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International Practices in Criminological Crime Forecasting and Their Applicability Within the National Legal System

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Abstract
This article analyzes the significance of criminological forecasting in combating crime, advanced international practices, and the possibilities of their application within the legal system of Uzbekistan. The experiences of the United States, the United Kingdom, Germany, Japan, and Russia in predicting criminal activity have been examined, with particular emphasis placed on data analysis, the use of artificial intelligence, preventive risk assessment, community cooperation, and technological surveillance mechanisms.

Keywords: Criminological forecasting, crime, forecasting, statistical analysis, legal system, risk assessment, data analysis, prevention, crime dynamics, criminogenic situation, monitoring mapping, security, innovation, surveillance system, foreign experience, law enforcement, public cooperation.

Introduction

The necessity of ensuring the fight against crime from legal, organizational, and scientific perspectives has led many countries in the world to establish specialized criminological organizations, scientific centers, and institutions. As D.V. Vasilev emphasizes, studying foreign experience allows identifying factors that contribute to social progress, uncovering fundamental laws of the development of society and its subsystems, determining criteria for socio-historical development, and creating the possibility to predict the dynamics of development [1]. In this field, approaches to combating crime can be divided into three directions.

1. Western (USA) approach — data-driven strategies, i.e., crime prediction often relies on Big Data, statistical models, and machine learning. In the USA, PBPP (Predictive Policing) systems are used to direct police resources to areas with a high probability of crime, thereby increasing the possibility of preventing crimes. Analytical models pay special attention to analyzing the temporal-spatial dynamics of crimes, identifying risk indicators, and strategically allocating resources.

2. European approach — relying on integrated social policies and experimental models, criminological forecasting takes into account not only police data but also socio-economic indicators. For example, in Germany, the Netherlands, and Scandinavian countries, crime prediction considers factors related to citizen safety, social assistance systems, employment levels, and education. Furthermore, experimental policies (intervention programs) and evaluations in crime prevention are prioritized in strategic decision-making.

3. Asia and other regions (Japan, South Korea, and Singapore) — crime prediction systems based on technological integration and cooperation make extensive use of artificial intelligence, CCTV monitoring, and IoT sensors. They focus on real-time data collection and early detection of risky situations through pre-alert systems. At the same time, international cooperation (Europol, Interpol) is strategically important for global crime statistics and experience exchange, as regional integration is necessary in predicting transnational crimes.

In the USA, criminological research is coordinated by the American Society of Criminology and the National Council on Crime Control, bringing together scientists and practitioners [2]. Canada collaborates closely with the USA through its criminologists' association [3]. In the United Kingdom, the Home Office research team and leading universities serve as major scientific centers in criminology [4].

In Germany, criminological research is mainly conducted at university faculties of law, psychology, sociology, and medicine. At the Max Planck Institute for Foreign and International Criminal Law in Freiburg, the Criminological Research Group prepares a series of "Criminological Research Reports." In Lower Saxony, the Institute of Legal Research (Hanover) publishes the "Interdisciplinary Articles on Criminological Research." In addition, the Federal Institute of Criminal Law Enforcement (Wiesbaden), the Bavarian State Criminal Police Department (Munich), and departments within the Lower Saxony Ministry of Justice conduct ongoing criminological research to identify the causes of crimes and predict them before they occur.

Germany also has "Polizeiliche Kriminalprävention" (PK) — a police unit for crime prevention. This structure uses high-tech criminological monitoring systems for crime statistics, crime analysis, risk levels, crime zone maps, and causes of juvenile delinquency. Within this system: real-time information on crime dynamics is collected; special preventive strategies are developed for each city and federal territory; and "Kriminalprävention vor Ort" (crime prevention on-site) programs are implemented in cooperation with schools, neighborhoods, and social organizations. Youth at risk of criminal behavior, their psychological condition, and social risk factors are monitored [5].

Artificial intelligence systems have also been integrated into crime analysis in Germany. For example, the PredPol (Predictive Policing) system forecasts the probability of crimes occurring at specific times and locations, allowing police patrols to optimize movements based on actual risk zones. Lessons from Germany include: implementing AI-based predictive systems to identify high-risk areas and groups, and involving social services, psychologists, and respected neighborhood leaders in working with at-risk populations (based on the German "Schul sozialarbeit" — school social work model) [6]. Unlike the USA and Switzerland, Germany does not collect data on individuals who could potentially commit crimes [7].

