Digitalization and artificial intelligence in criminal proceedings: Issues of legal regulation

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Abstract

The article addresses the need to develop legal mechanisms that facilitate the use of technologies to accelerate and improve justice, while also considering potential risks related to data processing, confidentiality of information, and the possibility of errors in automated processes. It is essential to balance technological progress with the protection of human rights, making this research topic relevant amid ongoing digital transformation trends. The study employs a set of methods traditionally used in legal science, enabling a comprehensive and in-depth analysis of the subject. Its aim is to thoroughly examine the legal aspects of integrating digital technologies and artificial intelligence into criminal proceedings in Kazakhstan, as well as to analyze their impact on the efficiency of such proceedings. The article discusses issues related to the legal regulation of digital technologies and artificial intelligence in criminal justice. It reviews existing legal norms governing the use of AI and digital solutions in criminal proceedings and considers potential risks and legal challenges associated with their implementation. The findings of this research will contribute to the enhancement of legal regulations concerning digital technologies and AI in criminal justice. Implementing the proposed measures will also help protect the rights of participants, minimize risks associated with digital solutions, and promote transparency and fairness in justice within the context of digital transformation.

Keywords: Artificial intelligence, Criminal proceedings, Digital solutions, Digitalization, Justice, Process, Regulation.

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1. Introduction

Digitalization and the introduction of artificial intelligence (AI) have a significant impact on all areas of human activity, including criminal proceedings. Modern technologies are changing approaches to investigating crimes, processing evidence, litigation, and ensuring justice. The introduction of digital solutions and AI in criminal proceedings can increase their efficiency, speed up decision-making, and reduce the workload of the judiciary. However, along with potential benefits, new legal challenges arise related to regulating the use of technologies, protecting the rights of participants in the process, and observing the principles of a fair trial. The relevance of the study is due to the need for legal regulation of the use of digital technologies and AI in criminal proceedings. The introduction of digital technologies and artificial intelligence (AI) in the investigation and trial process opens up new opportunities for improving the efficiency of justice, automating routine procedures, and more accurately analyzing evidence. At the same time, the use of such technologies poses new challenges for the legal system related to regulating their use, protecting the rights of participants in the process, and ensuring compliance with the principles of a fair trial. In the context of rapid digitalization, it is important to develop legal mechanisms to ensure the lawful and fair use of these technologies in the interests of society. Issues of data accuracy and reliability, automated decision-making, and personal data protection require special attention from legislators.

This study aims to examine the key aspects of the legal regulation of digitalization and AI in criminal proceedings, analyze existing legal norms and their application in practice, and develop recommendations for improving legislation in this area.

2. Research Design

This study aims to examine the legal regulation of the use of digital technologies and artificial intelligence in criminal proceedings. The main goal is to determine how these technologies can contribute to increasing the efficiency of criminal proceedings and to offer recommendations for improving legal regulation to minimize potential risks. The study will include the following stages:

2.1. Theoretical Analysis
- Analyzing existing legal norms and regulations governing the use of digital technologies and artificial intelligence in criminal proceedings;
- Studying scientific literature and international experience in the legal regulation of AI use in the legal system to identify main approaches and best practices.

2.2. Comparative Legal Analysis
- Analyzing legal regulations in different jurisdictions to identify the strengths and weaknesses of various approaches to the use of AI and digital solutions in criminal proceedings.
- Comparing the experience of Kazakhstan with international standards and practices.

2.3. Qualitative Analysis of Law Enforcement Practice
- Study of the practice of using digital technologies and AI in real criminal cases, including analysis of court decisions and precedents where digital technologies were used, such as automated data analysis systems or video surveillance systems employing AI.
- Interviews with practicing lawyers, judges, and investigators to identify current problems and limitations in law enforcement.

2.4. Development of Recommendations
- Based on the analysis, recommendations will be formulated to improve legislation and law enforcement practice.
- Inclusion of proposals to ensure the protection of the rights of participants in criminal proceedings and the prevention of possible abuses when using AI and digital technologies.

2.5. Hypothesis Assessment and Verification
- Testing the hypothesis that proper legal regulation and the introduction of digital technologies and AI in criminal proceedings can significantly improve their efficiency and quality.

