty will create a fair, transparent, and trustworthy system in law enforcement in Indonesia.

The theory of legal certainty also demands predictability of the legal impact of certain actions. In the context of implementing the use of DNA evidence in the process of investigating general criminal

acts, law enforcement in carrying out investigations against perpetrators of criminal acts can carry it out easily, on the other hand it is very helpful in uncovering various criminal cases or criminal acts, identifying victims of accidents or natural disasters, and determining the kinship relationship between parents. Certainty about the legal sanctions that will be received can be a deterrent factor for potential law violators. By prioritizing legal certainty in the implementation of the use of DNA evidence in the process of investigating general crimes that are increasingly diverse, the legal system can build public trust, that the perpetrators of criminal acts are easy to know. When the rule of law is implemented consistently and transparently, people will feel confident that justice will be upheld, and their rights will be protected. This will help increase trust in the legal system as a whole.

However, DNA testing has proven to be effective in helping police uncover crime cases, but this method also has its own vulnerabilities. DNA can be damaged due to contamination, decay and degradation. DNA contamination can occur, among others, due to the entry of foreign DNA, the mistake of officers who are not sterile, or leaving garbage. Therefore, to prevent contamination at crime scenes, it is necessary to use gloves, masks and head coverings, as well as during DNA testing (Administrator Universitas Gadjah Mada, 2017). On the other hand, the scarcity of DNA experts as well as limited supporting equipment makes the cost of conducting DNA tests very expensive.

In the midst of the complexity of the challenges faced by the Indonesian criminal justice system, especially in the process of investigating general crimes, it is important to deeply understand how DNA technology has been implemented, as well as the obstacles faced in its implementation. DNA technology has become a very important evidence tool in upholding justice and determining responsibility in criminal acts. However, its implementation in Indonesia still faces various obstacles. One of the obstacles highlighted is the lack of adequate infrastructure and equipment to conduct DNA tests efficiently. In addition, the lack of adequate understanding and training for law enforcers is also a factor that slows down the process of integrating this technology in the criminal investigation process. Limited resources and lack of coordination between institutions are also obstacles to the effectiveness of the use of DNA tests in the Indonesian criminal justice system. On the other hand, DNA technology offers great potential to improve accuracy and fairness in legal proceedings. By understanding more deeply how DNA testing can be effectively applied in the process of investigating common crimes, it is possible to identify the right solutions to overcome the obstacles faced and improve the criminal justice system.

There is no provision that specifically regulates the use of DNA tests in the Criminal Code, so the legality issue is subjective and requires interpretation (S.M. Amin, 1981). Before discussing further about the use of DNA tests as evidence in trials, many thoughts and reviews show that DNA tests are directly related to clue evidence. In the collection of evidence to prove a criminal act, it is stated in the valid evidence according to Article 184 paragraph (1) of the Criminal Code are witness statements, expert testimony, letter, instructions, and defendant's statement.

The implementation of the legal force of using DNA test results as evidence in the process of investigating general crimes in Indonesia, which is based on the principle of utility, provides various significant benefits to the criminal justice system. The use of DNA tests strengthens evidence in investigations, speeds up the identification of suspects and victims, and prevents law enforcement errors by providing strong evidence of a person's involvement in a crime. Evidence through DNA tests can be categorized as evidence whose authenticity is quite accurate, so there is no need to doubt it. Even its authenticity is sometimes stronger than other evidence, such as confessions, testimonies and oaths. For in many cases confession and testimony often occur under fear, because there is pressure and threat to him and it does not at all describe the true confession (Achmad S. Soemoedipraja, 2009)

In addition, the use of DNA tests also improves the efficiency of the criminal justice system by speeding up the investigation, prosecution, and court processes, as well as providing better protection for victims of crimes. Thus, the use of DNA test results in the process of investigating general crimes in Indonesia consistently with the principle of utility will result in more efficient, fair, and effective law enforcement and increase public trust in the criminal justice system. However, the use of DNA tests in terms of proof also has several disadvantages, namely:

- 1) If the perpetrator is an identical twin brother of the suspect, because both have the exact same DNA band, making it difficult to identify the perpetrator.
- 2) DNA tests are still rarely carried out in Indonesia, due to the scarcity of DNA experts and limited supporting equipment. This causes costs. To perform this test is very expensive.