Germany's experience shows that crime prevention should rely not only on punitive measures but also on early warning, forecasting, and collaboration with civil institutions. This approach can enhance the effectiveness of crime control in Uzbekistan, enabling scientific management and strengthening legal security. Criminological forecasting allows concentrating necessary choices and actions in key directions for crime prevention. This not only helps prevent current regional crimes but also creates conditions for actively influencing them in the future. Therefore, forecasting is becoming an increasingly important factor in improving criminological planning, providing it with new qualities — scientific rigor, objectivity, and validity.

In their seminar "Planning, Implementing, and Evaluating Crime Prevention Measures," J. Grem and T. Bennet noted that in Europe, North America, and other countries, crime prevention strategies are often not systematically or centrally organized, and criminological planning is insufficient. They acknowledge the importance of developing and implementing crime prevention programs [8]. In England, the Kickholt project aimed to reduce burglaries in high-risk residential areas, illustrating that successful planning and prevention are often frequent and localized. Similar examples can be found in American sources.

In Japan, crime prevention is even more organized and consistent, though local and private approaches still dominate planning and intervention. Hence, in many countries, local or individual approaches prevail in crime prevention planning and forecasting. Therefore, planning crime prevention and counteraction at national and regional levels is recommended in conjunction with local and private strategies.

Countries such as Australia, the USA, the UK, Hungary, Germany, Ireland, Spain, Canada, Korea, Latvia, the Netherlands, Azerbaijan, Russia, Thailand, France, China, Japan, and India have specialized criminology institutes for scientific study of crime factors [9]. In addition, foreign countries practice using artificial intelligence to obtain data on the time and location of crimes for effective forecasting. In the USA and Japan, scientific organizations analyze crime factors and criminal behavior using AI technology to develop timely management decisions. The UK Criminology Institute has centers specializing in studying property crimes, violence, sexual offenses, and extremism [10].

Territorial criminological laboratories and in-depth regional crime analysis practices exist in many developed countries. For example, in the USA, several states and major cities have established Crime Analysis Centers (CACs) for crime statistics, prevention, and forecasting. In the UK, territorial criminological research centers operate under the "Crime Science" concept, developing localized approaches to crime prevention [11]. Germany and the Netherlands have expert teams for regional crime analysis and prevention, considering the socio-economic and demographic characteristics of regions [12].

Accordingly, establishing territorial criminological laboratories in Uzbekistan would allow in-depth regional analysis and forecasting of crime. They would serve to adapt preventive measures to specific regions using AI and statistical models. As a result, the crime control system would shift from a centralized approach to scientific-analytical management.

Currently, many foreign experts emphasize several software tools' capabilities. Most often, these tools rely on GIS systems and allow using various models for crime prediction. Forecast success depends on the environment, crime type, and data quality. Frequently occurring crimes (e.g., vehicle theft) are more predictable than violent crimes such as assault or murder.

The most popular predictive software is the cloud-based PredPol, developed in 2012 in the USA through a collaboration between the Los Angeles Police Department and the University of California, Los Angeles, based on 70 years of research [13]. The system analyzes crime type, date, and time but does not use personal data. The smallest analyzable unit is a square with a 500-foot (approximately 150 meters) side. After PredPol was implemented in the USA, many regions observed up to a 30% reduction in crime (e.g., Alhambra, California Police Department, or Norcross, GA Police Department).

Another competitive predictive policing program is HunchLab, developed by Azavea in the USA [14]. The "Crime Radar" software predicts crime and assists law enforcement based on data; it was developed by the Igarap Institute, an independent center for civil, digital, and climate security analysis. From 2020 to 2022, its financial support amounted to $1.4 million. "Crime Radar" is widely used in the USA for crime prevention and forecasting [15].

Another effective software is "Command Central Analytics" (Motorola Solutions), primarily used in Europe. The system integrates RMS and SAPR data analysis, queries, visualization, and data sharing into a highly customizable dashboard [16].

Researchers at the Electronics and Telecommunications Research Institute (ETRI) in South Korea developed an AI model capable of predicting crimes called Dejavu. The software analyzes real-time video, assesses the risk of criminal activity, and predicts crime rate increases by evaluating multiple factors. The neural network studies public behavior and compares it with criminal patterns, distinguishing between different types of offenses. Tests showed the model could predict multiple crimes with over 82% accuracy [17].

S. Golitsin emphasized that when implementing AI-based software, compliance with personal data laws is necessary, and system effectiveness should consider not only video streams but also social media behavior. This shows that deploying AI-based predictive software requires a legal and regulatory framework.

