

Review Article

ARTIFICIAL INTELLIGENCE
AND DIGITALIZATION IN INVESTIGATIVE
AND LAW ENFORCEMENT ACTIVITY
OF THE REPUBLIC OF KAZAKHSTAN

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ABSTRACT

Background: Digital transformation of law enforcement systems is an integral part of the modern development of state organizations. The implementation of Artificial Intelligence (AI) technologies in the sphere of legal proceedings and criminal process demonstrates significant potential to optimize investigative processes, accelerate information processing, and improve the quality of investigations. In addition, global expertise reveals a set of substantive challenges associated with the application of AI systems in law enforcement. Among them are critical issues concerning the correspondence between the use of AI during investigations and the principles of criminal proceedings, personal data protection, compliance with international human rights standards, fair proceedings, and the risk of discrimination.

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Issues of legal regulations of high-risk artificial intelligence systems, as required by EU Regulation EU 2024/1689 of the European Parliament and of the Council of 13 June 2024 (hereinafter referred to as the "European AI Act") and other overseas tools, are becoming relevant for all states, including countries of the post-Soviet space.

Method: The current research is based on the application of a complex approach, which includes analysis of active Kazakhstani legislation, international documents, and the study of existing AI development concepts and modern Kazakhstani innovations based on AI. As for the basic method, comparative law is used to clarify positive experience and differences in approaches to AI regulation between Kazakhstan and leading global jurisdictions. The research included a systematic analysis of official strategic documents, current regulations, scientific publications, and international standards in the field of digitalization. Particular attention is paid to the study of classification mechanisms of high-risk AI technologies and existing approaches to their use in law enforcement.

Results and Conclusions: In conclusion, this study has identified key directions for the application of AI tools in Kazakhstan. Furthermore, the analysis highlights an urgent need to develop a comprehensive legislative framework to create the necessary conditions for the domestic use of AI in the law enforcement activities of the Republic of Kazakhstan. It was revealed that successful digital transformation requires harmonization of national regulations with international standards, creating transparent assessment criteria for the risks of AI systems, and setting effective control and supervision mechanisms. The research demonstrated the importance of ensuring algorithmic transparency and fairness in the application of AI in criminal proceedings to guarantee human rights. Based on the authors' analysis, an integrated management model for digital transformation is proposed, including legislative initiatives, the development of professional standards, and the creation of control mechanisms. Thus, the implementation of this proposed model allows Kazakhstan to maximize the advantages of AI technologies to improve the quality of law enforcement activities, while simultaneously ensuring the firm protection of citizens' constitutional rights and fundamental freedoms.

1 INTRODUCTION

Modern threats to public security necessitate a complex digital transformation of the law enforcement field, oriented not only to advancing the efficiency and effectiveness of police work but also to increasing public trust. As researchers note, developments in digital tools, as well as Artificial Intelligence systems (hereinafter referred to as "AI"), are shaping new standards of interaction between the state and citizens, facilitating crime

prevention and the optimization of investigations.¹ Digital solutions have become an integral part of law-making practice and ensure the adaptation of the application of law to the challenges of the digital era.² Furthermore, scientists emphasize the importance of interagency cooperation and the continuous development of employees' competencies for the successful implementation of innovations in practice.³ The implementation of AI in law enforcement activities is recognized as an important vector for the development of modern jurisprudence and security, as evidenced by extensive publications in both international and domestic scientific journals.⁴

However, despite the significance of technological progress and its potential to optimize pre-trial investigation and court proceedings, the implementation of algorithmic systems in criminal procedure requires an extremely careful, gradual, and human rights-based approach centered on the priority of protecting the rights and freedoms of the suspect and defendant. Any attribution of AI results to the factual status of evidence, in accordance with the principles of admissibility, reliability, and, when taken together, sufficiency, which is beyond doubt, is capable of exposing any pressure on the internal beliefs of law enforcement officers during the trial of a criminal case.

Algorithmic solutions based on probability assessment potentially concern the content of the presumption of innocence and the rules on interpreting ineliminable doubts in favor of the defendant, if in practice such assessments play a significant role when solving issues about bringing a subject to liability, or, for example, issues regarding the imposition of a pretrial restraint in relation to the subject of an offense.

- 1 Kiel Brennan-Marquez and Stephen E Henderson, 'Artificial Intelligence and Role-Reversible Judgment' (2019) 109(2) *The Journal of Criminal Law and Criminology* 137, doi:10.2139/ssrn.3224549; Paolo Bory, Simone Natale and Christian Katzenbach, 'Strong and Weak AI Narratives: An Analytical Framework' (2024) 40(4) *AI & Society* 2107, doi:10.1007/s00146-024-02087-8; Francesco Borgesano and others, 'Artificial intelligence and Justice: A Systematic Literature Review and Future Research Perspectives on Justice 5.0' (2025) 28(11) *European Journal of Innovation Management* 349, doi:10.1108/EJIM-01-2025-0117.
- 2 Patricia Haley and Darrell Norman Burrell, 'Integrating Artificial Intelligence into Law Enforcement' (2025) 9(2) *SocioEconomic Challenges* 60, doi:10.61093/sec.9(2).60-77.2025; Patricia Haley and Darrell Norman Burrell, 'Leveraging Geo-Profiling to Address Rape as a Public Health and Criminal Epidemic in the United States' (2024) 29(3) *Land Forces Academy Review* 358, doi:10.2478/raft-2024-0038; Seyedeh Monira Hejazi and others, 'Application of Artificial Intelligence in Security-Oriented Criminal Policy: Opportunities and Challenges' (2025) 4(4) *Legal Studies in Digital Age* 1, doi:10.61838/kman.lsd.223.
- 3 Mohammadsadegh Sheykhvand and others, 'A Comparative Study of the Facilitator Application of Artificial Intelligence in Criminal Prosecution: Capacities and Challenges' (2023) 27(1) *Comparative Law Research* 81.
- 4 Viktor Nalutsyshyn, Volodymyr Nalutsyshyn and Rostyslav Golovchak, 'Foreign Experience in the Application of Artificial Intelligence in Law Enforcement' (2025) 3(57) *Socio-Economic Relations in the Digital Society* 94, doi:10.55643/ser.3.57.2025.617.

