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TRANSFORMATION OF CRIME COMBAT IN THE DIGITAL ERA: FROM CONVENTIONAL CRIMINAL LAW TO DATA-BASED PREDICTIVE SYSTEMS

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Abstract

The development of digital technology has brought significant changes to crime patterns, which are increasingly complex, rapid, and data-driven. This situation demands a transformation in the crime prevention system, which no longer relies solely on conventional, reactive criminal law approaches, but also moves towards data-driven, preventative and predictive approaches. This study aims to analyze the paradigm shift in crime prevention from conventional models to data-driven predictive systems from a criminal law perspective. The research method used is normative juridical with a statutory and conceptual approach. The results show that the conventional criminal law system has limitations in responding to the dynamic nature of digital crime, so the integration of technologies such as big data and artificial intelligence is necessary to support early detection and crime prevention. However, the implementation of predictive systems must still adhere to the principles of legality, legal certainty, and protection of human rights to avoid abuse of authority and algorithmic bias. Thus, the transformation of crime prevention in the digital era is an urgent need to create a criminal justice system that is more effective, adaptive, and responsive to technological developments.

Keywords: Criminal Law Transformation, Digital Crime, Predictive Systems, Big Data, Law Enforcement

INTRODUCTION

The development of digital technology over the past two decades has brought significant changes to various aspects of human life, including criminal law enforcement. Crime is no longer conventional and easily identified through physical and direct patterns, but has transformed into digital-based, structured crimes, often involving automated, data-driven systems and algorithms. This phenomenon demonstrates that the nature of crime has fundamentally changed, necessitating a shift in the way the state combats crime.

From a classical criminal law perspective, crime prevention is carried out through a repressive approach, namely taking action after a crime has occurred through the process of investigation, prosecution, and sentencing. However, this approach is considered no longer effective in dealing with the dynamics of modern crime, which are fast-paced, cross-border, and technology-driven. Therefore, the need arises to develop a more preventative and data-driven crime prevention model (Sudarto, 1986).

In line with these developments, the concept of predictive policing, or prediction-based law enforcement, has begun to be introduced into the modern criminal justice system. Predictive policing is an approach that uses historical data analysis, algorithms, and artificial intelligence to predict the likelihood of crime, including the location, time, and patterns of crime (Perry et al., 2013). This approach aims not only to respond to crime but also to prevent it through big data analytics.

Recent studies have shown that the use of data-driven technology in law enforcement can improve the effectiveness of police patrols, accelerate the identification of crime-prone areas, and facilitate evidence-based policing (Perry et al., 2013). In fact, several artificial intelligence-based systems have significantly improved the accuracy of crime location predictions compared to conventional methods (Suramta, 2025). However, despite this potential, there are also several serious challenges that require attention.

One of the main challenges in implementing data-driven crime prevention systems is the risk of algorithmic bias, which can lead to injustice in law enforcement. The data used as the basis for predictions often comes from historical records that are not entirely neutral, thus reinforcing existing social inequalities in society (Akpinar et al., 2021). Furthermore, the use of personal data in predictive systems also raises serious issues related to privacy protection and human rights, especially if not strictly regulated by national laws.

In Indonesia, technological developments in law enforcement are beginning to focus on digitizing the justice system and utilizing information technology in the investigation and monitoring of crime. However, normatively, the Indonesian criminal justice system is still dominated by a conventional, reactive approach. This indicates a gap between the development of criminal technology and the current legal system's response (Wibisono et al., 2025).

Furthermore, several studies have shown that the implementation of predictive policing in the Indonesian context still faces various obstacles, such as limited data infrastructure, the absence of specific regulations governing the use of algorithms in law enforcement, and a lack of understanding of data-based technology among law enforcement officials (Pamesti, 2023). This situation demonstrates that transforming crime prevention in the digital era requires not only technological change but also comprehensive legal and institutional reform.

Furthermore, from a criminal policy perspective, crime prevention cannot rely solely on criminal law but must also involve preventative social policies (Arief, 2017). Therefore, integrating conventional criminal law approaches with predictive systems is crucial for creating a more effective, efficient, and equitable law enforcement system.

Based on this description, it is clear that the transformation of crime prevention in the digital era is an unavoidable necessity. The shift from a conventional criminal justice system

to a data-driven predictive system requires a renewed legal paradigm, strengthened regulations, and increased capacity of law enforcement officials in managing digital technology. Therefore, this research is crucial in examining how this transformation can be implemented appropriately without neglecting the basic principles of criminal law, such as justice, legal certainty, and protection of human rights.

RESEARCH METHODS

This research is normative legal research, namely research conducted by examining legal norms contained in legislation, legal doctrine, and legal principles developed in legal science. Normative legal research focuses on literature studies to analyze law as a system of norms that regulate human behavior in society (Soekanto & Mamudji, 2020). This approach is used because the issue of transforming crime prevention in the digital era is closely related to the development of criminal law norms and the need for a technology-based reconstruction of the law enforcement system.