This approach will enable a comprehensive study of the issues related to the digitalization of criminal proceedings, identify the main legal challenges, and propose solutions to overcome them.

3. Research Methods

This study was conducted using a set of methods traditionally used in legal science, allowing for a comprehensive and in-depth analysis of the topic. The main methods include:

1. General scientific method, which allows for the identification of the main patterns and generalizations in the area under study, providing a theoretical basis for further analysis.

2. The historical and legal method allows for the consideration of the development of legal regulation, tracing changes and the evolution of legislation, and identifying the causes of changes within the historical context.

3. The comparative legal method is used to analyze the legislation of various countries, allowing for the identification of similarities and differences in legal approaches and the adoption of best practices.

4. Formal logical methods help to structure legal norms, identify contradictions or gaps in legislation, and suggest ways to eliminate them.

5. The systemic and structural method provides a holistic approach to the study of legal norms and institutions, analyzing their interrelations and interactions within the legal system.

Along with these methods, private methods were used that met the goals and objectives of the study:

- Analysis and evaluation of narrative sources allowed the use of reports and other materials for an in-depth study of the problem.
- Study of regulatory legal acts of neighboring countries provided an opportunity to compare the legislation of Kazakhstan with the legal systems of neighboring states;
- Analysis of international legal acts ratified by Kazakhstan provides an understanding of the obligations and standards that national legislation must comply with.

The integrated use of these methods and approaches allowed for a deep and multifaceted analysis of the topic, identification of existing problems, and proposal of possible solutions.

4. Research Background

In recent years, the use of artificial intelligence (AI) tools has been actively researched and promoted in many areas of state activity around the world. At the same time, some concerns have been expressed regarding the emergence of adverse consequences and costs for the population. In a rapidly changing global landscape, technological progress is both a source of transformation and a challenge [1]. Around the world, judicial systems are implementing digital technologies to improve the efficiency of civil and commercial processes [2]. These tools help improve transparency and access to justice [3]. However, the success of the digitalization of the judicial system depends on a strategic approach to its use, which helps strengthen the rule of law, protect human rights, and improve the effectiveness of justice. However, technologies can both promote and threaten justice, so it is important to consider their benefits and risks in order to uphold the rule of law and human rights [4].

Despite global digitalization efforts, development is slowed by challenges in the areas of technology, law, culture, and learning [5]. In 2020, the pandemic led to widespread court closures, accelerating the adoption of online services, digital procedures, and virtual courts to ensure the functioning of justice. The pandemic exposed the lack of technological readiness in judicial systems, especially in less developed countries, where low technology, poor connectivity, and limited internet access have created additional challenges.

Digitalization of the justice sector is not possible without the creation of the necessary infrastructure, which serves as the basis for transformation. The importance of digitalizing processes such as handling court documents and paying fees must be recognized to ensure progress [6]. A key challenge is to achieve cooperation between different judicial bodies through integrated e-services. The use of artificial intelligence (AI) in legal processes significantly speeds up and improves the accuracy of legal services. AI tools are widely used in legal practice, but their use raises complex issues, including confidentiality, bias, and ethical aspects [7]. In criminal cases, AI helps process large volumes of data, which helps improve efficiency and reduce costs.

Artificial intelligence and machine learning are improving legal research, making it faster and more accurate, requiring lawyers to master new technologies [8]. Although attention to digitalization and AI in the justice sector is growing, existing research focuses on individual aspects [9, 10]. At the same time, the comprehensive impact of digital transformation and AI integration remains understudied [11], especially after the pandemic, which accelerated the adoption of technologies [12-15]. Based on the study of foreign experience, the author concluded that digitalization and the use of artificial intelligence in criminal proceedings play an important role in modernizing judicial systems and increasing the efficiency of justice. These technologies allow for the automation of processes, the speeding up of case processing, and the improvement of access to justice. The experience of the COVID-19 pandemic has demonstrated the importance of digital transformation, stimulating the development of online services and virtual courts to ensure the smooth functioning of the legal system. However, the introduction of digital technologies and AI comes with a number of challenges, such as ensuring confidentiality, preventing bias, and observing ethical standards. Addressing these issues requires a comprehensive approach, including legal regulation, the creation of the necessary infrastructure, and the training of specialists. Thus, digitalization and AI are not only tools for improving the efficiency of justice but also factors that require careful regulation and adaptation. If used correctly, they can strengthen the rule of law, improve the protection of human rights, and make the legal system more modern and accessible.

