

E-ISSN: 2707-6644

P-ISSN: 2707-6636

Impact Factor (RJIF): 5.43

www.computersciencejournals.com/ijcpdm

IJCPCM 2025; 6(2): 215-224

Received: 12-07-2025

Accepted: 16-08-2025

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A systematic review on criminal justice system: Past, present, and future

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DOI: <https://www.doi.org/10.33545/27076636.2025.v6.i2b.130>

Abstract

This systematic review has effectively explored the evolution of the criminal justice system with the rapid advancements of law and technology. The study has demonstrated the examination of past developments, current trends in the aspects of AI and digital policing as well as various types of future innovations, including quantum computing. The research has clearly highlighted the benefits of technology. On the other hand, it has also addressed various types of ethical concerns. Some of these critical concerns include bias and privacy of data. Findings that are obtained throughout the journey of this study suggest that to maintain alignment with stricter regulations despite the rapid improvement enforced by AI. This is why future research needs to be careful about ethically adopting the benefits of AI and blockchain security.

Keywords: Criminal justice, AI, digital forensics, blockchain security, quantum computing, law enforcement

Introduction

1.1 Overview of the Criminal Justice System

The criminal justice system is a structured framework. It works on factors including enforcing laws, maintaining public order as well as making sure that overall justice is maintained through the agencies enforcing laws, courts, and correctional institutions ^[1]. A very crucial role is played by the criminal justice system in the matter of providing protection to the citizens, preventing the chances of crime as well as upholding legal rights. A legal justice system that functions well makes sure that trials are fair, offenders are rehabilitated as well as criminal activities are deterred ^[2]. According to the government of the UK, the proven rate of reoffending for offenders in England and Wales was recorded to be 26.5% for the month of January to March in the year 2023 cohort ^[3]. This fact indicates that there are approximately 22,000 out of 83,000 offenders who have committed a repeat offense. This specific statistic clearly highlights the ongoing challenges in the reduction of repeat offenses.

1.2 Impact of Technology on Modern Law Enforcement and Judicial Processes

The recent advancements in technology have notably transformed the prevention of crime, investigation as well as the processes of the judiciary ^[4]. This is how it has contributed to enhancing the level of efficiency and accuracy of the criminal justice system. Artificial Intelligence or AI and predictive analytics significantly helps in assisting the enforcement of law in the matter of identifying the patterns of crime as well as identifying potential crime. A critical study has found that surveillance based on AI is able to reduce the time of response AI-based surveillance can reduce the time of response for crimes by up to 35% ^[5]. On one hand, the technology of blockchain in the judicial systems has contributed to enhancing the security of security. It has been possible with the help of preventing the tampering of legal records. On the other hand, digital forensics also helps in effectively recovering data from different types of cybercrime activities. There are notable studies that have found that digital forensics has led to a notable increase in the matter of solving cybercrime cases throughout the globe ^[6]. The automated system of managing cases has also reduced court backlogs.

1.3 Research Aim and Objectives

Research Aim

The primary aim of this study is to effectively analyse the evolution, current applications, and future potential of technology in the criminal justice system.

Research Objectives

- To clearly explore the development of the criminal justice system and its advancements in technology.
- To evaluate the role of AI, cybersecurity as well as digital forensics in the modern enforcement of law and the processes of judiciary.
- To analyse the benefits, risks, and ethical concerns that are associated with the use of technology in criminal justice.
- To analyse the future opportunities and challenges for effectively integrating technology in the criminal justice system.

1.4 Research Questions

- How has the criminal justice system evolved in association with the advancements in technology?
- What are the recent applications of AI, cybersecurity as well as digital forensics in the enforcement of law and judicial processes?
- What are the specific benefits, risks as well as ethical concerns that are associated with the use of technology in the system of criminal justice?
- What are the future opportunities and challenges for the integration of technology in the criminal justice system?

2. Methodology

2.1 Systematic Review Framework

This specific study has properly followed the approach of a systematic review [7]. This has been done to effectively explore the past, present, and future conditions of the criminal justice system. This study was conducted on the basis of a structured search. This was done with the help of using academic databases, government reports as well as

various legal case studies [8]. This specific approach has ensured that all the crucial areas are covered comprehensively. This study has primarily aimed to effectively understand the historical development, current trends as well as future advancements in the judicial processes and enforcement of the law.