In determining the suspect to be subsequently criminally prosecuted against him, the results of the Deoxyribonucleic Acid test (DNA test) cannot be used as sufficient preliminary evidence, because

the phrase 'preliminary evidence' in determining the suspect in Article 1 number 14 of the Criminal Procedure Code must be interpreted as at least two pieces of evidence in accordance with Article 184 of the Criminal Procedure Code accompanied by the examination of the prospective suspect. The results of the DNA test as evidence at the trial must also be supported by other evidence for the judge to impose a criminal sentence on the defendant. This is because Article 183 of the Criminal Procedure Code has stipulated that in order to impose a criminal sentence on the defendant, his guilt must be proven with at least two valid pieces of evidence and on proof with at least two valid pieces of evidence, the judge obtains confidence that the criminal act really occurred and that the defendant is guilty of committing it.

Some of the novelties that use the most up-to-date DNA tests are how the Police are able to reveal the perpetrators of the crime of murder based on the match of DNA samples found at the crime scene (crime scene). The technique of using DNA tests is especially helpful in proving criminal acts, especially those related to violence, such as murder, persecution, rape, and other criminal acts (Taufiqul Hulam, 2012) In Indonesia, the DNA profile database in one laboratory is still under development by the Police Medical Division of the National Police Health Centre. The DNA database system has a feature to calculate DNA similarities between close relatives who have direct blood relations that are directly inherited.

Proof based on science and technology is proof through DNA. Although the results of the DNA test are written evidence embodied from expert testimony, the execution of the DNA test is not an easy matter, because in the process of implementing the DNA test, there is an element of the availability of a man who is suspected of being a biological father to carry out a DNA test, considering that the execution of a body in the civil field in Indonesian regulations does not yet exist, so that even though there is a court decision that requires the man who is suspected of being a biological father from illegitimate children to carry out DNA tests, but there are no regulations that force it, so it is certain that the problem of proof will drag on and may even never be proven (Bowontari, 2019).

In the case of narcotics crimes, in arresting a person suspected of abusing narcotics, they must collect evidence or sufficient evidence to strengthen their reasons for arresting someone suspected of abusing narcotics. One way to prove that someone uses narcotics is by using a urine test, in addition to that there are many other ways to prove that someone uses narcotics or not, namely by doing a blood test, hair test, deoxyribonucleic acid (DNA) test, and/or other body parts tests in accordance with the development of science and technology.

The provisions on the use of urine tests are regulated in Article 75 letter l of Law Number 35 of 2009 concerning Narcotics which states that: "in order to conduct an investigation, BNN investigators are authorized to conduct urine tests, blood tests, hair tests, deoxyribonucleic acid (DNA) tests, and/or other body parts tests". According to the explanation of Article 75 letter l of Law Number 35 of 2009 that: "investigators can conduct all of these tests, but in reality from the various types of tests that are a way to prove that a person uses narcotics, the investigator will only conduct one of the tests. The tests that are often carried out by investigators and are seen as representative of all the tests above are urine tests."

In the application of DNA testing to the investigation of general criminal acts, the same principle should be applicable. DNA technology provides strong scientific evidence of a person's identity in the context of criminal investigations. As in the Constitutional Court's decision and the handling of narcotics crimes, until now general crimes are rarely carried out using DNA tests. The use of DNA tests helps change the legal paradigm to be more inclusive and responsive to the development of science and technology (Widjaja T, 2022). In relation to the application of law, there is often a conflict between legal certainty and justice. Legal certainty has concrete properties and can be measured in real terms, while justice tends to be abstract and subjective. When facing a legal problem, the principle of justice is often the top priority because the law is not only seen from the perspective of written law. As such, it is important for the legal system to undergo a process of continuous change to ensure that the law remains relevant to the development of society and can maintain a balance between legal certainty and justice. These efforts will help ensure that the law can function effectively as an instrument of social control in today's dynamic and complex society.