Analyzing digitalization and the use of artificial intelligence in criminal proceedings in the Republic of Kazakhstan, we note that since 2017, criminal proceedings in the Republic of Kazakhstan have been conducted in paper and/or electronic formats (Article 42-1 of the Criminal Procedure Code of the Republic of Kazakhstan - hereinafter the CPC RK). Since the same year, as part of the implementation of the state program "Digital Kazakhstan," the Prosecutor General's Office, on the basis of the information system "Unified Register of Pre-Trial Investigations," developed the module "Electronic Criminal Case" (e-CC), which significantly simplified the investigation process, reducing the workload of investigators and inquiry officers. Assessing the role of artificial intelligence systems in various spheres of public life, L.V. Bertovsky noted that, along with traditional forms of legal proceedings, technologies are steadily penetrating this activity, with digital data being a key factor, and their processing and use of the obtained results can significantly increase its efficiency [16]. At the same time, he noted that the main problems of digital production, which should be paid attention to in theoretical research and later in lawmaking, are sequential processes corresponding to the following stages:

- Obtaining and processing information relevant for the purposes of legal proceedings into machine-readable formats and its accumulating it on a single medium.
- Technical processing and analysis of the received information in order to form a proposed decision;
- Reverse transformation of typewritten information into human-readable form, evaluation of the received information, and use of its results.

The adoption and implementation of a sustainable and standards-based strategy for training law enforcement officers mean that they will need to be trained to the appropriate level to identify and use electronic information as evidence, investigate crimes related to the use of modern technologies, and ensure that individual employees possess the skills to investigate cybercrimes and conduct forensic examinations of electronic evidence.

5. Findings
### 5.1. Analysis and Results

The issues of legal regulation of digitalization and artificial intelligence in criminal proceedings are important in the modern context, since the rapid development of technologies has a profound impact on legal systems around the world. In the context of the digital transformation of society, new opportunities and challenges arise that require a rethinking of existing legal norms and mechanisms. The rationale for the choice of the study includes the following aspects (Figure 1).
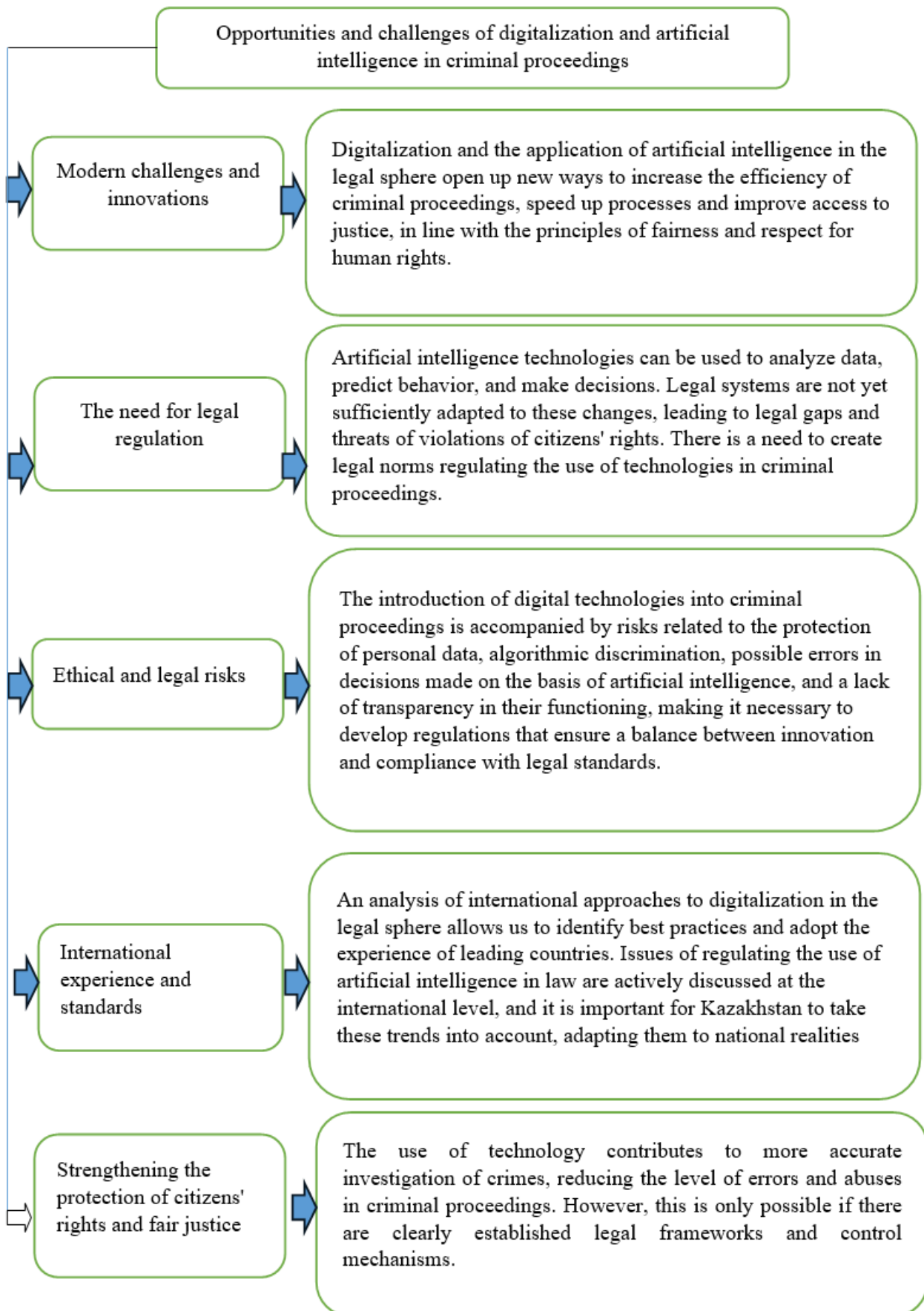
Figure 1.
Opportunities and challenges of digitalization and artificial intelligence in criminal proceedings by the authors