The approaches used in this research are a statutory approach and a conceptual approach. The statutory approach is conducted by examining various regulations related to criminal law, cyber law, and the use of information technology in law enforcement. Meanwhile, the conceptual approach is used to analyze concepts such as conventional criminal law, predictive policing, artificial intelligence, and big data in the context of modern crime prevention (Marzuki, 2021).

The types and sources of legal materials used in this study are secondary legal materials, consisting of primary legal materials, secondary legal materials, and tertiary legal materials. Primary legal materials include laws and regulations relevant to criminal law and information technology. Secondary legal materials consist of law books, scientific journals, academic articles, and previous research results related to digital crime and predictive systems in law enforcement. Meanwhile, tertiary legal materials include legal dictionaries, encyclopedias, and other reference sources that support the understanding of legal terms (Amiruddin & Asikin, 2019).

The legal material collection technique is carried out through library research, namely by collecting, reading, identifying, and analyzing various legal literature relevant to the research topic. This library research aims to obtain accurate secondary data as a basis for analysis of the problem being studied.

The analysis of legal materials was conducted qualitatively using a descriptive analytical method. This method was used to systematically describe and analyze the transformation of crime prevention from conventional criminal law to a data-based predictive system. Furthermore, conclusions were drawn using a deductive method, namely drawing conclusions from general provisions to specific issues in the context of criminal law enforcement in the digital era (Ibrahim, 2018).

RESULT AND DISCUSSION

A. The Transformation of Crime Prevention from a Conventional Criminal Law System to a Data-Based Predictive System in the Digital Era

The transformation of crime prevention in the digital era is a logical consequence of the increasingly complex, rapid, and technology-based nature of crime. The conventional criminal justice system is fundamentally built on a reactive paradigm, where the state acts after a crime has occurred through mechanisms of investigation, inquiry, prosecution, and sentencing. In this model, criminal law serves as a repressive tool to provide a deterrent effect on perpetrators (Remmelink, 2019). However, in the context of the digital era, this approach is deemed inadequate because crimes can be committed anonymously, across jurisdictions, and in a very short time.

The first form of transformation in crime prevention is a paradigm shift from retributive-repressive criminal law to data-driven, preventative criminal law. This approach emphasizes prevention efforts before crimes occur by utilizing digital data analysis. This system enables law enforcement officials to identify potential crimes based on behavioral patterns, digital footprints, and suspicious activity recorded in electronic systems (Arief, 2018). Thus, criminal law no longer functions solely as a "punitive tool" but also as an instrument for early crime detection.

The second transformation is the emergence of the concept of a data-driven criminal justice system, a criminal justice system based on large-scale data processing and analysis. This system integrates data from various institutions, such as the police, immigration, banking, and digital platforms, to develop more accurate crime patterns. Big data enables the identification of crime trends, the geographic distribution of crimes, and even the relationships between perpetrators, previously invisible to conventional systems (Howard, 2021).

The third transformation is the application of artificial intelligence (AI) and machine learning in predictive policing. This technology is used to analyze historical crime data and generate predictions about the location, time, and type of crimes likely to occur in the future. This system has been used in several developed countries to assist police in determining risk-based patrol strategies (Eisenberg, 2020). However, the application of this technology also poses serious challenges related to algorithm accuracy, data bias, and the potential for discrimination in law enforcement.

The fourth transformation is a change in the sources and forms of evidence in criminal law. In conventional systems, evidence is primarily physical and involves direct witnesses. However, in the digital era, digital evidence such as metadata, activity logs, AI-based CCTV recordings, electronic transaction traces, and digital communications have become the primary evidence in proving criminal acts (Vogiatzis, 2021). This requires changes in criminal procedure law to accommodate the dynamic and easily manipulated characteristics of electronic evidence.

The fifth transformation is integration across law enforcement agencies through an integrated information system. Modern law enforcement no longer operates in silos, but rather relies on data collaboration between agencies. For example, data integration between the police, prosecutors, immigration, financial authorities, and digital service providers. This system enables early detection of organized criminal activities such as money laundering, human trafficking, and transnational cybercrime (UNODC, 2023).

The sixth transformation is the emergence of algorithmic governance models in law enforcement. In this model, algorithms are used to assist in legal decision-making, such as assessing perpetrator risk, prioritizing cases, and determining law enforcement patterns. However, the use of algorithms in the legal system also raises important issues related to transparency, accountability, and potential human rights violations, particularly if legal decisions rely heavily on automated systems (Yeung, 2018).

The seventh transformation is strengthening the protection of personal data and the ethical use of technology in law enforcement. The increasing use of data in predictive systems raises the risk of data misuse by the state and third parties. Therefore, a balance is needed between effective law enforcement and protecting citizens' privacy rights. In this context, the principles of legality, proportionality, and accountability are crucial in any implementation of data-based predictive systems (Council of Europe, 2022).