2.2 Data Collection Process and Inclusion/Exclusion

Criteria: The process of collecting data for this specific systematic review has involved searching various reliable sources. Some of these sources include Google Scholar, Scopus, Pub Med [9]. This study has also explored the official reports published by the UK Ministry of Justice. This systematic review has kept the proper focus only on the publications published from 2015 to 2025. The time frame of 10 years is

Criteria Inclusion Exclusion

- Time Frame Studies published between 2015 and 2025
Studies published before 2015
- Language English-language publications Non-English publications
- Source Type Peer-reviewed journal articles, government reports, case studies Blogs, opinion pieces, and unpublished manuscripts
- Geographical Focus Studies related to the UK criminal justice system Studies unrelated to the UK, except for comparative analysis
- Relevance Research on law enforcement, judicial processes, and technological impacts Studies without direct relevance to criminal justice

Data Quality Empirical studies with verifiable data Studies lacking empirical evidence or official references chosen only to provide a broader as well as effective understanding of the criminal justice reforms and the trends that are emerging nowadays [10]. The table below clearly demonstrates the criteria of inclusion and exclusion of studies that are followed within this study.

Table 1: Inclusion and Exclusion Criteria

Criteria	Inclusion	Exclusion
Time Frame	Studies published between 2015 and 2025	Studies published before 2015
Language	English-language publications	Non-English publications
Source Type	Peer-reviewed journal articles, government reports, case studies	Blogs, opinion pieces, and unpublished manuscripts
Geographical Focus	Studies related to the UK criminal justice system	Studies unrelated to the UK, except for comparative analysis
Relevance	Research on law enforcement, judicial processes, and technological impacts	Studies without direct relevance to criminal justice
Data Quality	Empirical studies with verifiable data	Studies lacking empirical evidence or official references

2.3 Classification of Sources and Analytical Approach

The sources that were gathered for this study were categorised into three main sections. These sections include historical evolution, current trends, and future developments. Research on the historical evolution has helped in the matter of examining the legal reforms. Current studies have kept the focus on the factors of digital policing and AI in the enforcement of law. On the other hand, literature on future trends has effectively explored AI sentencing and blockchain security. A qualitative thematic analysis has been followed for this specific systematic

review [11]. This has significantly helped in recognising the key patterns, highlighting the evolution of the justice system as well as effectively exploring the advancements that may contribute to shaping the future of the criminal justice system.

3. Results: Evolution and Technological Integration in Criminal Justice

3.1. Evolution of the Criminal Justice System (Past)

Societal transformations, legal advancements, as well as technological innovations played a commendable role in the

evolution of the criminal justice system. Many years ago when technology was not developed, informal, community-driven, and rudimentary systems primarily set the stage for law enforcement as well as judicial processes. In the scenario of colonial America, law enforcement mainly depended on constables and night watchmen. They were mainly responsible for maintaining order via the initial involvement of the community. The Anglo-Saxon common law adopted by England had significant implications for colonial America's judicial system^[18]. In the Anglo-Saxon common law, sheriffs, constables, and watchmen were major characters who had the right to enforce the law as well as this judicial system also included a form of justice where people had social obligations in the subject of maintaining order. England and America both countries had experienced a shift from rural farming societies to urban and industrial ones, for which gradually crime, riots, and public disturbances became more common in both countries. Regardless of the rise in crime, people in both countries did not want the establishment of permanent police forces because of the fear that a standing police force probably has too much power and could be misused by the government. The first public police forces established in colonial North America were the watchmen organized in Boston in 1631 and in New Amsterdam (New York City) in 1647^[19]. Like the watchmen in England, the maximum number of officers in colonial America did not get a fixed salary but were paid by private citizens. In early the law enforcement framework in America was primarily informal as well as community-based. The roles of sheriffs, constables, and watchmen are far distinct in comparison to modern policing because they were not formally trained. Along with the rapid growth of urbanization, a rapid increment was also noticed in crime rates which constantly necessitated the need for more organized police forces. On the other hand, early Judicial processes were very simple, where local courts took the responsibility for civil and criminal disputes. Most of the time courts are guided by community norms instead of

standardized legal principles. The ratification of the U.S. Constitution in 1787 brought a significant transformation in the overall system of justice by introducing a structured justice system^[20]. As well as the Bill of Rights introduced some prime principles including due process, protection against self-incrimination, as well as the right to legal representation^[21]. These principles somewhere establish the foundation for modern criminal justice practices.

During the time frame of the 19th century, the judicial system became more specialized. At this time Separate courts were established for handling different types of cases. In the subject of corrections, corporal punishment was turned into penitentiary-based rehabilitation which pointed out at the gradual change in the judicial system related to crime and punishment. In this context, the name of the great reformer Zebulon Brockway is notable. He introduced indeterminate sentencing and parole systems, aiming at establishing rehabilitation over punishment. The establishment of the first indeterminate sentencing system in the country was the most excellent innovation of Brockway^[22].

