



IMPACT OF SCIENTIFIC DEVELOPMENT ON CRIMINAL JURISPRUDENCE IN INDIA

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Abstract: Scientific advancements have significantly influenced criminal jurisprudence in India, enhancing the accuracy and reliability of evidence in investigations and trials. Advanced forensic techniques, such as DNA profiling, fingerprint analysis, and digital forensics, have revolutionized criminal investigations and trials, providing more accurate and reliable evidence. Modern technologies, such as surveillance cameras, GPS tracking, and cyber forensics, have improved law enforcement agencies' capabilities in gathering evidence and tracking criminal activities. Expert testimonies from various scientific fields have become common, providing insights for judges and juries. Multimedia technologies have allowed for more effective evidence presentation, with visual aids, computer simulations, and 3D reconstructions helping judges understand crime circumstances more accurately. Psychological and behavioral science has contributed to developing criminal profiles, aiding law enforcement in narrowing down suspects and predicting potential criminal behavior patterns. Digital forensics have enabled the tracing of digital footprints and the origin of cyberattacks. Scientific insights into criminal behavior have influenced criminal justice reforms, emphasized rehabilitation and addressed root causes of crime. Technology adoption in court proceedings has increased access to justice, reduced costs, and expedited legal processes.

Keywords: Scientific Advancement, Criminal Jurisprudence, India, Evidence, Justice, Investigation, Trial, Forensic Technique, Cyber Forensic.

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Introduction:

The demand of humanity throughout history for peace, tolerance, equality, justice, and a society free of crime may be traced all the way back to the history of nomadic groups and ancient civilizations. The struggle to establish justice and secure peace is something that can be compared to the development of complex societies, which saw a major shift in unquenchable desires for resources, vengeance, lust, and a vicious disposition for one another. This struggle is something that can be compared to the evolution of complex societies. Our culture is in desperate need of a remedy in the shape of legal jurisprudence in order to put a stop to the destructive developments that are taking place.¹

Criminology, the knowledge of crime, and the growth of criminal law as a topic and a reality that strives to remove the harmful components in society are all examples of legal cures that have been developed through time. One of these legal cures is the evolution of criminal law. The fundamental issues that surfaced all that time ago remain, to this day, the same as they were thousands of years ago, which raises an interesting point to consider: despite the fact that civilizations have achieved significant gains in their respective political, scientific, social, and economic spheres, the fundamental complaints that surfaced all that time ago are still the same as they were thousands of years ago. These modern problems are the outcome of the fact that

people in countries all over the world have developed a criminal mentality and a monotonous temperament.²

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A man is born with a feeling of right and wrong; the conscience of a human being is the rudder that is used to decipher between what is right and what is wrong. The sense of right and wrong is something that a man always has. It is sufficient to examine the history of humanity, which is encoded with the concept of reward and punishment dependant upon the circumstances, in order to discern age-old rituals connected to crimes and offenders. No matter whatever religious scriptures we consult, the Sharia law, the Mosaic rules, or the Vedic texts all have one thing in common: they do not let wrongdoing to be tolerated without consequence. Justice is a virtue that has always been essential to human existence and to the functioning of society³.

Technology advancements:

It is likely that technological advancements will have a significant impact on the future of criminal law. This could include the use of artificial intelligence in legal research, predictive policing algorithms, and improved forensic techniques. Additionally, issues related to privacy and data protection may arise as technology becomes more integrated into law enforcement practices.⁴