There is a serious risk that the burden of evidence will increase for the defense: in addition to other evidence obtained as a result of the investigation, additional information may arise that requires a response and, consequently, refutation by the lawyers. The scope of principles of criminal procedure turns out to be no less vulnerable. The development of principles of competitiveness, equality of prosecution and defense, division of criminal procedural functions, disposition, and publicity constitutes a set of principles whose ratio and interaction define the type of modern criminal procedure. For example, consider the principle of competitiveness and equality of the parties: if the prosecution has specialized devices using AI and the defense is not equipped with comparable access either to the information obtained as a result of using such devices, or their parameters, work specificity, limitations, potential errors, and erroneousness, and so on.

Simultaneously, scientists have expressed concerns about the potential risks of rapid change, which may negatively affect law enforcement. The history of criminal procedure has seen anti-humanistic methods of investigation, data collection, and evidence evaluation.

Thus, an additional threat represents the potential impact of algorithmic recommendations on the realization of the principles of court independence, the free assessment of evidence, and the immediacy of court proceedings.

If such recommendations are not strictly delineated by the legislator, and if the status and nature of such information are not defined in analogy with results obtained from polygraph testing or by hiring specialists from the field, then there is a growing risk that the court's independent analysis of the evidence will be undermined.

Finally, processing large amounts of personal data within AI systems raises concerns about the fundamental rights to the inviolability of private life, the privacy of correspondence and communication, the protection of personal information, and the effective means of defending these rights against unwarranted interference. When there are no strict procedural frameworks and transparent admissibility criteria for such interferences, this erodes the principle of legality and the inviolability of private life.

In this regard, the subsequent paragraphs of the article will emphasize, in particular, how the designed regulatory approaches and the practical testing of artificial intelligence technologies align with the key principles of Kazakhstan's criminal procedural law and international human rights standards.

2 METHODOLOGY OF RESEARCH

The foundation of the research methodology of the given article lies in a complex legal-analytical approach. Within the scope of work, a combination of formal-legal, comparative-legal, and empirical methods is employed, enabling a comprehensive analysis of both the regulatory foundations of the digitalization of law enforcement activity and the applied aspects of integrating Artificial Intelligence into the legal environment.

The first stage was the analysis of international standards governing the use of digital technologies in public security. The selected countries for the analysis were chosen for their rapid adaptation of legislation to diverse technologies and the application of these technologies in criminal proceedings. Particular attention is paid to the comparison of Kazakhstani legislation with provisions of European directives. To identify legal risks associated with the application of high-risk AI systems, formal-logical and systematic-structural methods were used, enabling the uncovering of specifics of regulatory standards and the identification of challenging areas in their application.

Within the scope of comparative legal analysis, scientific publications and empirical reports on the implementation of AI research in the fields of fighting cybercrime, prevention organizations, and investigations into violations of the law were examined.

Content analysis of cases of digital services' functioning played an important role in justifying the applied conclusions ("Law and order", "ForensicLIMS", anti-fraud center), as well as in summarizing statistical data. During the work, goal-oriented research on digital control institutions, the storage of substantial evidence, and legal mechanisms of digital control concerning the integration of blockchain technology and cryptocurrency exchanges into the prevention structure and crime investigation was conducted.

Methods of foreign expertise interpretation harmoniously matched up with empirical modeling and juridical forecasting.

The article also explored the possibilities of leveraging modern developments by Kazakhstani information technology specialists, specifically the search for AI-based solutions within the framework of pre-trial investigations. Deductive and inductive approaches, the collection and processing of qualitative and quantitative data, and the systematic assessment of organizational-legal consequences, including the scaling of digital solutions, were used as auxiliary tools.

Such a structured and interdisciplinary methodological foundation ensures that the research has sufficient levels of trust and relevance of its conclusions, making it possible to integrate national juridical practice with advanced international developments in the field of digitalization of law enforcement agencies.

3 DISCUSSION

The significance of AI implementation in the law enforcement system is that AI can radically enhance the effectiveness of big data analysis, identify crime patterns, and predict criminal risk, allowing it to outpace traditional methods in speed and the scope of information.⁵

5 *Europol, AI and Policing: The Benefits and Challenges of Artificial Intelligence for Law Enforcement* (Publications Office of the European Union 2024) doi:10.2813/0321023.

Scientists note that AI is being implemented according to the following main directions:

- face recognition and biometrics for searching and identification of individuals sought by the authorities;
- predictive modeling and communication massive analysis for forecasting of potentials and prevention of offenses;
- automation of processes regarding digital forensics, including processing of evidence in case studies, study of video recordings, and creating analytical reports;
- enhancement of effectiveness regarding the investigation of transnational crimes (according to articles by foreign researchers).⁶

AI also enables the release of human resources and the redirection of law enforcement agencies' employees' efforts towards challenging tasks that require legal assessment and ethical judgment. In the EU, the USA, and China, big data analysis algorithms and machine learning are being implemented to fight cybercrime and terrorism.⁷

Global tendencies, risks, and challenges. European researchers underscore AI's potential for digital transformation in law enforcement, ranging from criminal analysis to the automation of routine operations.⁸

Among key challenges:

- protection of personal data and compliance with basic human rights when using AI;
- transparency and accountability of decisions of algorithmic systems for the prevention of failures in criminal proceedings;
- necessity of international coordination, and also legislative regulation of AI application in police and criminalistics.⁹

Particular attention is paid to the classification of high-risk AI systems in accordance with the new European legislation, which strictly regulates automated methods of impact on individuals.