Researchers at the University of Chicago used an AI model from 2014 to 2016 to predict weekly crime rates across the city with nearly 90% accuracy a week in advance. Similar success was achieved in seven major US cities. The study published in Nature Human Behavior allowed researchers to not only predict crime but also analyze responses to different crime types [18].

Since 2017, Dubai has introduced "Smart Police Station" unmanned units in several areas [19].

Currently, advanced countries extensively use ICT capabilities such as body cameras, facial recognition, license plate identification, nuclear analytics, neural networks, heuristic engines, recursive processors, Bayesian networks, cryptographic algorithms, document processors, computational linguistics, voice recognition, natural language processing, gait analysis, biometric identification, pattern analysis, threat detection, and classification.

Following our proposals, criminological forecasting can be fully analyzed by computer technology and presented ready for use without human interaction. Implementation of foreign criminology institute research into practice has allowed reducing crime rates by 35–55% on average through identifying key factors and preventing them early [20].

Japan has implemented the AI-based Crime Nabi system by Singular Perturbations Inc., analyzing historical crime data, demographic, geographic, and weather information to determine when and where crimes may occur. It has shown 50% higher accuracy than traditional methods, optimizing patrol routes [21]. Japanese experience highlights the importance of socio-cultural factors, family

institutions, neighborhood-type communities, education systems, and labor relations in crime prediction. Trends in youth behavior, migration processes, and urbanization are systematically analyzed. Japan uses a model based on state-society cooperation, linked to historically developed social discipline, collective responsibility, and high legal consciousness. Crime prevention is conducted not only through punitive measures but also via comprehensive preventive policies.

In China, crime prediction is implemented through data analytics and predictive analytics. In Zhejiang province, the "Public Security Assessment and Warning System" started in 2016, with the core component "Police Cloud" centralizing and analyzing large amounts of police data. By 2019, it included over 600 data categories and 1.6 trillion data points, covering crime statistics, personal information, public safety, and other data types. This system helps identify risky time-location zones and direct police resources accordingly [22]. China's model stands out due to centralized data management and a comprehensive digital monitoring infrastructure, integrating CCTV networks, biometric systems, and administrative databases for AI-driven risk identification. Real-time operation, rapid analysis of large datasets, and preventive action planning are key advantages [23].

The EU Artificial Intelligence Act is a major binding regulation adopted by the European Parliament and Council that creates a legal framework for the development and use of AI systems, including those used in policing and crime prediction. It classifies AI systems by risk level and imposes strict requirements on "high-risk" uses such as law enforcement tools — including transparency, quality, bias mitigation, and conformity assessment — and prohibits certain applications entirely, such as AI systems that predict a person's risk of committing a crime or profile them based on behaviour without legal basis [24].

In the Nordic region (Denmark, Norway, Sweden and neighboring countries) there is no single uniform predictive policing system, but there has been growing research, critical evaluation and legal/regulatory discussion about how data-driven crime forecasting tools should be used in law enforcement. A major collaborative research initiative, the CUPP (Critical Understanding of Predictive Policing) project funded by NordForsk, examined how digital and data-driven police technologies — including predictive analytics — are understood, implemented, and experienced by officers and developers across Denmark, Norway, Sweden and other Nordic countries. The project highlighted both opportunities and risks, noting that routine predictive tools (like POL-INTEL and STATUS) have been adopted into practice but sometimes lack transparency, political debate, and clear governance frameworks, leading to concerns about bias and disproportionate targeting of marginalized groups in some implementations [25].

Legally, Nordic countries take different regulatory approaches to predictive technologies. For example, academic research indicates that Denmark allows broader use of analytical tools within general police work, whereas Norway restricts such systems more tightly, permitting them mainly within specialized units like the Police Security Service, and places emphasis on human rights safeguards such as the presumption of innocence and due process under the European Convention on Human Rights. Both countries also share a lack of detailed procedural rules on how to evaluate and control algorithmic decision-making, meaning that general legal protections must fill the gap until more specific legislation is developed.