Some remarkable advancements in technology have transformed the overall criminal justice system in the 20th century. Police radios are mainly introduced in the 1930s. The emergence of police radios revolutionized law enforcement because they optimized the overall way of real-time communication and brought significant improvements in response times and coordination. In the 20th century, another revolution in the justice system was the emergence of Forensic science. In the subject of criminal investigations, forensic science can help to shed light on a lot of important evidence^[23]. Fingerprinting became a standard strategy for identifying suspects in the early 20th century which is the strongest evidence of the contribution of forensic science in criminal justice. DNA analysis method came to light in the late 20th century which brought a significant transformation in the overall process of solving crimes^[24].



Fig 1: The evolution of forensic science since first^[28]

With the DNA evidence, it was easy for investigators to make a definitive identification of suspects and is significant in exonerating wrongfully convicted individuals^[25]. The

emergence of the DNA analysis strategy also reinforces the importance of science-based justice.

Besides these advancements, lie detector or polygraph tests, were also being used in several cases but their reliability

remained controversial [26]. As well as the use of photography in the case of criminal identification was seen in the mid-19th century. The mugshot system which is a standard practice in law enforcement today basically emerged from the standardization of criminal photography, that is pioneered by French criminologist Alphonse Bertillon [27]. The introduction of the telegraph system is also considered as one of the best technological innovations in criminal justice because it made communication very easy between different law enforcement agencies which further made coordination more excellent and facilitating in criminal cases. In 1967 FBI established the National Crime Information Center or NCIC which has been addressed as the most significant technological advancement in law enforcement [31]. The main role of this database is centralizing criminal records, fingerprints, as well as other critical data, which makes it very easy for agencies across the country to access and share information in an ethical way.

Landmark Case / Development **The overview of the case**
Impact on Criminal Justice: The Bertillon system (Late 19th Century) Developed by Alphonse Bertillon, this system used anthropometry (body measurements) for identifying individuals. Marked an early attempt at scientific policing and systematic identification, though later replaced by fingerprinting.

The Lindbergh Kidnapping Case (1932)
A high-profile case where forensic techniques like handwriting analysis, evidence collection, and crime scene investigation were used. Set new investigative standards, highlighting the importance of forensic science in solving crimes.

The Use of Radios in Policing (1930s)
The introduction of police radios allowed patrol officers to instantly communicate with dispatch centers. Improved response times and situational awareness, shaping modern policing strategies.

Table 3.1: Landmark Cases and Technological Advancements in Criminal Justice

Landmark Case / Development	The overview of the case	Impact on Criminal Justice
The Bertillon System (Late 19th Century)	Developed by Alphonse Bertillon, this system used anthropometry (body measurements) for identifying individuals.	Marked an early attempt at scientific policing and systematic identification, though later replaced by fingerprinting.
The Lindbergh Kidnapping Case (1932)	A high-profile case where forensic techniques like handwriting analysis, evidence collection, and crime scene investigation were used.	Set new investigative standards, highlighting the importance of forensic science in solving crimes.
The Use of Radios in Policing (1930s)	The introduction of police radios allowed patrol officers to instantly communicate with dispatch centers.	Improved response times and situational awareness, shaping modern policing strategies.

3.2. Current Trends and Technological Integration (Present): The adoption of artificial intelligence, blockchain, cybersecurity, data analytics, as well as biometrics brings some rapid changes in the overall procedure of criminal justice. The use of these kinds of

technologies is very efficient for improving efficiency, accuracy, and transparency in law enforcement as well as judicial processes. Although there are multiple ethical issues associated with privacy, bias, and regulatory oversight are raised in the subject of their practical implementation.