6 Adnan Siraj and others, 'Redefining Accountability: AI's Role in Prosecuting Transnational Crimes under International Law' (2025) 6(2) *Audit of Comparative Law Journal* 124, doi:10.22219/aclj.v6i2.40434.

7 *ibid*

8 Lena Klasén, Niclas Fock and Robert Forchheimer, 'The Invisible Evidence: Digital Forensics as Key to Solving Crimes in the Digital Age' (2024) 362 *Forensic Science International* 112133, doi:10.1016/j.forsciint.2024.112133.

9 Athina Sachoulidou, 'Harnessing AI for Law Enforcement: Solutions and Boundaries from the Forthcoming AI Act' (2024) 15(2) *New Journal of European Criminal Law* 117, doi:10.1177/20322844241260114.

Along with that, one of the main issues occupying Kazakhstan scientists and the authors of this article is the potential for using modern technologies from the perspective of complying with the principles of criminal procedure, which mankind has come to through a long way and through the evolution of rights of defense and the liberty of subjects of an offense.

In criminal procedure, the constitutional and procedural criteria of the presumption of innocence hold particular significance.

4 RESULTS

The modern development of digital technologies in the Republic of Kazakhstan and in criminal proceedings is happening very quickly. Along with this, the Criminal Procedural Code of the Republic of Kazakhstan [10] (hereinafter referred to as “CPC-RK”) does not contain systematic regulation of the use of IT solutions that employ AI as an independent type of evidentiary information. This poses risks to participants’ constitutional rights in the procedure.

For the purpose of ensuring legal certainty, it is necessary to complement the CPC-RK by defining results obtained through the use of AI systems with a strict indication of their auxiliary, orienting feature. Such a definition may be codified in Article 111 of the CPC-RK as an independent source of factual data, subject to obligatory verification and comparison with other evidence (testimonies, expert findings, substantial evidence, and others) but not substituting for them.

Taking into account the realization of pilot programs in Kazakhstan regarding the use of intellectual systems in the activity of pre-trial investigation authorities, such as digital assistants for investigators, analytical models for investigation planning, and the automated preparation of procedural documents, it would be advisable to establish a special test mode for using these technologies in regulations. Such a mode must assume the following: a) mandatory marking of the results of AI as recommendations; b) direct prohibitions on the adoption of key procedural solutions (being named as a suspect, the imposition of a pretrial restraint, and generating defendant acts) exclusively on the basis of AI inferences without an independent assessment of their justification by an official; c) procedural fixation of the algorithm parameters (data, model version, volume, and features of the used data), necessary for subsequent verification and objections; d) certification and periodicity of checking the used data.

From the perspective of the basic principles of Kazakhstan criminal procedure (legality, competitiveness, ensuring the right to a defense, the presumption of innocence, and the independence of the court), a stricter articulation of human rights guarantees is required when using AI technologies under the CPC-RK.

It is important to consider the potential to complement the CPC-RK with the principles of technological neutrality and procedural equality in the age of digitalization. This principle has to ensure:

- the obligations of criminal prosecution authorities to uncover the defendant's information about using AI systems and the obtained results;
- right of the defendant to order an expert examination.

a) Digitalization of preventive activity.

The Ministry of Internal Affairs of the Republic of Kazakhstan implements a comprehensive set of measures to integrate digital technologies and other innovative solutions into the public security assurance system.¹⁰ In the matter of the indicated transformations, the concept of forming the ideology of “Law and order” in society is being implemented.

At the same time, attention is paid to the target directions of prevention: prevention of juvenile crime, minimization of child injuries, assurance of traffic safety, counteractions against cybercrime, reintegration of ex-convicts, and intensification of prevention.

In parallel, the legislative framework is being updated: a bill on crime prevention is being considered in the Mazhilis of Parliament. Active engagement with civil society is underway, and the activities of over 4,000 organizations uniting approximately 20,000 citizens are being coordinated.

A new service called “Law and order” was implemented on behalf of the Head of State on the 23rd of June 2025 in the “EgovMobile” mobile application and by second-tier banks. The service gives the citizens an opportunity to efficiently inform police officers about crimes (traffic accidents, traffic violations, domestic violence, other accidents, incidents involving children, illegal actions of police officers). From the moment of the service launch, the police received more than 30,000 reports from citizens (EgovMobile – 10,831, Kaspi.kz – 9,444, Halyk Bank – 181, application “102” – 10,518).¹¹

As a result, 9799 individuals were subjected to administrative liability for traffic violations; criminal offenses were registered; 407 traffic accidents and 8729 accidents were processed; incidents involving children were reviewed; 419 individuals were subjected to criminal liability for domestic violence; and 767 complaints about employee actions were reviewed.¹²

10 Resolution of the Government of the Republic of Kazakhstan no 200 of 1 April 2025 ‘Concept for the Promotion of the Ideology of Law and Order in Society for 2025–2030’ [in Kazakh] <<https://adilet.zan.kz/kaz/docs/P2500000200>> accessed 7 January 2026.

11 Sanzhar A Adilov, ‘Statement at the meeting of the Coordinating Council on Ensuring Legality, Public Order and Combating Crime under the Office of the Prosecutor General, the Main Military and Transport Prosecutor’s Offices, regional and equivalent prosecutor’s offices (cities of republican significance and the capital)’ (2025) [in Kazakh].

12 *ibid*

Simultaneously, large-scale efforts to promote Law and Order are underway: across mass media and social networks, more than 18,000 materials have been published to shape legal culture and raise public awareness of prevention.