The application of the use of DNA tests for the investigation of general crimes may reflect the frequent conflict between legal certainty and justice in the justice system. Legal certainty in this context can be interpreted as the existence of concrete and measurable evidence, such as the validity of DNA test results that provide objective data about a person's involvement in a criminal act (H, 2021). On the

other hand, justice tends to be abstract and subjective, especially in the assessment of witness testimony or the defendant's statement. In the process of investigating general crimes, the principle of justice is often the top priority, because the law is not only seen from the perspective of legal texts, but also from the perspective of morality and ethics. The use of DNA tests can help maintain a balance between legal certainty and justice by providing strong and objective evidence that can strengthen fair and accurate law enforcement. However, in this case it is also necessary to consider that justice cannot always be achieved through the application of legal certainty alone, since each case has its own context that requires moral and ethical considerations.

Therefore, the application of the use of DNA tests for general criminal investigations must pay attention to both aspects of legal certainty and justice. Changes and adjustments in the legal system need to be constantly made to ensure that the law remains relevant to the development of society and can maintain the right balance between legal certainty and justice. Thus, the use of DNA tests in the investigation of general crimes can be an effective instrument in maintaining this balance in today's dynamic and complex society.

The proof of a criminal act in court is in the formal juridical area, so the legality of something to be used as evidence depends on the formal provisions that govern it. If it is associated with the formal provisions regarding valid evidence, both in positive law (KUHP), as stated above, then it is very clear that the results of the DNA test are not enshrined as one of the points in it. Until now, the use of DNA test evidence in the judicial process in Indonesia is only seen as a tool that can be used as evidence that has secondary evidentiary power, so it still needs the support of other evidence. DNA test evidence has not been seen as evidence that can support the process of identifying the perpetrators of criminal acts (Hilman Ali Fardhinand, 2015).

Strategic Steps to Overcome These Obstacles While Maximizing the Potential of This Technology in Law Enforcement

The law functions to control society and is a suggestion to make changes in society. In modern society, the use of law is carried out consciously by the community, not only to reinforce the patterns of habits and behaviours found in society, but also to direct the community to the desired goals, eliminate habits that they see as no longer appropriate, create new patterns of behaviour and so on (Satjipto Rahardjo, 2011). The use of law to make changes in society is closely related to the concept of organizing socio-economic life in society. Law enforcement is an effort by the apparatus to ensure legal certainty, order and legal protection in the current era of modernization and globalization can be carried out, if various dimensions of legal life always maintain harmony and harmony between civil moralization based on actual values in a civilized society. As a process of activities that includes various parties including the community in the framework of achieving goals, it is imperative to see criminal law enforcement as a criminal justice system (Satjipto Rahardjo, 2011) (Indra et al., 2024)

Law not only serves as a binding set of rules and regulations, but also as an instrument that directs human behaviour and interaction in society (Mardjono Reksodiputro, 2004). With the law, various conflicts of interest can be overcome and resolved fairly. The law provides a clear framework for each individual's rights and obligations, as well as providing a structured and orderly dispute resolution mechanism. Thus, the law helps societies to reach mutual agreements, avoid adverse conflicts, and create a safe and stable environment for all its members.

Law has a very important role in social life as a tool to create justice, order, and tranquillity, as well as to ensure legal certainty. Furthermore, the law is also directed to advance and improve the welfare of the community, which is formed based on the desires and awareness of individuals in society. The goal is for the law to function in accordance with the expectations of the community, which is to create harmony and peace in life together (Wirjono Prodjodikoro, 2000). Laws are made to provide protection of rights to every individual or group in community life so that there is no arbitrary treatment between people in society, one of which is to protect the human rights of every individual in daily life. Although there is a law that regulates and protects every person in society, it is possible that violations of the law may occur.

Law is an integral aspect of people's lives, because every discussion of law also involves the context of human life. No individual lives in isolation or apart from social interaction, as humans are inherently bound to live together. Society and humans are interrelated with each other; Society cannot exist without humans, and vice versa. More generally, society operates under the umbrella of the state, which has the authority to form rules embodied in laws and regulations. The law, basically, reflects

government policies regulated in the form of legislation. In practice, law is not only a subject, but also an object of development, because it plays a role in creating order and justice in society, which is a function of social supervision.