In foreign countries, legal frameworks have been established to regulate crime forecasting and AI-based predictive policing systems. In the European Union, the AI Act, effective from 2024,

imposes strict requirements on high-risk AI systems, including those used for crime prediction, mandating transparency, data quality, bias mitigation, and compliance standards. Additionally, the General Data Protection Regulation (GDPR) and the Law Enforcement Directive (LED) limit automated decision-making and predictive analyses that could affect individuals, ensuring personal data protection. At the national level, countries such as the United Kingdom, Austria, and other EU member states regulate police operations and predictive systems, allowing action only when there is a clear risk or legal basis. Moreover, integrated data-sharing systems like Prim II oversee the use of databases for crime forecasting, while AI and ML systems operate under legal frameworks that protect civil rights and ensure transparency. Internationally, civil society and NGOs emphasize discrimination prevention and personal data protection, influencing legislation and policy. Consequently, crime prediction systems in foreign countries are implemented with not only technological but also legal and ethical safeguards, respecting individual rights while supporting law enforcement.

The Europol Innovation Lab report highlights the transformative potential of artificial intelligence (AI) in law enforcement, emphasizing its capacity to analyze large and complex datasets, enhance digital forensics, improve resource allocation, and enable predictive policing. AI applications such as natural language processing, computer vision, biometrics, and generative AI offer tools to detect patterns, optimize police operations, and prioritize critical tasks. However, the report also underscores significant challenges, including risks of data bias, privacy infringements, ethical concerns, and potential discrimination. The EU Artificial Intelligence Act introduces a regulatory framework that defines high-risk AI systems, permissible uses for law enforcement, and obligations for accountability, transparency, and human rights protection. The report stresses the importance of balancing technological innovation with ethical considerations, fostering public trust, and ensuring collaboration and knowledge sharing among agencies. Ultimately, effective AI deployment in policing requires careful integration of legal, ethical, and operational safeguards while leveraging AI's capabilities to proactively prevent crime and enhance public safety.

Scientific literature analysis shows that an effective crime prediction model should: be multifactorial; rely on real statistical data; consider spatial and temporal dynamics; integrate socio-economic indicators; and provide practical usability for law enforcement. Such a model allows identifying high-risk crime segments, optimizing resource allocation, and scientifically explaining the characteristics of the local criminogenic environment.

In Uzbekistan, implementing a predictive policing or criminological forecasting system requires: an integrated crime database combining police, court, prosecution, and socio-economic indicators; establishment of ML and statistical analysis centers (territorial criminological laboratories) modeling real-time crime trends; and a legal and ethical oversight mechanism ensuring forecasts are used for preventive measures, not punishment. Territorial criminological monitoring centers would enable real-time crime dynamics analysis, AI-based predictive systems, and creation of PredPol-like regional risk maps.

Applying foreign experiences in Uzbekistan: first, using crime statistics and digitization from internal affairs, courts, and prosecution to implement hotspot analysis and risk scoring models; second, following the European approach, integrating socio-economic, demographic, and neighborhood data to enhance crime forecasts and plan preventive measures; third, following

China and Singapore, implementing pilot territorial projects in phases to optimize police resources and evaluate scientific results.

Challenges include technological and infrastructure limitations restricting broad digital monitoring and CCTV networks; data fragmentation across different systems requiring integration, normalization, and anonymization; legal restrictions on personal data collection; and a shortage of qualified ML and predictive analytics specialists.

Expanding criminological research at universities and scientific centers, developing prevention strategies based on scientific reports, enhancing local and regional individual prevention programs, utilizing effective foreign approaches, integrating forecasting mechanisms into state agencies, and basing planning decisions on scientific analysis are essential.

Uzbekistan has significant potential to implement predictive policing by leveraging its ongoing digital transformation, centralized crime databases, and growing research capacity in AI and statistical modeling. The Ministry of Internal Affairs' initiatives in data digitization and analytical units provide a foundation for real-time crime monitoring, hotspot mapping, and risk assessment. Collaboration with universities and research centers can strengthen the scientific basis for forecasting crime patterns, identifying high-risk areas, and optimizing preventive interventions. Emerging threats such as cybercrime highlight priority areas for targeted predictive strategies. Successful implementation will require skilled personnel, legal frameworks, and ethical safeguards to ensure compliance with privacy standards. By integrating these technological, institutional, and scientific resources, Uzbekistan could shift from reactive law enforcement toward proactive, evidence-based crime prevention, enhancing public safety and operational efficiency.

Modern criminology evaluates crime as a systemic process interconnected with economic, psychological, demographic, and spatial factors. Crime-influencing factors are expanding: urbanization, migration flows, youth unemployment, family conflicts, drug circulation, ICT-related risks, and other socio-economic factors directly affect criminal environments. Scientific analysis of these processes requires modern technologies — AI, machine learning (ML), and Big Data analytics.

In short, integrating AI and advanced technologies into criminological forecasting not only reduces crime but also increases societal security and significantly improves decision-making quality in law enforcement.

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