The considered informational strategy not only allows for the systematic dissemination of knowledge about the structure and principles of action of the national legislature but also facilitates the integration of the values of law and order into various fields of daily interactions between society and the state. This activity fosters social accountability, helps prevent crimes at an early stage, and reinforces societal discipline and trust in authorities.

Increasing legal awareness through modern communication channels initially transforms citizens' individual attitudes, reinforces the law's superiority in public consciousness, and lays the foundation for the long-term development of legal culture amid the digital transformation of state management.

b) Fight against cybercrime and internet fraud.

To combat financial crimes, the Antifraud Center was created in June 2024 to track and block suspicious transactions. Since then, 841 million tenge has been blocked, of which 457 million was returned to the victims.¹³ Except for that, a great amount of blockages of cash is explained by the fact that at the initial stage of Antifraud Center's work in conditions when practice lacked, the measures had been undertaken widely, without the regard to detailed analysis of operations.

In addition, in accordance with Article 25-1 of the Law of the Republic of Kazakhstan "On payments and payment systems", a new refund procedure is implemented via the Antifraud Center's platform functionality.¹⁴ The necessity of ensuring around-the-clock incident processing and the effectiveness of interagency interaction was highlighted.

In this context, Great Britain's expertise in combating financial crime is of particular interest and warrants specific attention to the organization of information exchange and the automation of financial intelligence processes.¹⁵

At the current moment, the central element of financial intelligence's activity (UKFIU) and law enforcement organs is a system of processing suspicious activity reports (SAR), received from the National Financial Sector, and from foreign partners and law enforcement structures.

13 *ibid*

14 Law of the Republic of Kazakhstan no 11-VI ZRK of 26 July 2016 'Payments and Payment Systems' (amended 3 January 2026) <<https://adilet.zan.kz/eng/docs/Z1600000011>> accessed 7 January 2026.

15 Diana Bociga, Nicholas Lord and Elisa Bellotti, 'Dare to Share: Information and Intelligence Sharing within the UK's Anti-Money Laundering Regime' (2025) 35(6) Policing and Society 812, doi:10.1080/10439463.2024.2428735.

A secure, free online platform is being used to transfer SAR reports, allowing messages to be sent around the clock. The system ensures efficient confirmation of report receipt and the assignment of a unique identifier, which distinguishes it favorably from manual information collection methods. All the reports are stored in a secure central database, ensuring their preservation and availability for analysis by large agencies.

UKFIU takes responsibility for the receipt, preliminary analysis, and organization of investigations on provided proceedings. Annually, the department receives around 460,000 SAR, the majority of which, after detailed analysis, are redirected to specialized agencies for further investigation, such as the National Terrorist Financial Investigation Unit (NTFIU), the police professional standards unit, and so on.

The rest of the reports are available for law enforcement agencies via protected communication channels.

The use of keywords and specialized codes enhances the effectiveness of information processing. The same SAR may be used simultaneously by different agencies: the tax and customs control service, local police, governmental organizations, etc., depending on the identified crimes and risk signals. Such an information-exchange model ensures high efficiency, integration of analytical capabilities, and a multisectoral response to financial crimes.

Returning to Kazakhstani expertise, let us note the following: Accounting and registration discipline and the efficient blocking of cash were intensified in August 2025 by the Republic of Kazakhstan's Ministry of Internal Affairs to improving the Antifraud Center's activities, its integration with the Web-Interface of the Unified Register of Pre-trial Investigations (Web-URPI), and to further advance joint activity in coordination with the General Prosecutor's Office of the Republic of Kazakhstan. Incidents are automatically received by police units on duty after official registration, and decisions must be made within twenty-four hours. At the same time, the system flaws are identified. One of the current problems is the absence of a mechanism to refund blocked cash. Therefore, it is advisable for the National Bank, in conjunction with the Ministry of Justice and other relevant governmental bodies, to undertake the necessary amendments to the Criminal Procedure Code of the Republic of Kazakhstan. Another issue is the lack of response to incidents created by the Ministry of Internal Affairs on weekends and holidays. Pursuant to the National Bank's internal acts, this work must be conducted around the clock. Additionally, not all incidents reported by Internal Affairs Agencies on non-working days are processed, violating the established three-day response time and reducing the likelihood of blocking cash. In connection with this, the National Bank was offered the opportunity to undertake corresponding measures to ensure twenty-four-hour incident processing during these periods.

There is also a need to integrate the Antifraud Center with cryptocurrency exchanges, as a significant portion of stolen funds is converted into cryptocurrency. However, the police

only learn about this after questioning suspects or witnesses. Of course, by this time, all the cash has been withdrawn. Digitalization of the banking system enables real-time interception of such actions and the blocking of cash and virtual assets. In this regard, it is advisable to work on integrating the Antifraud Center with cryptocurrency exchanges registered in the “Astana” International Financial Center (Binance, Bybit, Ataix Eurasia, CaspianEx, Delta DA, Biteeu Eurasia, and others).

c) Artificial Intelligence in investigative activity.

The implementation of the investigator's interactive assistant, incorporating elements of Artificial Intelligence, marks a new stage in the digitalization of criminal proceedings. The system automates investigation planning, reading processing, and the formation of procedural documents, enhancing the quality and speed of investigative activities.

In pilot mode, the system is approved in regions such as Astana and Kosshy, where AI helps analyze contradictions in indications, generate clarifying questions, and create expert conclusions. Development of new modules is ongoing for large-scale implementation nationwide.

To implement orders issued by the Head of State to accelerate the development of Artificial Intelligence in the Ministry of Internal Affairs, the Committee on Legal Statistics, and the special accounts of the General Prosecutor's Office of the Republic of Kazakhstan, an investigator's interactive assistant is being developed.