1. **Improved Forensic Techniques:** Technology has significantly enhanced forensic analysis, allowing investigators to collect and analyze evidence more effectively. Techniques like DNA profiling, fingerprint analysis, ballistics, and digital forensics have revolutionized crime-solving capabilities.
2. **Enhanced Surveillance and Monitoring:** Advanced surveillance technologies, such as CCTV cameras, facial recognition systems, and GPS tracking, have improved law enforcement's ability to monitor criminal activity, track suspects, and prevent crimes.
3. **Digital Evidence and Cybercrime:** The rise of digital technology has given birth to cybercrime, leading to the need for specialized investigators and tools to handle digital evidence. This includes investigating computer crimes, data breaches, online fraud, and cyberattacks.
4. **E-Discovery and Case Management:** Technology has made the discovery process more efficient, with the ability to process and manage vast amounts of electronic evidence. E-discovery tools help sort, search, and review electronic documents and communications relevant to a case.
5. **Predictive Policing:** Utilizing data analytics and machine learning, law enforcement agencies can analyze crime patterns and trends to predict potential hotspots and allocate resources more strategically to prevent crime.
6. **Body-Worn Cameras:** Police officers equipped with body-worn cameras provide an objective record of interactions between law enforcement and civilians, increasing accountability and improving transparency.
7. **Remote Court Proceedings:** Video conferencing and virtual courtrooms have become increasingly common, enabling remote hearings, reducing transportation costs, and expediting the judicial process.

8. **Data Management and Information Sharing:** Centralized databases and information-sharing platforms enable different agencies to collaborate effectively, facilitating the faster exchange of critical information across jurisdictions.
9. **Biometric Identification:** Biometric technologies, such as facial recognition and iris scanning, aid in identifying suspects, missing persons, and maintaining accurate records of criminals and offenders.
10. **Electronic Monitoring and Offender Rehabilitation:** Technology-enabled electronic monitoring devices allow for remote tracking of offenders on probation or parole, while computer-based programs can assist in offender rehabilitation and education.⁵

Despite these benefits, technological advancements in the criminal justice system also raise certain concerns and challenges, such as⁶:

- **Privacy and Civil Liberties:** The use of surveillance technologies and data collection can raise privacy issues and concerns about the potential misuse of personal information.
- **Digital Security:** As the reliance on technology grows, the risk of cyberattacks and data breaches also increases, potentially compromising sensitive case information.
- **Digital Divide:** Not all communities have equal access to technology, leading to potential disparities in accessing justice and participating in court proceedings.
- **Bias in Algorithms:** The use of algorithms for predictive policing and risk assessment can be biased, leading to concerns about potential discriminatory practices.
- **Training and Expertise:** Law enforcement personnel and legal professionals need adequate training and expertise to use technology effectively and avoid misinterpretation or mishandling of digital evidence.⁷

In conclusion, technological advancements have undoubtedly brought numerous benefits to the criminal justice system, improving investigation capabilities, efficiency, and public safety. However, it is crucial to address the challenges and ethical considerations to ensure that technology is used responsibly, fairly, and in compliance with legal and constitutional principles.⁸

Cybercrime and Digital Offenses:

With the growing reliance on technology, cybercrime is expected to become an increasingly prevalent issue. The development of new laws and regulations specifically targeting cyber offenses, such as hacking, identity theft, and online fraud, will be essential. Cybercrime and digital offenses have had a significant impact on the criminal justice system, introducing new challenges and complexities for law enforcement, prosecutors, and the judiciary. Here are some of the effects of cybercrime and digital offenses on the criminal justice system⁹:

1. **Increased Caseload:** The rise of cybercrime has led to a surge in criminal cases involving digital offenses such as hacking, identity theft, online fraud, and cyberbullying. This increased caseload can strain the resources and capacity of law enforcement and the courts.¹⁰
2. **Complex Investigations:** Cybercrime investigations often require specialized skills and knowledge in digital forensics, data analysis, and cyber threat intelligence. Law enforcement agencies need to invest in training and equipping their personnel to handle these complex cases effectively.
3. **Cross-Border Challenges:** Cybercrime knows no boundaries, and offenders can operate in jurisdictions with different laws and regulations. This raises challenges for extradition, international cooperation, and the enforcement of cybercrime laws globally.