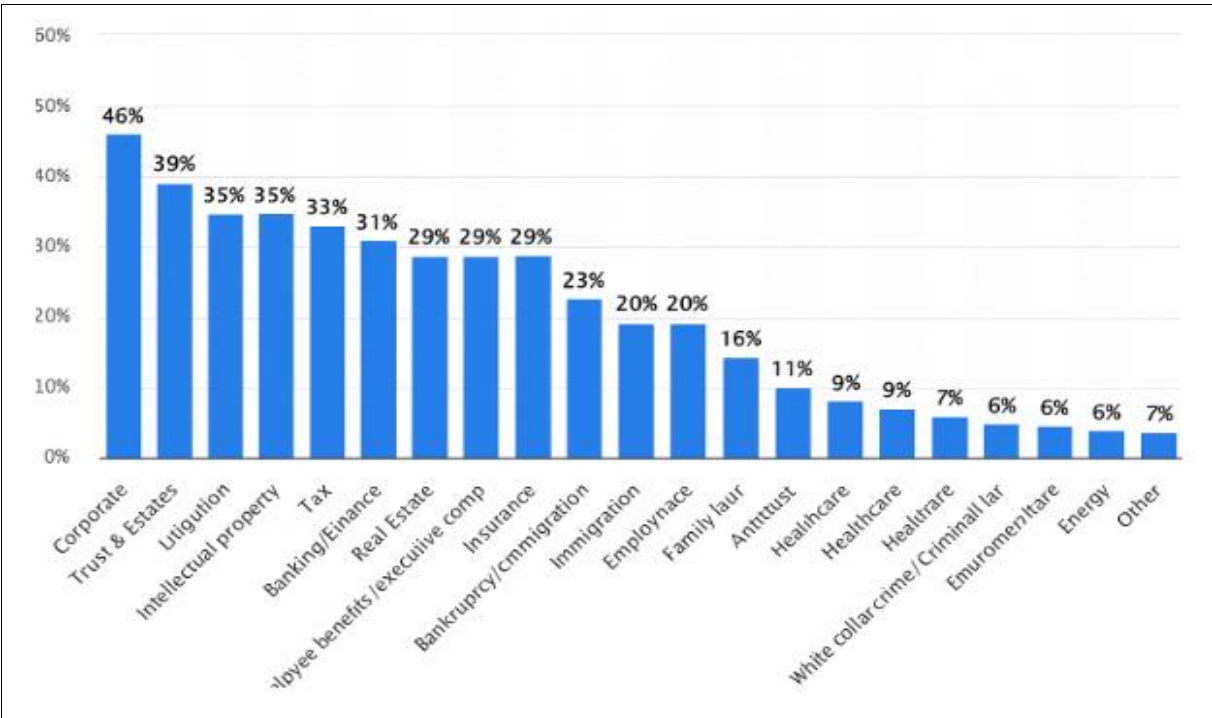


Fig 2: Legal Practice Areas Most Likely to be Impacted by Generative Artificial Intelligence [29]

In the present time, AI-powered surveillance systems are very popular devices because they optimise the overall process of real-time crime monitoring as well as make the way easy for investigators to identify suspects. There are some excellent technologies including facial recognition, automated license plate readers, and AI-based pattern detection which are very effective for assasin data from CCTV, body cameras, as well as drones. In this way, these technologies improve situational awareness. Nowadays, Real-Time Crime Centers or RTCCs also take help from AI in the matter of analysing crucial information from emergency calls, gunshot detectors, as well as surveillance feeds ^[32]. In this way, officers are able to respond quickly and allocate resources efficiently.

Investigators are now taking help from AI-driven predictive policing for the purpose of analyzing historical crime data which aids in identifying high-risk areas and allows for the enforcement of proactive law. AI also guides officers in tracking repeat offenders by detecting patterns in criminal behaviour. The major hurdle of using AI in crime investigation is the increasing concern of racial profiling and bias in predictive policing ^[33]. Most of the time, it happens when algorithms have relied on flawed historical data. Besides this, AI-based mass surveillance could violate

citizen rights as well as enable government overreach. Clear ethical guidelines, regulatory oversight, and transparency are necessary to address these issues and make sure the responsible use of AI in the Criminal Justice System. In a similar context, blockchain technology is used for securing evidence because it provides tamper-proof digital records. With the use of blockchain technology, it is possible to track chain-of-custody transparently, as well as it also helps to reduce the risk of forgery or unauthorized modifications. The chances of losing crucial information can be prevented by the use of decentralized blockchain-based storage because it secures legal records for which it will be easy to enhance trust in criminal justice proceedings.

Other than that, with the use of blockchain crime investigators are also able to prevent fraud and the chance of data manipulation. In addition to this, case management systems driven by blockchain technology are also helpful for secure access to case updates for law enforcement, prosecutors, and courts ^[34]. It is true that in the present time, the use of blockchain technology in the scenario of the Criminal Justice System is relevant but high costs and regulatory uncertainties related to this somewhere hinder its widespread adoption.