Thus, the transformation of crime prevention in the digital era represents a fundamental shift in the philosophy of criminal law, from a reactive approach to a predictive, technology-based approach. While this system offers greater efficiency and effectiveness in

crime prevention, its implementation must remain within legal frameworks that guarantee legal certainty, justice, and the protection of human rights.

B. Implications of Data-Based Crime Prevention System Transformation for the Criminal Law System and Criminal Policy in Indonesia

The transformation of crime prevention from a conventional criminal justice system to a data-driven predictive system marks a fundamental paradigm shift in criminal policy in Indonesia. While previously law enforcement was reactive, based on reports and past events, with a data-driven approach, the state has begun adopting a proactive and predictive model that utilizes big data analysis, artificial intelligence, and crime pattern mapping to anticipate potential crimes before they occur. This approach is known in international literature as predictive policing, which aims to improve the effectiveness of police resource distribution and accelerate law enforcement responses (Marasabessy, 2025).

In the context of the criminal justice system, this transformation has implications for the workings of fundamental principles of criminal law, particularly the principle of legality, the presumption of innocence, and the principle of proof. Data-driven predictive systems no longer rely solely on proof of past events but also on probabilistic analysis of potential future crimes. This has sparked academic debate because criminal law traditionally requires a concrete act (actus reus) and culpability (mens rea) before someone can be convicted (Ensign et al., 2017). Therefore, the application of predictive systems must remain within the law to prevent them from becoming tools of stigmatization or algorithm-based criminalization.

From a criminal policy perspective, this transformation reinforces the data- and technology-driven orientation of crime prevention policy. Several studies have shown that the use of predictive models can improve the accuracy of mapping crime-prone areas, enhance patrol effectiveness, and optimize the use of police resources (Rusmiyati, 2025). However, the implementation of this system also faces serious challenges in the form of data bias, uneven data quality, and the risk of feedback loops that can reinforce inequalities in law enforcement in certain areas (Akpinar et al., 2021).

Another implication concerns the institutional aspect of law enforcement, where the Indonesian National Police (Polri) and related institutions are required to undertake digital transformation through the integration of information systems, criminal data analysis centers, and the use of artificial intelligence technology in investigations. This transformation leads to the concept of smart policing, which combines real-time data, spatial analysis, and digital surveillance systems to support evidence-based decision-making (Syabrina, 2025). However, without adequate regulation, this system has the potential to raise new issues related to algorithmic transparency and human rights protection.

In the context of national criminal policy, the implementation of data-driven predictive systems also requires updates to criminal law and criminal procedure regulations. This includes regulations regarding the use of digital data as a law enforcement tool, algorithm validity standards, and limitations on the use of predictive analytics in the investigation and prosecution process. Furthermore, the principle of accountability is needed to ensure that technological systems do not replace the legal assessment role of law enforcement officers but rather serve as supporting tools (Suramta, 2025).

Thus, it can be concluded that the transformation to a data-driven crime prevention system has had a significant impact on Indonesia's criminal justice system, both in theory, practice, and policy. On the one hand, this approach increases the effectiveness of crime prevention and modernizes law enforcement. However, on the other hand, caution is needed in its implementation to avoid shifting the fundamental principles of criminal law, which uphold justice, legal certainty, and the protection of citizens' rights.

CONCLUSIONS

The development of digital technology has driven a paradigm shift in crime prevention, shifting from a reactive, conventional criminal justice system to a more preventative and proactive, data-driven, predictive system. This transformation is characterized by the use of big data, artificial intelligence (AI), machine learning, and algorithmic analysis to detect crime patterns, map crime-prone areas, and predict potential criminal acts before they occur. These changes demonstrate that modern law enforcement is no longer solely focused on taking action after a crime has occurred, but also on prevention efforts through systematic data processing and analysis.

The implementation of data-driven predictive systems in crime prevention in Indonesia has significant potential to improve the effectiveness of law enforcement, the efficiency of human resource use, and the quality of evidence-based policing. The National Police Precision Program and the development of intelligence-based policing are initial steps demonstrating the adaptation of technological developments within the national security system. However, the effectiveness of these systems still faces various challenges, including limited data integration between agencies, the risk of algorithmic bias, limited human resource capacity, and the lack of regulations specifically governing the use of predictive systems in criminal law enforcement.

The transformation of the data-driven crime prevention system also has important implications for the criminal justice system and criminal policy in Indonesia. The use of predictive technology must adhere to fundamental principles of criminal law, such as the principle of legality, the presumption of innocence, the protection of human rights, and the guarantee of personal data protection. Therefore, criminal law policy reform is needed to accommodate technological developments without neglecting the values of justice, legal certainty, and legal benefit. Thus, a data-driven predictive system can be an effective instrument in combating crime in the digital era while remaining aligned with the principles of the rule of law and the Indonesian criminal justice system.

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