4. **Digital Evidence Handling:** Collecting, preserving, and analyzing digital evidence is crucial in cybercrime cases. Ensuring the integrity and admissibility of digital evidence in court requires adherence to strict chain-of-custody protocols and specialized forensic techniques.
5. **Anonymity and Impersonation:** Cybercriminals often use anonymizing tools and techniques to conceal their identity and impersonate others online. This makes it challenging for investigators to trace the perpetrators and establish their true identities.
6. **Rapidly Evolving Threat Landscape:** Cyber threats and attack vectors are constantly evolving, necessitating continuous updates to laws, regulations, and investigative techniques to keep up with emerging cybercrime trends.
7. **Digital Rights and Privacy Concerns:** Balancing the need to investigate cybercrimes with safeguarding individuals' digital rights and privacy can be complex. There is a need to strike a balance between law enforcement's investigative powers and protecting citizens' fundamental rights.
8. **Capacity Building and Expertise:** The criminal justice system requires skilled personnel and resources to address cybercrime effectively. This includes training judges, prosecutors, and defense attorneys in the intricacies of digital offenses.
9. **Public Awareness and Reporting:** Encouraging the public to report cybercrimes is essential for effective law enforcement. However, many cybercrimes go unreported due to a lack of awareness or fear of reputational damage, hindering the investigation and prosecution of offenders.
10. **Cybersecurity for the Justice System:** As the criminal justice system increasingly relies on digital infrastructure for case management and information sharing, ensuring robust cybersecurity measures becomes imperative to protect sensitive case data from cyber threats.
11. **Restorative Justice and Rehabilitation:** In some cases, cybercriminals might be young individuals or first-time offenders who may benefit from rehabilitation rather than punitive measures. Implementing restorative justice practices can help address the root causes of digital offenses and prevent future criminal behavior.¹¹

In response to the challenges posed by cybercrime and digital offenses, the criminal justice system must continuously adapt and evolve. This includes investing in technology and expertise, enhancing international cooperation, updating legal frameworks, and raising public awareness about cyber threats and reporting mechanisms. Additionally, fostering collaborations between law enforcement, the private sector, and academia can help develop innovative solutions to combat cybercrime effectively¹².

AI in Law Enforcement and Criminal Profiling:

The use of AI algorithms for crime prediction and criminal profiling could become more widespread. This raises concerns about potential biases in these systems and the ethical implications of relying on algorithms to make decisions about individuals' criminal behavior. The advantages of predictive modelling and examples of their use in India¹³

The application of predictive analytics and artificial intelligence (AI) in the Indian system of criminal justice could result in a number of positive outcomes. These technologies have the potential to increase the effectiveness of criminal investigations, improve public safety by means of improved risk assessment, and lessen the influence of bias in decision-making.¹⁴ Here are some examples and cases of how these benefits have been realized in the Indian context¹⁵:

- 1 **Improved Efficiency in Investigating Crimes:** One of the most significant benefits of Predictive Analytics and AI in criminal justice in India is their ability to improve the efficiency of investigating crimes. For example, the Mumbai Police have been

using Predictive Analytics and AI to predict the likelihood of crime in a particular area and plan their resources accordingly. The system uses historical crime data to identify patterns and predict future crimes, enabling the police to take proactive measures and prevent crimes from happening.¹⁶

- 2 Enhanced Public Safety through Better Risk Assessment:** Predictive Analytics and AI can also enhance public safety by improving risk assessment. In India, the National Crime Records Bureau (NCRB) has developed a system called Crime and Criminal Tracking Network and Systems (CCTNS), which collects and analyzes crime data from across the country. The system uses this data to identify high-risk individuals, such as repeat offenders and known criminals, and monitor their activities.