Laws are created to maintain order and justice in community life. In accordance with the content of Article 1 paragraph (3) of the 1945 Constitution which reads: "The State of Indonesia is a country of law." It is also in accordance with the ideals of the Indonesian Nation as stated in the Preamble to the 1945 Constitution in the 4th paragraph, namely: "To protect the entire Indonesian nation and all of Indonesia's bloodshed and to promote the general welfare, educate the nation's life, and participate in implementing a world order based on independence, lasting peace, and social justice."

In everyday life, humans are often faced with urgent needs, including the need to satisfy themselves or to maintain social status. In general, human needs can be met in circumstances that do not require internal or external pressure. However, for urgent needs that must be met immediately, often actions are taken without careful consideration, which can ultimately harm the environment or other individuals. This kind of action can produce negative impacts that are disproportionate to the desired circumstances and quality of life.

An act is considered a crime or violation of the law when it violates the provisions stipulated in the laws of the Republic of Indonesia and endangers recognized legal interests. By regulating prohibitions and providing the threat of criminal sanctions for these violations, the law functions to provide legal protection for these interests, as well as provide a foundation for the enforcement of justice in society. Thus, the law has a very important role in maintaining order, justice, and security in community life (Sri Endah Wahyuningsih, 2013).

Crime is behaviour that goes against laws and social norms, which society considers undesirable. In a social context, crime is a phenomenon that often occurs in various places and times. This shows that crime is not only a local or national problem, but also a problem faced by all people in the world, both in the past, present, and in the future (J.E. Sahetapy, 2007). Therefore, crime can be considered a common phenomenon. In the legal rules in Indonesia, every criminal act, both related to criminal acts and violations, must still be processed with existing legal rules (Tjoetjoe Sandjaja Hernanto dan Tina Amelia, 2024)

Criminal acts are acts that are prohibited by law, with the prohibition accompanied by certain threats or criminal sanctions. Violation of the prohibition can result in a person being subject to criminal sanctions, so it can also be said that criminal acts are prohibited and threatened with criminal punishment according to the rule of law (Moeljanto, 2015). A criminal offender is someone who meets all the elements of a violation that has been determined in the law, both subjective and objective elements. The status of the perpetrator of a criminal act does not depend on whether the decision to commit the criminal act comes from himself or herself or is influenced by a third party (Moeljatno, 2003).

The criminal justice process in criminal cases, which includes the stages of investigation, prosecution, court, and implementation of court decisions in Correctional Institutions, is a very important series in upholding justice in society (Sri Widoyati Wiratmo, 2003). To ensure integrity and fairness in the process, it is necessary to have officials who not only have a deep understanding of the law, but also sensitivity to human rights. The treatment of suspects, defendants, and inmates must always be based on basic principles, such as the principle of presumption of innocence, which guarantees that a person is presumed innocent until proven otherwise. The importance of paying attention to human rights and individual dignity should not be sacrificed for the sake of law enforcement. In fact, the existence of the judicial system must be a guarantee for every individual to get fair and proper treatment, without fear of abuse of power or arbitrary treatment. Therefore, law enforcers must not only be technically skilled in carrying out their duties, but must also have high morality, wisdom, and a broad understanding of the social, psychological, and ethical conditions that surround their duties.

In the face of the complexity of legal cases, wisdom and a broad understanding of the weaknesses and strengths of human beings and their societies are key in ensuring that every action taken by law enforcement is within the corridors of justice and humanity. Thus, law enforcement is not only about applying rules, but also an effort to protect and ensure that human rights and individual dignity are maintained in every legal process that takes place. The National Police of the Republic of Indonesia is one of the institutions that plays an important role in handling criminal cases. An institution that ranks first in handling and disclosing cases that occur in the community. The police, in this case, the National

Police institution is expected to coordinate with agencies related to the disclosure of criminal offenders, for example judicial medicine (forensics) installations in several teaching hospitals or with the Faculty of Medicine in several universities that are located in accordance with the existence of local police institutions (Tunggul Adreas, 2014).