It implies digital technologies that:

- automate investigation activity;
- reduce labor costs;
- assist in creating an investigation plan;
- processes indications of participants in criminal proceedings;
- offers question variants necessary for clarifying and appointing forensic examinations from leading investigation practices.

Moreover, AI reduces investigation time by taking on all technical work. If there are indications that AI performs comparative analysis, identifies contradictions, and generates specific questions for further inquiry, it can also be used to facilitate subsequent face-to-face confrontations between participants in the proceedings.

As of today, three functioning modules have been approved for pilot mode, starting in June 2025, in two capital districts and the town of Kosshy in the Akmola region. These include:

- investigation planning;
- indications processing;
- creating procedural documents.

There is another module in development, drafting a ruling on the classification of the act. This is a desire among the investigators themselves who participate in the pilot project.

Considering this, a complete replacement of employees' activities is out of the question; AI only assists in investigating criminal proceedings more effectively, identifying failures and directing the work. This is in line with criminal procedure law for swift and complete disclosure, criminal investigations, exposure, and the criminal prosecution of individuals charged with crimes.

Based on the results of the pilot project, the system will be advanced for nationwide implementation.

In the context of conducting scientific research on the project named "Innovative approaches to conduct verbal investigative actions with application of Artificial Intelligence tools," the following priorities are put forward:

1) Development of intellectual equipment for automated recording of investigative actions is an interdisciplinary task at the intersection between jurisprudence, computational linguistics, machine learning, and cryptography security. The current state of documenting verbal investigative actions is characterized by high labor intensity and substantial reliance on the investigator's subjective perception, which poses risks to compliance with participants' procedural rights and to the completeness and reliability of the recorded information.

A fundamental issue is the lack of technological solutions that can integrate automated speech recognition with simultaneous analysis of compliance with procedural requirements, while ensuring the unchangeability and juridical significance of the created documents. Traditional systems of recognition do not consider the specifics of juridical discourse, the dialogical nature of questioning with inherent interventions and emotional nuances, and do not implement semantic analysis of content to identify potentially coercive interrogation techniques. The research conducted is directed towards the creation of a scientifically grounded methodology for system development, integrating multimodal data processing, intellectual analysis, the conduct, and cryptographically secure documentation into a Unified technological complex.

2) Development of a methodology for annotating multimodal data. Creating a high-quality annotated dataset requires developing a detailed methodology for annotating linguistic features of interrogation, as well as juridically significant aspects of compliance with procedural rules.

The procedure begins with creating interdisciplinary work groups, including specialists in criminal proceedings, interrogation psychology, and computer linguistics, that develop a hierarchical taxonomy of marking categories. The process of annotating is organized iteratively, with periodic calibration sessions in which a team discusses difficult cases and clarifies the interpretation of the marking category, ensuring dynamic advancement of the methodology based on accumulated experience.

3) *Creation of specialized models of speech recognition.* The development of the system of automatic speech recognition for tasks on recording interrogations requires adaptation of modern architectures to specific conditions of use, including necessity of two language support, processing of speech with emotional expressions, and also functioning in a complex acoustic situation with overlapping replicas of participants. The crucial stage is a procedure of further training of the basic model on query data, which allows model to adapt to juridical terminology, peculiarities in question construction by investigators, and response patterns of interrogated persons.

A training program is organized as a multi-stage process, starting with data preparation, including the creation of precise transcripts for training audio recordings, proceeding through iterative training with a gradual reduction in training speed, and completing validation on the deferred test set. Model quality assessment is implemented by calculating an indicator called Word Error Rate, with target values of at least 95 percent for Russian and at least 92 percent for Kazakh, which aligns with a level considered admissible for further application under production conditions.

4) *Development of a system of semantic analysis and query techniques classification.*

Automatic identification of potentially unacceptable interrogation techniques requires a system of deep semantic analysis capable of interpreting a witness's intentions beyond the literal meaning of words. The architecture of such a system is based on the application of large language models, pre-trained on extensive textual corpora and then retrained on specific query data, with the types of investigative actions marked.

The creation process for a classifier of query techniques begins with developing a hierarchical taxonomy of categories based on an analysis of the provisions of the Criminal Proceedings Code of the Republic of Kazakhstan and international recommendations on the ethical conduct of interrogations. A taxonomy is structured around levels of criticality, distinguishing categories of critical crimes that render evidence unacceptable; a category of substantial procedural crimes; and a category of non-optimal practices without legal consequences but indicating insufficient professionalism.

5) *Creating a subsystem for acoustic analysis of psychophysiological state.* Identification of stress signs and psychological pressure requires analysis of paralinguistic characteristics of speech, which are not reflected in textual transcripts. Acoustic parameters, such as fundamental frequency, pitch variation, speech rate, pause duration, and energy correlation across different frequency ranges, contain information about a speaker's emotional state. The development of a stress detection system is based on the architecture of ECAPA-TDNN, specialized for extracting signs from speech signals through temporal-channel convolution, an attention mechanism, and statistical aggregation across multiple time scales. The given architecture demonstrates resilience to variation in acoustic conditions and capacity to distinguish long-term patterns from short speech fragments.

Training the stress detection model is performed on marked speech segments from interrogated persons, in which annotators assessed stress level on a six-point scale based on a combination of acoustic signs and situational context. Such an approach allows models to normalize stress assessment relative to the individual's baseline, enhancing the precision of detecting significant changes in state.

Integration of stress detection with the investigator's content analysis of questions enables identification of causal connections between the use of specific interrogation techniques and changes in the psychophysiological state of the interrogated person. The system tracks the temporal dynamics of stress levels, identifying sharp fluctuations that follow specific statements made by investigators, which serve as indicators of potentially coercive impact.

6) Architecture design of integrated module for crime detection.