Predictive Analytics and AI can also reduce bias in decision-making by eliminating human subjectivity. In India, the Odisha police have developed an AI-based system called Crime and Criminal Tracking Network and Systems (CCTNS) and have developed an AI-based system called "Crime Criminal Analytics and Prediction System" (CAPS), which uses machine learning algorithms to predict the likelihood of an accused person fleeing the state. This system has reduced the dependence on subjective decisions by police officers and judges, making the process more objective.¹⁷

Another example of how Predictive Analytics and AI can reduce bias in decisionmaking is by predicting the likelihood of a suspect re-offending. In India, the Telangana police have implemented an AI-based system called "Integrated Criminal Justice System" (ICJS), which uses data from various sources to create a profile of a suspect, including their criminal history and social media activity. The system can then predict the likelihood of a suspect re-offending, enabling the police to make more informed decisions about their release on bail or parole.¹⁸

Although the use of Predictive Analytics and AI in criminal justice in India has several benefits. These technologies have improved the efficiency of investigating crimes, enhanced public safety through better risk assessment, and reduced bias in decision-making. With further development and integration, they have the potential to revolutionize the criminal justice system in India and lead to a more just and efficient system.¹⁹

Climate Crimes and Environmental Law:

As environmental concerns become more pressing, new criminal laws might emerge to address crimes against the environment, such as illegal logging, wildlife trafficking, and pollution. India has been making efforts to address climate crimes and environmental issues through its legal framework and policies. Climate crimes generally refer to activities that significantly contribute to climate change, such as illegal logging, wildlife trafficking, industrial pollution, and other activities that harm the environment²⁰.

Environmental law in India primarily encompasses the following key aspects²¹:

- 1. Legislation and Regulatory Framework:** India has several laws and regulations aimed at protecting the environment and addressing climate change. The primary legislation includes the Environment Protection Act (1986), the Wildlife Protection Act (1972), the Forest Conservation Act (1980), and the Water (Prevention and Control of Pollution) Act (1974), among others.
- 2. National Action Plans and Policies:** India has formulated various national action plans and policies to tackle climate change and environmental issues. Notably, India is a signatory to the Paris Agreement and has committed to reducing its carbon emissions and adopting sustainable practices.

3. **Pollution Control and Compliance:** Environmental laws in India aim to control pollution and regulate the activities of industries and businesses. The Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs) monitor and enforce compliance with environmental standards.
4. **Wildlife Conservation and Biodiversity Protection:** India's wildlife laws focus on protecting endangered species, conserving biodiversity, and preventing wildlife trafficking. The Wildlife Protection Act and the Indian Forest Act (1927) are crucial in this regard.
5. **Environmental Impact Assessment (EIA):** India follows the EIA process for evaluating the potential environmental impacts of development projects before granting environmental clearances. The EIA process ensures that projects adhere to environmental norms and sustainable practices.²²
6. **Renewable Energy Promotion:** India has been actively promoting renewable energy sources, such as solar and wind power, to reduce reliance on fossil fuels and mitigate climate change.
7. **International Cooperation:** India collaborates with other nations and international organizations to address global environmental issues and promote sustainable development.²³

It is important to note that while India has made progress in environmental law and climate action, there are still challenges and areas that need further attention. Enforcement of environmental regulations can be challenging, and illegal activities continue to pose threats to the environment. Additionally, the balance between development and environmental conservation remains a complex issue, particularly in a rapidly growing economy like India.²⁴ As developments beyond September 2021 are beyond my knowledge, I recommend checking more recent sources for the latest updates on climate crimes and environmental law in India. Government publications, official websites, and reports from environmental organizations are good resources to keep up-to-date on the current state of affairs²⁵.

Ethical Considerations:

The integration of technology into criminal law will bring up ethical dilemmas related to surveillance, privacy, and individual rights. Striking a balance between public safety and civil liberties will remain a challenge. The integration of technology into criminal law raises various ethical dilemmas that require careful consideration. Here are some of the key ethical dilemmas associated with technology in the criminal justice system²⁶:

1. **Privacy and Surveillance:** The use of advanced surveillance technologies, such as facial recognition and mass data collection, raises concerns about individual privacy rights. Balancing the need for public safety with protecting citizens' privacy is a challenging ethical dilemma.
2. **Data Security and Integrity:** As the criminal justice system relies more on digital data, ensuring the security and integrity of sensitive information becomes crucial. The ethical dilemma lies in safeguarding data from cyber threats while maintaining accessibility for legitimate investigative purposes.
3. **Algorithmic Bias:** The use of algorithms in predictive policing and risk assessment tools can perpetuate biases present in historical data. This raises ethical questions about fairness and the potential reinforcement of systemic discrimination in law enforcement practices.
4. **Transparency and Accountability:** The use of technology in criminal law can sometimes involve complex algorithms and decision-making processes. Ensuring

transparency and accountability in such systems becomes essential to maintaining public trust and preventing potential abuses.