Currently, the electronic criminal case system covers all stages, including the registration of criminal offenses, pre-trial investigation, trial, and even the execution of punishment. Since its introduction in January 2018, over 200,000 cases have

been investigated electronically, of which more than 29,000 have been sent to court Figure 2). According to the data presented in Figure 2, it can be noted that since the introduction of the electronic format in January 2018, over 200,000 cases have been investigated, of which over 29,000 have been sent to court. This represents approximately 14.5% of the total number of cases, indicating a relatively high level of utilization of the electronic format within the law enforcement system.
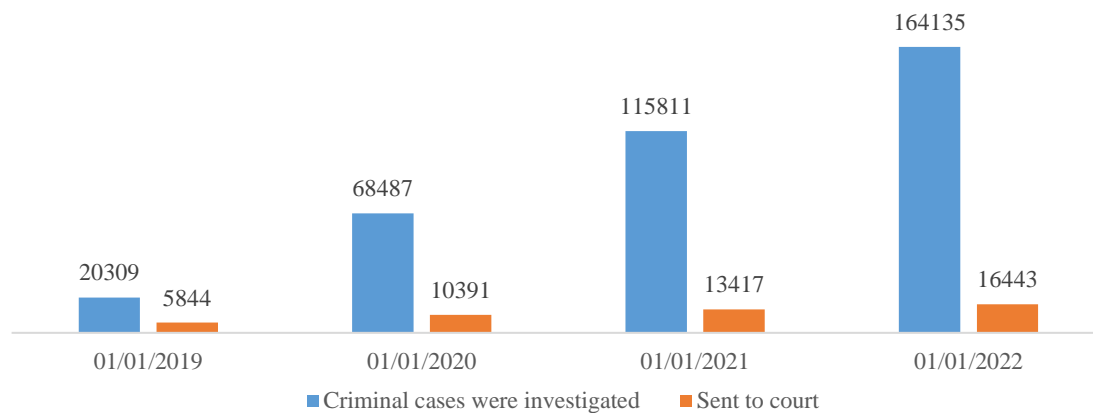
Figure 2.
Criminal investigations in electronic format
Source: compiled by the authors according to https://qamqor.gov.kz/crimestat/indicators.