Creating a functional procedural rights compliance monitoring system requires integrating multiple specialized models into a unified processing process with a high-level reasoning mechanism. The system's architecture is structured as a sequence of processing levels, beginning with the sensor level involving multimodal data capture, continuing with the level of recognition with conversion audio to text and video into structured metadata, proceeding to the level of semantic analysis with intention and emotion classification, and ending with level of context reasoning, uniting outputs of underlying level for final conclusions about the existence of violations.

7) Creating a cryptographically protected documentation system.

Maintaining the juridical significance of automatically generated protocols requires the immutability of fixed information and the ability to cryptographically verify document authenticity. The decision is based on the use of distributed register technology, in which each element of the protocol is cryptographically linked to previous fragments via a hash chain. Each completed protocol is signed with the device's private key, enabling any verifying party to cryptographically verify that the protocol was created by a specific registered device and has not been modified since creation. The system also implements timestamp mechanisms by integrating with trusted timestamp services, ensuring independent confirmation of the protocol's creation time with split-second precision.

8) Development of the device's hardware platform. Creating physical devices requires integrating high-performance computational components with specialized sensors for audio and video data into a compact, autonomously functioning form factor. The choice of computational platform is determined by requirements for performance, necessary for implementing multiple machine learning models in real-time, while maintaining low energy consumption to enable many hours of autonomous operation. Platforms based on NVIDIA's graphics processors, such as the Jetson series, demonstrate an optimal balance of computational power and energy efficiency thanks to an architecture designed for deep learning operations and support for mixed-precision calculations.

9) *Integration with existing information systems of law-enforcement agencies.* Maintaining the device's practical application requires developing mechanisms for seamless integration with the existing information infrastructure of pre-trial investigation authorities. The key element of integration is the connection to the URRI (Unified Register of Pre-trial Investigations), the Centralized System that accumulates all procedural information on criminal proceedings in the Republic of Kazakhstan. The architecture of integration implements two-directional data exchange, where the device extracts contextual information about a case, including the procedural status of the interrogated person and the history of previous investigative actions to inform analysis, and sends the created protocols to the centralized system for inclusion in the case file.

The technical implementation of the integration is based on protected web services with authentication through the electronic digital signature infrastructure operating in Kazakhstan. The device is equipped with an interface to connect investigators' digital signature tokens, ensuring a cryptographic link between the created protocols and the specific authority responsible for interrogation. The data exchange protocol implements reliance-support mechanisms, including automatic reconnection when a temporary connection is lost, local data buffering, transmission expectation, and secure delivery through receipt confirmation at the application level. The system is adapted to operate under limited or unstable network conditions, typical of some investigative units, maintaining full autonomy of basic functions and synchronizing only when the connection is restored.

10) *System validation and organization of pilot implementation.* Ensuring the system's reliability and practical application requires implementing a multi-level testing program that encompasses both the components' technical characteristics and comfort of use and effectiveness under real conditions. The laboratory testing phase is organized as a systematic progression through a set of synthetic test scenarios, developed to cover the full range of procedural situations and potential violations. Testing methodology includes the creation of controlled reconstructions of interrogations with professional actors, conducted within detailed scenarios that encompass various combinations of procedural statuses, communication languages, interrogation techniques, and interrogated persons' stress levels. Each reconstruction is concurrently assessed by legal experts, creating reference marking of violations for further comparison with automatic system detections.

The user's training program is structured as a multilevel process, beginning with theoretical preparation on the system's operating principles and possibilities for interpreting outputs, proceeding with practical lessons in educational scenarios, and concluding with supervised real interrogations, followed by further analysis of the system's work. A critical aspect of learning is forming accurate expectations about the system's capabilities and limitations. Automatic detection serves as an assistive tool, requiring jurists' professional judgment for final interpretation, but does not substitute for human expertise. Additionally, written methodological recommendations and video instructions that cover typical application scenarios and action algorithms for emergency situations.

d) Electronic systems for storage of substantial evidence.

The E-AYGAQ ZAT project ensures the automated recording of substantial evidence. The given novation allows for the exclusion of labor-intensive paper recording of substantial evidence.

Thanks to the “online viewing” function, a head can control the entire process, from submission to storage of substantial evidence to a further decision on their fate.

The Ministry of Internal Affairs is sequentially developing the police's digital infrastructure to enhance the level of the legal order, transparency, and the effectiveness of law enforcement agencies' functioning in the modern conditions of an information society. The security alarm system, connected to the duty station, is set up. Entry to the hardware program complex is controlled by employees' biometric data. Substantial evidence is placed in a package with a "QR code" containing all information about the substantial evidence in criminal proceedings. For the nationwide implementation of the project, it is necessary to integrate the information systems “Unified Register of Pre-trial Investigations” and “Torelik”.

One of the fundamental tasks of law enforcement agencies in fighting crime is to identify property obtained through crime for use in compensating for damages. Along with this, criminals no longer store cash in accounts but instead prefer to legalize their criminal income by purchasing securities. In this regard, the Ministry of Internal Affairs of the Republic of Kazakhstan, during the year, together with the Committee on Legal Statistics and Special Accounts (CLSSA), is conducting work on integrating the Central Depository of securities with the System of information exchange of law enforcement, special state, and other bodies.

e) Automating forensic work.

The “ForensicLIMS” system is designed to drive the digital transformation of forensic expertise. It maintains control of overflow of substantial evidence, automatic reporting, and exclusion of manual document flow. Thanks to analytical functions, the system allows us to identify crime patterns and reduce the workload for regional departments.

Also, a pilot project called “Video HD”, aims to optimize registration of civil applications at events that do not involve signs of a crime. The project addresses the shift away from paper media by introducing video-recording systems for calls, which facilitate the automation of document flow and data processing.