5. **Digital Divide:** Technological advancements can create disparities in access to justice. Individuals without access to digital tools or who lack digital literacy might face difficulties navigating the system, raising concerns about equal access to justice.
6. **Preventive Policing vs. Individual Rights:** Utilizing technology for predictive policing may lead to apprehending individuals based on probabilities rather than evidence of actual criminal intent. This poses ethical questions regarding balancing the potential benefits of crime prevention with individual rights and the presumption of innocence.²⁷
7. **Autonomous Systems and Liability:** The use of autonomous systems, such as AI-powered decision-making tools, can complicate the assignment of responsibility and liability when errors occur. Identifying accountability for decisions made by machines is an ethical challenge.
8. **Informed Consent and Data Collection:** The collection and use of digital evidence, such as data from mobile devices or social media, might raise concerns about informed consent and the scope of data collection from individuals not directly involved in a criminal investigation.
9. **Digital Evidence Authentication:** Authenticating digital evidence can be difficult, and an ethical dilemma arises when courts and law enforcement must determine the admissibility of digital evidence without compromising the integrity of the process.
10. **Unintended Consequences of Technology Use:** Implementing technology in criminal law may have unintended consequences, such as encouraging more sophisticated criminal activities, leading to a perpetual technological arms race between law enforcement and criminals.²⁸

Regular ethical impact assessments and ongoing dialogue about the implications of technology adoption are crucial for guiding its responsible integration into criminal law.²⁹

Conclusion:

In conclusion, predictive analytics and artificial intelligence have the potential to change the criminal justice system in India, which would result in benefits such as increased efficiency and accuracy as well as a reduction in the overall rate of crime. Nevertheless, utilizing them comes with its fair share of difficulties and dangers, including the possibility of introducing prejudice and inaccuracy, as well as infringing upon fundamental legal rights. As a result, a well-rounded strategy is required in order to guarantee that the application of predictive analytics and AI in the criminal justice system is transparent, responsible, and in line with the ideals outlined in the constitution.

It is imperative that suitable legislative frameworks and monitoring mechanisms be developed in order to control the use of predictive analytics and AI in the criminal justice system in order to achieve this balance. In criminal proceedings, the judicial system has the responsibility of ensuring that basic rights are not infringed upon and that due process and justice are observed. In addition, there have to be public consultations and involvement in order to cultivate trust and confidence in the application of these technologies.

Improving the precision, transparency, and accountability of these technologies should be the primary focus of future research and policy considerations on the application of predictive analytics and AI in the criminal justice system. It is necessary to do an analysis of the effect they have had on society, focusing in particular on the underprivileged populations, and to address any possible prejudices or unintended repercussions.

In the field of criminal justice, the application of predictive analytics and artificial intelligence is still in its infancy in India. Even while certain programs, like face recognition technology and predictive policing, have already been put into place, there is still an ongoing discussion regarding whether or not they are effective and whether or not they pose any possible concerns. It is very necessary for India to devise a strategy that is well-balanced and takes into account the potential benefits and problems posed by new technologies, all while preserving fundamental rights and adhering to due process in legal proceedings.

In general, the application of predictive analytics and AI in the field of criminal justice is a contentious problem that is constantly growing and calls for serious analysis as well as regulation. It is necessary to do an analysis of the benefits as well as the difficulties, and it is essential to settle on a strategy that gives equal weight to accountability, transparency, and equity.

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