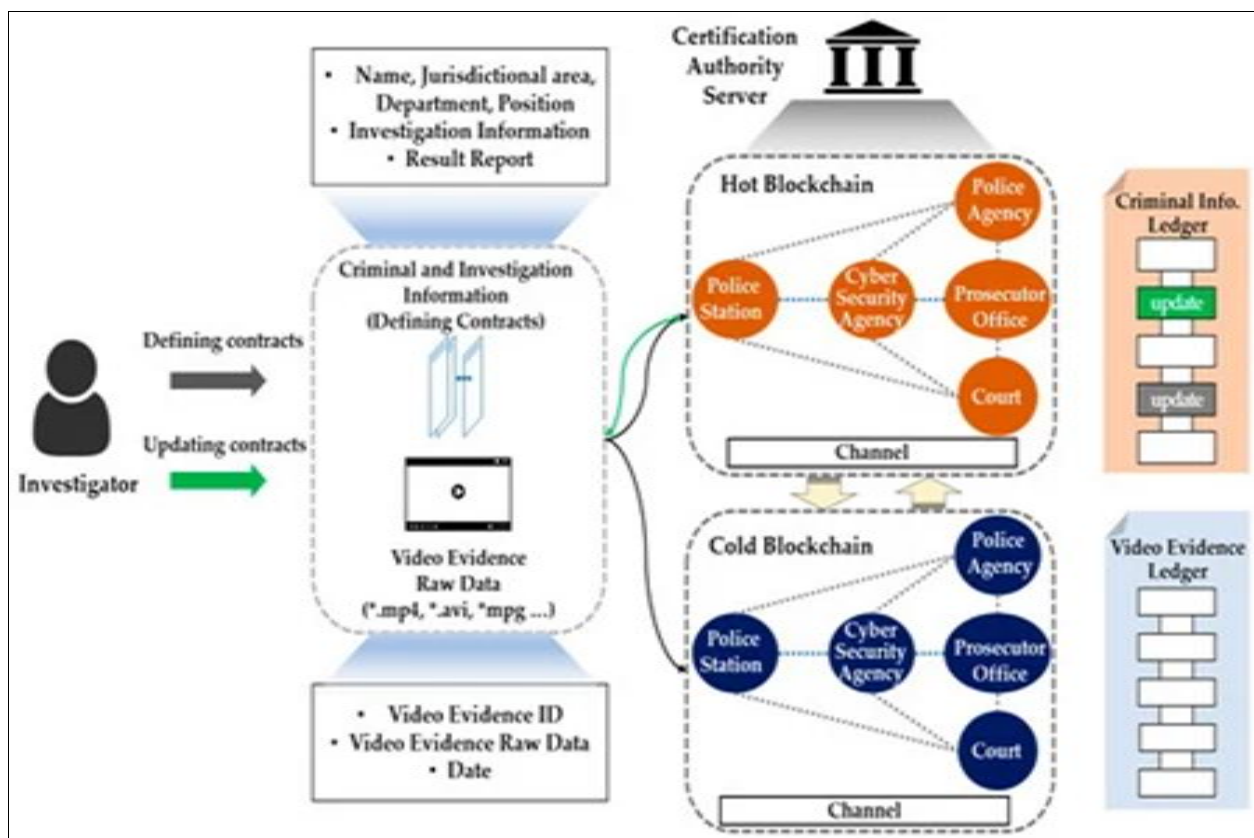


Fig 3: How Does Two-Level Blockchain System Work in the Criminal Justice System ^[30]

Day by day the ratio of cybercrime, financial fraud, and ransomware attacks increases, for which it becomes necessary for the judicial department to enforce strong cybersecurity regulations. Detection of threats, analyze risks, as well as protecting networks with encryption are some excellent features of AI-powered security systems that are used for the purpose of preventing and reducing cyber-attacks ^[35].

The emergence of some modern forensic tools makes the way very optimised for investigators to extract evidence from encrypted devices and damaged storage media ^[36]. With the use of automated forensic imaging, they can easily administer digital evidence in court. Like investigators, cybercriminals also begin the use of advanced techniques, for which it is necessary for law enforcement to continually enhance cybersecurity measures and at the same time ensure compliance with privacy laws.

In the judicial department machine learning technologies are used for analyzing past case data for predict sentencing outcomes. AI-powered models are used for the assessment of offender risk, recidivism probability, as well as sentencing consistency [37]. The use of these models in criminal justice procedures is definitely an effective way to reduce human bias, though there are still some concerns about algorithmic fairness, as AI may replicate existing disparities in sentencing. As well as systems navigated by the advanced technology of AI are very effective for streamlining operations court as they automate the overall process of document sorting, scheduling, and legal research. The use of AI ultimately reduces administrative workloads, as well as improves court efficiency. Apart from this, it has also been very important to implement strong data security measures for protecting sensitive case files from unauthorized access. Biometric technology is also excellent for suspect identification via fingerprint matching, DNA sequencing, and facial recognition. Advanced fingerprint analysis allows for faster and more accurate matches [38]. On the other hand, automated DNA profiling optimizes the overall procedure of forensic investigations which ultimately helps to solve cold cases and prevent wrongful convictions. Biometric authentication systems store iris scans, voice patterns, as well as facial recognition data in law enforcement databases, which is helpful for border security, inmate tracking, and parole monitoring [39]. Concerns about biometric data privacy and unauthorized surveillance is also considerable. It is a must for regulatory frameworks to ensure ethical and secure usage of biometric technologies to protect civil liberties.