Implementation of this decision makes it possible to significantly reduce the time spent processing applications and to enhance the quality of application accounting and registration, while minimizing the risk of concealment or fragmentation of the facts of a crime. Since August 2025, the “Video HD” system has been approved in five regional territorial police departments and is being implemented in cities and regions with different criminogenic specificities.

The platform implementation is receiving particular attention to optimize prosecutors' work when checking and processing order materials: during the first nine months of 2025, 1.2 million such materials were processed across the Republic,¹⁶ which places high demands on technical and office maintenance resources. The "Video HD" system frees up office space, reduces paper storage volume, and streamlines tasks related to effective space management.

The Ministry of Internal Affairs is sequentially developing the police's digital infrastructure to enhance the level of the legal order, transparency, and the effectiveness of law enforcement agencies' functioning in the modern conditions of an information society.

5 CONCLUSIONS

Research on the complex digitalization of law enforcement activities in Kazakhstan has demonstrated significant progress in integrating innovative technologies, including Artificial Intelligence, automated analytical platforms, and systems for digital document accounting. The use of AI has enhanced the efficiency and quality of big data analysis, enabling the forecasting of criminogenic risks and the identification of crime patterns, which aligns with the expertise of advanced jurisdictions in Europe and the USA. The creation of specialized services for civilians, active promotion of legal culture, and the launch of pilot projects facilitated the growth of social responsibility and reinforced the population's trust in law enforcement agencies.

Together with this, the development of digital technologies in the law enforcement field was accompanied by a range of fundamental challenges, such as maintaining cybersecurity, protecting personal data, ensuring transparency of algorithmic solutions, and ensuring compliance with basic human rights. Analysis of foreign expertise confirmed the expediency of creating and automating integrated antifraud centers, implementing interagency exchange mechanisms, and a dynamic monitoring system for banking and cryptocurrency operations. During the operational process, particular attention is paid to legislative regulation, professional training of personnel, and the development of future jurists' competencies.

The scientific significance and prospects of AI-driven automation of investigative protocols. The developed methodology makes an interdisciplinary contribution at the intersection of computer linguistics, machine learning, and jurisprudence, demonstrating the feasibility of applying advanced AI technologies to address socially significant tasks related to the protection of personal rights in criminal proceedings. The scientific novelty of the work lies in the development of a comprehensive approach to multimodal analysis of verbal investigative actions, integrating linguistic, acoustic, and contextual levels of analysis into a unified system for reasoning about compliance with procedural rules.

16 Adilov (n 12).

Methodology for data annotation, developed in the context of the project, contributes to the development of corpus linguistics of juridical discourse, creating a detailed taxonomy of communicative strategies in the context of interrogation and assurance of infrastructure for further research.

Technological innovations include the adaptation of deep learning architectures for specific analysis tasks in legally significant communication, the development of diarization methods for identifying speakers in complex acoustic conditions with overlapping replicas, and the creation of effective model quantization algorithms for operation on devices with limited computational resources. The application of blockchain technology in the context of law enforcement document flow demonstrates a novel approach to maintaining the constancy of juridically significant information while preserving functional autonomy without a constant connection to centralized infrastructure. These findings have potential applications in a wide range of other juridical procedures that require reliable fixation of oral interactions, including court hearings, notarial acts, and administrative hearings.

Prospects for further system development include expanding multimodal analysis by integrating computer vision to automate the detection of non-verbal stress indicators, such as facial microexpressions, gesture dynamics, and changes in body posture. The application of transformer-based architectures to video sequence processing opens opportunities to identify subtle behavioral patterns that are not available when speech analysis is performed in isolation. Development of adaptive learning mechanisms enables the system to continually improve based on accumulated application experience, automatically updating trigger-word dictionaries and adjusting classification thresholds in response to expert feedback. Expanding the linguistic scope to include additional languages and adapting violation-detection rules to the procedural requirements of other jurisdictions creates opportunities for the international application of the developed technology.

Integration with analytical systems for big data processing enables meta-analysis of interrogation-conducting patterns across the entire law enforcement system, identifying systemic issues and informing the development of programs to improve investigators' qualifications. Aggregated, anonymized statistics on violation types and frequencies across various departments may serve as a tool for assessing the effectiveness of management interventions and dynamic quality. Creation of centralized storage for anonymized interrogation reports with detailed stamp shapes a unique research infrastructure for further fundamental research in the fields of interrogation psychology, power communication linguistics, and the effectiveness of different investigative techniques.

Recommendations developed by the authors in the context of the current research:

1. To advance the national legislature, consider international standards, implement regulatory mechanisms for work with high-risk AI systems, and support legal adaptation to the rapidly changing technologies in the digital space.

The development of a complex model for the use of artificial intelligence in the criminal procedure of the Republic of Kazakhstan requires institutionalized interaction among the legislator, the law-applier, the scientific community, and civil society institutions. Scientifically grounded proposals for the modernization of the CPC-RK in this area must draw not only on comparative legal analysis of foreign expertise but also on the results of Kazakhstan's pilot programs, official strategies for digital development, and the doctrinal interpretation of the impact of algorithmic technologies on citizens' constitutional rights¹⁷

Such a distinction between the regulatory and empirical bases of inferences will yield a more sustainable conception of legal regulation of AI in criminal procedure. This approach minimizes risks to individuals' rights and liberties while enhancing the efficiency of investigations and the administration of justice.

In this context, a framework approach is the best option for generating jurisprudential constructions of regulations. However, it is also important to develop instructions on the use of AI at the level of subordinate regulatory legal acts. Unfortunately, researchers have not yet found foreign articles or regulations that could be directly incorporated into domestic legislation. Therefore, it is proposed that we develop such regulatory acts by involving not only scientists and practitioners in jurisprudence but also specialists in information technology. These experts can provide substantive support in understanding the nature and specifics of AI applications.