Based on the presented data, the following mathematical analysis was carried out to identify the percentage of cases sent to court relative to investigated cases:

- 2019 - 28.78% of cases that were investigated were sent to court;
- 2020 - 15.17% of cases were sent to court, which shows a significant decrease;
- 2021 - 11.59% of cases sent to court continued to decline;
- 2022 - only 10.02% of investigated cases were sent to court.

These data indicate a steady downward trend in the proportion of criminal cases sent to court as the number of investigated cases increases.

In Kazakhstan, measures are regularly taken to improve the efficiency of law enforcement agencies, and as a result, there is an annual decrease in criminal offenses. Over the past 5 years, the number of registered offenses has decreased by 32%. The activities include the digitalization of the entire law enforcement system and the transition to an electronic format for conducting cases (Figure 3).
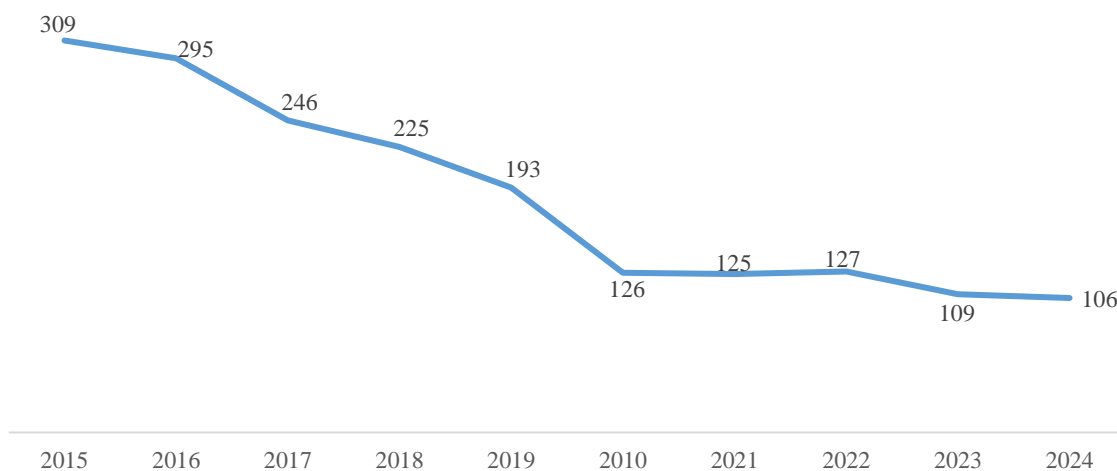
Figure 3.
Pre-trial criminal investigations initiated, thousands.
Source: Compiled by the authors according to https://qamqor.gov.kz/crimestat/indicators.

Over the past 5 years, the number of registered criminal offenses has decreased by 32%. If we take the starting point (5 years ago) as the value N0, then the current number of registered offenses is:

$$N = N0 \times (1 - 0.32) = 0.68 \times N0 \qquad (1)$$

This means a decrease of one-third from the initial level, which is associated with the digitalization of the law enforcement system and the transition to electronic formats. The total number of registered cases in the Republic of