3.3. Future Directions of Technology in Criminal Justice (Future):

AI is set to revolutionize courtrooms through

automated legal assistance, AI-driven case analysis, and virtual trials. Smart courtrooms will use AI-based transcription services, automated legal research tools, and real-time evidence analysis to speed up judicial processes. Virtual reality (VR) may also assist in recreating crime scenes for jurors.

Also, AI chatbots and virtual legal aids can assist citizens in accessing legal counsel, case news, and document drafting, in a more convenient and accessible justice. On the other hand, dependence upon AI creates a fear of algorithmic bias and diminishing human judgment within legal processes. Quantum computing will considerably improve methods for encryption, rendering data breaches and cyberattacks more difficult to implement [40]. Law enforcement organizations will gain from quicker data processing, better crime forecasting models, and better digital forensics.

However, quantum computing could also enable criminals to break existing encryption standards, posing a security threat. To address this, researchers are developing quantum-resistant encryption methods to protect sensitive legal and law enforcement data.

As technology advances, concerns about bias in AI decision-making, deepfake evidence manipulation, and mass surveillance will become critical [41]. Courts and lawmakers must establish clear regulations and oversight mechanisms to prevent misuse and protect human rights.

The increasing use of biometric surveillance, predictive policing, and digital case management raises privacy concerns. Governments must ensure that legal frameworks evolve to protect citizen data while allowing technological advancements to improve justice processes. Striking a balance between innovation and privacy protection will be crucial for the future of criminal justice.



Fig 4: Recent Technologies Improving the Criminal Justice Community [42]

3.4. Future Directions in Technological Integration of Criminal Justice: In the future, globalization and international cooperation will increasingly shape the technological direction of criminal justice systems across borders. As crimes like human trafficking, cyberterrorism, and global money laundering span continents, there is a

greater need for international collaboration supported by technology.

Interpol and Europol already leverage secure information systems and global databases to facilitate criminal investigations. Moving forward, advancements in global digital policing infrastructure, such as unified biometric

databases, AI-powered language translation systems for international evidence collection, and interlinked blockchain evidence trails will be vital in combating international crime efficiently and transparently.

Moreover, countries like Estonia, which pioneered digital government systems, may serve as blueprints for establishing digitized legal ecosystems where every phase of criminal justice arrest, charge, bail, trial, sentencing, and rehabilitation is seamlessly integrated through technology.

However, interoperability between nations will be a major challenge. Different countries follow different standards for data collection, evidence storage, and legal interpretation. Creating standardized legal protocols using AI and blockchain frameworks can address these challenges, enabling law enforcement bodies across countries to coordinate more efficiently, especially during global emergencies or criminal manhunts.

The increasing dependence on advanced technology in criminal justice demands an equally advanced workforce. In the future, police officers, legal professionals, forensic experts, and corrections staff will need comprehensive training in AI ethics, digital forensics, blockchain usage, and data privacy regulations.

Universities and police academies will be required to integrate cross-disciplinary curricula involving law, computer science, ethics, and psychology. Courses focusing on algorithm literacy, cybersecurity fundamentals, and bias mitigation in AI systems will become essential in ensuring that personnel understand not only how to use technology but also how to interpret it responsibly.

Further, there will be an increasing demand for forensic data analysts, AI interpreters, and legal technologists. These professionals will act as intermediaries between legal teams and technological systems, ensuring that tools are implemented properly and decisions made with them are legally defensible and ethically grounded.

Virtual reality (VR) and augmented reality (AR) can also be employed in training environments. For example, simulated courtrooms and virtual crime scene reconstructions can immerse learners in realistic, interactive environments, improving understanding and decision-making under pressure.

The justice system of the future will witness the emergence of fully digital courts, where physical presence is minimized, and operations are optimized through automation and secure connectivity. Digital filing, e-evidence, e-hearings, and online dispute resolution will become mainstream.

Smart correctional systems will also become more prevalent. Prisons may use biometric monitoring and AI to track inmate health, behavior, and rehabilitation progress. Sensors and wearable devices could monitor vital signs and alert authorities to possible incidents like fights or health emergencies. Machine learning can predict behavioral trends in inmates and identify early signs of violence or radicalization, allowing intervention before escalation.

Electronic monitoring systems, such as GPS-enabled ankle bracelets, will be enhanced with geofencing technologies, allowing parole and probation officers to track offenders more accurately. These systems may also include AI algorithms to detect attempts at tampering or escaping supervision.