The current development of information technology causes the world to become limitless and has a significant impact on social change, this makes the development of information technology itself a double-edged sword, namely contributing to the improvement of people's welfare and the progress of human civilization, on the other hand it can also be an effective means to commit illegal acts (Ahmad M. Ramli, 2006). Legal reform in the context of the implementation and DNA test-based proof in the process of investigating general crimes in Indonesia can be associated with the theory of legal reform developed by Prof. Dr. Mochtar Kusumaatmadja, SH., LL.M. According to this theory, legal reform must be able to accommodate changing social, economic, and technological developments, while still maintaining fundamental legal values and principles.

In the context of the implementation and proof based on DNA tests in the process of investigating general crimes in Indonesia, legal reform needs to anticipate new challenges and risks that arise along with science and technology. Thus, regulations on the implementation and proof based on DNA tests in the process of investigating general crimes in Indonesia must be able to answer the demands of modern society without sacrificing the principles of justice. In addition, legal reform must also be carried out gradually and consistently, by involving various stakeholders and paying attention to its impact on society as a whole.

Law, in addition to being a set of norms that are enforced to be obeyed, also has a very vital role in developing a society. This can be studied from the perspective that law is not only the foundation for social order, but also an instrument that aims to shape and direct people's behaviour in accordance with the provisions that have been set. In this context, legal reform plays an important role as a process that reviews and evaluates various existing legal provisions, with the aim of making the necessary changes to create efficiency, justice, and provide opportunities for individuals or community groups to obtain treatment in accordance with applicable legal principles. Therefore, legal reform aims not only to adapt legal provisions to the changing times and the demands of society, but also to ensure that the law remains relevant and effective in responding to evolving social dynamics (Teguh Prasetyo, 2017).

The theory of legal reform recognizes the need to adapt to the development of science and technology. In the context of the implementation and proof based on DNA tests in the investigation process of general crimes in Indonesia, technology to support DNA test proof continues to develop rapidly, creating new challenges in law enforcement, especially in uncovering criminality. By reforming the law related to the implementation and proof based on DNA tests in the investigation process of general crimes in Indonesia, then law enforcement can provide legal protection that is in the nature of handling the occurrence of crime in the life of the community (Phillipus M. Hadjon, 2007). By using the theory of legal reform, the legal system can be updated to accommodate technological advances and respond to the implementation and proof based on DNA tests in the process of investigating general crimes in Indonesia.

The application of the theory of legal reform allows the identification of shortcomings or gaps in the existing legal framework, in terms of the implementation and proof based on DNA tests in the process of investigating general crimes in Indonesia, the main shortcoming is the high cost that must be incurred to disclose a criminal act. Thus, the legal framework can be updated to more effectively handle the implementation and proof based on DNA tests in the process of investigating general crimes in Indonesia. The theory of law reform encourages innovation in law enforcement to face new emerging challenges. In the implementation and proof based on DNA tests in the process of investigating common crimes in Indonesia, new methods such as data analysis and artificial intelligence can be used to detect and prevent acts that harm others more efficiently. The application of the theory of legal reform allows the implementation and proof based on DNA tests in the process of investigating general crimes in Indonesia optimally in law enforcement efforts. By updating the legal framework in restricting the implementation and evidence based on DNA tests in the process of investigating general crimes in Indonesia, the theory of legal reform can also increase legal awareness and compliance with applicable regulations. With clear and relevant regulations, business actors and individuals will be more likely to obey the law and avoid committing criminal acts.

CONCLUSION

Artificial intelligence-based DNA tests in Indonesia's public crime investigations have the potential to enhance law enforcement accuracy and efficiency. However, challenges such as limited infrastructure, high costs, lack of trained human resources, and DNA contamination risk pose significant obstacles. To ensure optimal use of DNA tests in Indonesia's criminal justice system, clearer regulations and law enforcement capacity building are urgently needed. Legal reform is crucial to balance moral values with human rights protection and adapt to technological developments like DNA-based proof. Future research should focus on developing a regulatory framework for AI-assisted DNA testing, examining best practices for evidence handling, data protection, and contamination prevention. Additionally, assessing financial feasibility and infrastructure requirements for DNA testing in public crime investigations and investigating capacity-building initiatives for law enforcement, including specialized training in forensic DNA technology, could provide insights for Indonesia's legal reforms.

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