Kazakhstan, as well as by severity and offenses, using the electronic registration format as of 10/25/2024 is shown in Figure 4.
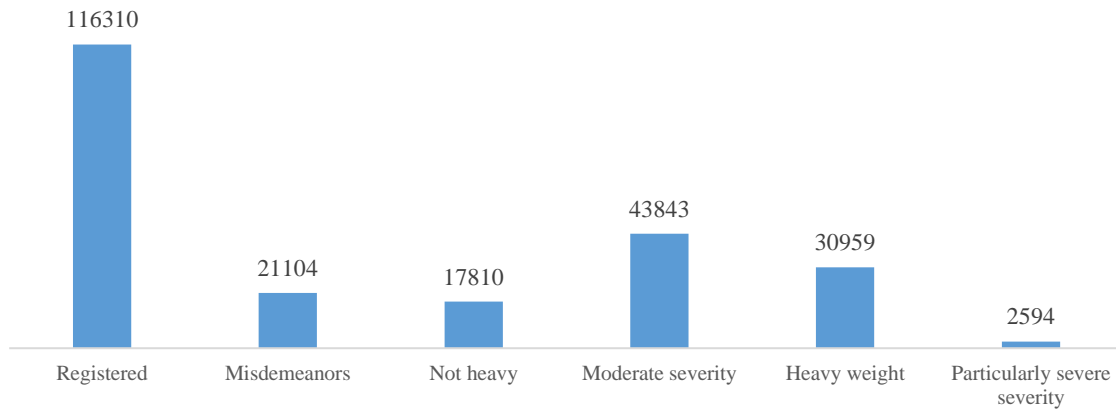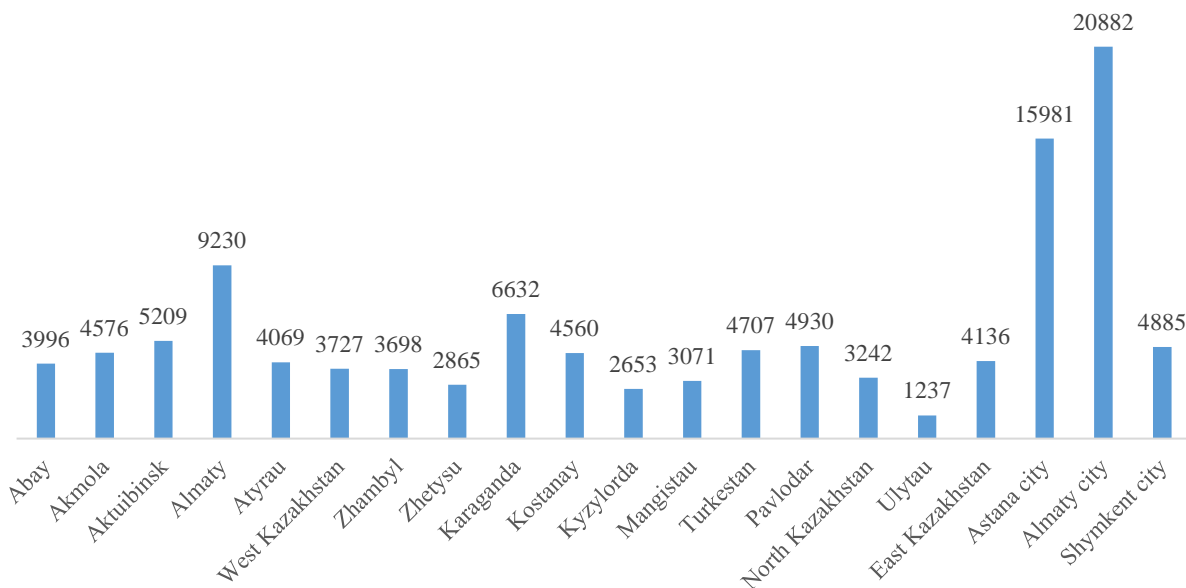

Figure 4.
Total number of registered criminal cases, severity and offenses in the Republic of Kazakhstan.
Source: compiled by the authors according to https://qamqor.gov.kz/crimestat/indicators

If we look at it from a regional perspective, the situation looks like this (Figure 5).

Figure 5.
Number of registered cases in the regional aspect, thousands.
Source: compiled by the authors according to https://qamqor.gov.kz/crimestat/indicators.

To conduct a correlation analysis of the relationship between the level of digitalization (the percentage of cases considered in electronic format) and the change in the number of registered offenses, we have the following data:
- The percentage of cases considered in electronic format for each year from 2018 to 2024.
- The number of registered criminal offenses from 2018 to 2024.

The data required for the calculations are presented in Table 1.

5.2. Application Functionality

Digitalization and the introduction of artificial intelligence into criminal proceedings have a significant impact on their efficiency and transparency.

Table 1.
Initial data required to conduct a correlation analysis of the relationship between the level of digitalization (percentage of cases considered in electronic format) and the change in the number of registered criminal offenses.