The use of AI must be accompanied by a range of requirements that should be addressed on a regulatory basis:

- consent of the subject of the offense and clarification to him of the legal consequences regarding the use of their data;
- the opportunity for the defense party to review the data and their associated obligations;
- maintaining data confidentiality and protecting data from hacking and unauthorized dissemination (for example, a video of an interrogation);
- uninterruptedness of actions (if a video interrogation is used, it must be recorded from the very beginning until the very end in the presence of the defendant);
- there must be a mechanism through which data obtained via different devices or solutions can be appealed or questioned and not taken into account when rendering a decision in the case.

2. It is proposed to work out the integration of the Antifraud Center with cryptocurrency exchanges registered in IFCA (International Financial Center "Astana") (Binance, Bybit, Ataix Eurasia, CaspianEx, Delta DA, Biteeu Eurasia, etc.).

17 A Akhpanov, S Sabitov and R Shaykhadenov, 'Criminal Pre-Trial Proceedings in the Republic of Kazakhstan: Trend of the Institutional Transformations' (2018) 34(85) Opcion 107.

3. To intensify educational programs on digital competencies for employees of law enforcement agencies and the overall civil service sector.

The authors of the given article believe that the use of AI must not simply substitute for or compensate for the incompetence of law enforcement officials. Instead, it must enhance their potential and save human resources, reducing the time between the commission of a crime and the rendering of a decision on the case, thereby minimizing procedural errors, defining the behavioral model of the authority, tactics for conducting interrogations, and situation modeling.

4. To introduce pilot projects on digitalization of procedural actions, conduct persistent monitoring of their results, and define the readiness of officials and the efficiency of IT solutions when conducting investigation actions. The authors believe that it is reasonable to implement such solutions using AI for certain categories of cases and to limit its use to very high-risk crimes.

5. Support informational campaigns, directed toward the development of legal culture and preventive awareness among citizens, applying modern communication technologies for the enhancement of legal literacy and engagement level.

Thus, the implementation of these recommendations will facilitate the shaping of an effective, open, and modern law enforcement system, capable of responding appropriately to the challenges of the digital era and reinforcing the competitiveness of the national legal order.

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АНОТАЦІЯ УКРАЇНСЬКОЮ МОВОЮ

Оглядова стаття

ШТУЧНИЙ ІНТЕЛЕКТ ТА ЦИФРОВІЗАЦІЯ В РОЗСЛІДУВАЛЬНІЙ ТА ПРАВООХОРОННІЙ ДІЯЛЬНОСТІ В РЕСПУБЛІЦІ КАЗАХСТАН

Арстан Ахпанов, Санжар Аділов, Єргалі Мабієв та Ляззат Нурлумбаєва *

АНОТАЦІЯ

Вступ. Цифрова трансформація правоохоронних органів є невід'ємною частиною сучасного розвитку державних організацій. Впровадження технологій штучного інтелекту (ШІ) у сферу судочинства та кримінального судочинства демонструє значний потенціал для оптимізації слідчих процесів, прискорення обробки інформації та підвищення якості розслідувань. Водночас, в світі виявляються суттєві виклики, пов'язані з застосуванням систем штучного інтелекту в правоохоронних органах. Серед них критичні питання щодо відповідності використання ШІ принципам кримінального процесу під час розслідувань, захисту персональних даних, дотримання міжнародних стандартів у сфері прав людини, дотримання права та справедливий суд та ризику дискримінації.

Питання правового регулювання систем штучного інтелекту високого ризику, як того вимагає Регламент ЄС № 2024/1689 Європейського Парламенту та Ради від 13 червня 2024 року (далі – «Акт ЄС про ШІ»), а також інші зарубіжні інструменти, стають актуальними для всіх держав, зокрема для країн пострадянського простору.

Методи. Це дослідження ґрунтується на застосуванні комплексного підходу, в межах якого здійснено аналіз чинного законодавства Республіки Казахстан, міжнародних актів, узагальнено наявні концепції розвитку ШІ та охарактеризовано сучасні казахстанські інновації на основі ШІ. Як базовий метод, для з'ясування позитивного досвіду та відмінностей у підходах до регулювання ШІ між Казахстаном та провідними світовими юрисдикціями використовується порівняльно-правовий підхід. У статті було здійснено системний аналіз офіційних стратегічних документів, чинних нормативних актів,

наукових публікацій та міжнародних стандартів у сфері цифровізації. Особлива увага приділяється вивченню механізмів класифікації високоризикованих технологій ШІ та підходів до їх використання в правоохоронній діяльності.

Результати та висновки. У висновках виділено напрямки застосування інструментів штучного інтелекту в Казахстані та вказано на необхідність розробки комплексної законодавчої бази, яка створює умови для внутрішнього використання ШІ в правоохоронній діяльності в Республіці Казахстан. Було виявлено, що успішна цифрова трансформація вимагає гармонізації національного законодавства з міжнародними стандартами, створення прозорих критеріїв оцінки ризиків систем ШІ та встановлення ефективних механізмів контролю та нагляду. Дослідження продемонструвало важливість забезпечення алгоритмічної прозорості та справедливості у застосуванні ШІ в кримінальному судочинстві для гарантування прав людини. На основі аналізу авторами запропоновано інтегровану модель управління цифровою трансформацією, що містить законодавчі ініціативи, розробку професійних стандартів та створення механізмів контролю. Впровадження запропонованої моделі дозволить Казахстану максимізувати переваги технологій ШІ для підвищення якості правоохоронної діяльності, одночасно забезпечуючи надійний захист конституційних прав та основоположних свобод громадян.

Ключові слова. Штучний інтелект, системи ШІ з високим рівнем ризику, правове регулювання ШІ, пілотні проекти впровадження ШІ.