However, it is essential to ensure that such surveillance systems do not become overly punitive. Ethical principles

must guide their deployment, ensuring they rehabilitate rather than merely control.

As criminal justice becomes increasingly data-driven, the ethical, legal, and social implications (ELSI) of emerging technologies must be continuously examined. AI-based decision-making tools in risk assessment and sentencing may inadvertently reproduce racial, socioeconomic, or gender-based biases if not properly audited.

The opacity of AI algorithms, often referred to as the “black box” problem, poses a fundamental challenge to due process. If a suspect is denied bail based on a predictive algorithm, but the reasoning behind the algorithm’s output is not explainable, it could compromise their legal rights.

Another issue is deepfake technology. Future courtrooms will need robust tools and expert systems to distinguish authentic evidence from fabricated ones. As deepfake audio and video tools become increasingly sophisticated, ensuring the integrity and admissibility of digital evidence will require advanced validation tools and strict verification protocols.

Legal frameworks must evolve in parallel with technological capabilities. Laws must be updated to recognize new forms of evidence, define acceptable uses of surveillance, and clarify liability in AI-based decisions. For example, who is accountable if an AI system wrongly classifies an individual as a suspect?

Privacy laws such as the EU’s General Data Protection Regulation (GDPR) and the UK’s Data Protection Act 2018 offer good starting points, but more comprehensive and international legal standards are needed to manage emerging challenges in AI governance and data rights.

Technological transformation cannot be successful without public trust. Community engagement, participatory governance, and transparency in technology deployment are key to ensuring that the public sees new tools as fair and effective.

Police departments and courts must communicate clearly with citizens about how AI, biometrics, and surveillance are used, what data is collected, and how it is protected. This could be done through public dashboards, transparency reports, and community advisory boards that oversee the use of technologies.

Civic tech platforms may also allow citizens to report crimes, track the status of complaints, and access public records more easily, thereby fostering inclusivity and transparency. The ultimate goal should be a criminal justice system that serves the people and is held accountable by the people, not a system that operates in opacity or breeds suspicion.

The future of criminal justice must also align with sustainability goals. Digitization and technological advancement can reduce the carbon footprint of the justice sector. For instance, virtual trials minimize travel, digital records reduce paper use, and cloud-based data centers can be powered by renewable energy.

New police vehicles could be electric or hybrid-powered, and law enforcement buildings may adopt green architecture, incorporating solar panels and energy-efficient systems. Waste management from forensic labs and evidence storage units must also follow environmentally responsible practices.

Environmental forensics, a growing field, will also play a larger role in investigating crimes against nature, such as illegal mining, deforestation, and wildlife trafficking.

Technology such as satellite monitoring, drone-based observation, and sensor analytics will support these efforts.

Despite the promises of technology, several integration challenges will persist in the coming years

- **Legacy Systems:** Many institutions still operate on outdated digital or manual systems. Upgrading to smart systems requires significant investment and cultural change.
- **Funding Constraints:** Smaller or under-resourced law enforcement agencies may struggle to afford sophisticated AI systems or cyber forensics labs.
- **Skill Gaps:** Rapid tech advancement often outpaces the training and recruitment of tech-savvy professionals in the public sector.
- **Cybersecurity Threats:** As justice systems go digital, they become attractive targets for cyberattacks. Data breaches could undermine trust and compromise sensitive legal proceedings.
- **Resistance to Change:** Judicial professionals and law enforcement officers accustomed to traditional practices may be skeptical of automation and AI tools.
- **Overreliance on Technology:** Depending too much on automation could lead to dehumanized justice processes and the erosion of empathy in sentencing and rehabilitation.

Addressing these challenges requires a combination of visionary leadership, long-term strategic planning, interdisciplinary collaboration, and robust policymaking.

3.5 Summary of the Results Section

The evolution of the criminal justice system from its rudimentary and community-driven roots to a data-augmented, AI-driven networked system has been remarkable. The 20th century laid the foundation through forensic innovation, telecommunications, and the professionalization of police and courts. Today, AI, blockchain, biometric systems, and cybersecurity tools have deeply integrated into law enforcement and judiciary practices, enabling rapid, precise, and accountable operations.

The future points to further sophistication smart courtrooms, AI-driven legal analysis, quantum-secure databases, and international digital justice platforms. However, this digital transformation comes with risks. Issues such as bias, deepfake manipulation, data security, and public trust must be addressed through ethical foresight, regulatory vigilance, and inclusive policymaking.

Ultimately, the fusion of technological innovation with human-centric values is what will determine whether the criminal justice system of the future is not only efficient but also fair, inclusive, and just.

4. Challenges and ethical concerns

There are various concerns that have been raised about the effectiveness of AI and predictive policing models in the matter of enforcing the law ^[12]. There are various studies that have highlighted the fact that the algorithms of AI may often reflect some kind of societal biases. This specific fact may unfairly target various specific groups. The 2025 report of Amnesty International, named "Automated Racism," has clearly highlighted the fact that AI-generated tools often heavily depend on data from various types of historically

biased practices, including stop-and-search ^[13]. This fact creates disproportionate effects on the Black communities. This heavy reliance on AI algorithms may increase existing biases that may target specific groups ^[14]. This is why it is very crucial to clearly address these challenges with the help of transparent models of AI models as well as stronger safeguards of law.

The privacy of data is another critical issue. The rapidly increasing use of various tools for surveillance and digital records contributes to creating critical concerns about the privacy of data. According to the 2024 report by the Information Commissioner's Office, UK, notable gaps in law lead to exposing individuals to critical breaches ^[15]. Establishing policies on the basis of AIO algorithms may create critical risks of surveillance as well as potential misuse. This is why it is very crucial to effectively integrate stronger legal safeguards and transparent models of AI. This specific approach will help in using the benefits of technology in an ethical and fair way.

Furthermore, the use of AI in decision-making such as bail determinations, parole decisions, or sentencing recommendations requires careful regulation. Bias in such systems could lead to unjust outcomes, such as denying parole based on flawed risk assessments. The opacity of "black box" AI models complicates efforts to identify and correct these biases. To mitigate these issues, it is essential to embed ethical-by-design principles into AI development. This includes ensuring that data sets are representative, that decision processes are transparent, and that affected individuals have access to meaningful redress.

Ultimately, while AI and digital tools have the potential to make justice systems more efficient, these benefits must not come at the cost of fairness, accountability, and individual rights. Ethical deployment requires multi-stakeholder collaboration including technologists, legal experts, civil society, and affected communities to ensure that innovations uphold the principles of justice and equality.

5. Discussion and research gap

5.1 Identified Gaps in Existing Research

The systematic review has identified critical gaps in the research on criminal justice. The number of long-term studies is noted to be very less on the ethical effects of AI in the matter of establishing policies and sentences. Research has found that most of the studies keep focus only on the short-term impacts of AI. On the other hand, there are very less studies that are conducted on how the approach of automated decisions affects the aspects of fairness and public trust over a period of time.

A limited amount of research on the adoption of blockchain in criminal justice contributes to another critical research gap. There are various types of biometric tools including facial recognition and DNA profiling that has efficiently contributed to enhancing the accuracy. But, the studies on their misuse, bias as well as legal issues are very less. On the other hand, the research on the integration of blockchain in the matter of enforcing laws is lacking despite the broader benefits for data security. The risks of quantum computing are also not explored properly. This is why it is very crucial to have more effective studies on these areas of research. These specific studies will help future researchers obtain knowledge on the long-term effects of these technologies. On the other hand, the studies will also make sure that the technologies are being used in an ethical manner.

5.2 Future Research Recommendations

The systematic review suggests that it is very crucial for future research to keep a proper focus on the approach of developing ethical frameworks of AI. This is only to reduce the number of biases in the process of predictive policing^[16]. On the other hand, studies also need to effectively examine the effectiveness of blockchain in the task of managing legal records while simultaneously maintaining the privacy of data. Having proper research on quantum-resistant encryption may also be vital in the effective addressing of cyber threats^[17]. On the other hand, interdisciplinary studies conducted on the combination of law, technology as well as ethics is also expected to provide significant help to the policymakers in the matter of creating balanced regulations. The effective addressing of these specific gaps will make sure that the advancements in technology in criminal justice are highly aligned with legal protections and public trust.

6. Conclusion

The specific systematic review has demonstrated that the approaches of criminal justice has developed noticeable changes over a period of time. This specific change is especially driven by the continuous progress of legal and technological aspects. The process of establishing policies in the past has heavily depended on various basic measures. But, the investigation has significantly improved with the help of the advancements, including forensic science. Nowadays, AI and digital tools notably help in the process of enforcing the law. Though there are various concerns that still exist about bias and privacy of data. The future will likely to evidence courtrooms driven by AI and quantum computing. This specific situation will require more alignment with strong regulations. On the other hand, it is also crucial to use technology in an ethical way. This may help in enhancing the fairness as well as the public trust. The benefits of AI, biometrics as well as blockchain may provide security and efficiency. But it is very crucial to make sure that the misuses are carefully prevented. A proper balance between innovation and ethical considerations may be the key to a fair and transparent criminal justice system.

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