Year	Registered, units	Moderate severity,%	Heavy, %	Actions, %	Not heavy, %	Particularly serious, %
2021	157884	45	25	14	14	2
2022	157473	43	28	13	14	2
2023	140272	42	27	14	16	1
2024	116310	38	27	18	15	2

Source: compiled by the authors according to https://qamqor.gov.kz/crimestat/indicators

First, it is necessary to calculate the Pearson correlation coefficient (r) for two variables:

X – percentage of cases in electronic format

Y – number of registered offenses

The Pearson correlation coefficient is calculated using the formula:

$$r = \frac{\sum(X_i - \bar{X}) * (Y_i - \bar{Y})}{\sqrt{\sum(X_i - \bar{X})^2 * \sum(Y_i - \bar{Y})^2}} \qquad (2)$$

where:

X_i, Y_i –values of variables in each year;

$\bar{X}$, $\bar{Y}$ – average values of variables.

The analysis of the correlation between the different variables shows the following:

1) Year and the total number of cases registered - the correlation coefficient is -0.935, indicating a strong negative correlation. This suggests that over time, the total number of offenses registered has been decreasing significantly.

2) Year and the percentage of moderate cases - the correlation is -0.965, indicating a strong negative relationship. The percentage of moderate cases has been decreasing over time.

3) Year and the percentage of misdemeanors - the correlation is 0.757, indicating a moderate positive correlation, which suggests that the percentage of misdemeanors has been increasing in recent years.

4) Year and the percentage of minor cases - the correlation coefficient is 0.674, which also indicates a positive relationship. This means that the percentage of minor cases has been increasing.

The relationship between the percentages of different categories of cases:

- The percentage of moderate cases is negatively correlated with the percentage of misdemeanors (-0.868), which indicates that as the average severity decreases, the number of misdemeanors increases.
- The percentage of minor cases is negatively correlated with the percentage of very serious cases (-0.870), indicating a tendency for very serious cases to decrease while less serious cases increase.

These correlations allow us to conclude that, in the period from 2021 to 2024, there was a general decrease in registered cases and a change in the crime structure, with an increase in the share of less serious offenses (Table 2).

Table 2.
Final results of correlation analysis.

Indicators	Year	Total_Cases	Medium_Severity_%	Severe_%
Year	1,000000	-0,935488	-9,647638e-01	0.512989
Total_Cases	-0.935488	1.000000	9.590049e-01	-0.207079
Medium_Severity_%	-0.964764	0.959005	1.000000e+00	-0.449921
Severe_%	0.512989	-0.207079	-4.499213e-01	1.000000
Minor_Offenses_%	0.756889	-0.930168	-8.680930e-01	-0.029867
Low_Severity_%	0.674200	-0.570614	-4.730499e-01	0.207514
Very_Severe_%	-0.258199	0.092338	-1.005664e-16	-0.132453
	Year	Total_Cases	Medium_Severity_%	Severe_%
Year	1,000000	0.756889	0.674200	-2.581989e-01
Total_Cases	-0.935488	-0.930168	-0.570614	9.233780e-02
Medium_Severity_%	-0.964764	-0.868093	-0.473050	-1.005664e-16
Severe_%	0.512989	-0.029867	0.207514	-1.324532e-01
Minor_Offenses_%	0.756889	1.000000	0.274774	2.254938e-01
Low_Severity_%	0.674200	0.274774	1.000000	-8.703883e-01
Very_Severe_%	-0.258199	0.225494	-0.870388	1.000000e+00

6. Conclusion

In order to prevent torture, Kazakh authors propose using artificial intelligence tools by chipping employees of criminal prosecution agencies [17]. In the future, investigative and judicial practice may require the issuance of electronic monitoring devices for suspects, accused, and defendants when applying criminal procedural measures of restraint not related to detention, as well as for persons with a criminal record for crimes related to pedophilia.

The legal basis for this proposal is Part 3 of Article 140 of the Criminal Procedure Code of the Republic of Kazakhstan, the provisions of which may be more effective if control over the proper behavior of these persons is strengthened. When applying a preventive measure not related to detention, one or more of the following obligations may be imposed on the suspect, accused, or defendant:

1) To appear before the person conducting the pre-trial investigation, the prosecutor, or the court at the time established by them;

2) Not to leave their permanent or temporary place of residence without the permission of the body conducting the criminal proceedings;

3) notify the person conducting the criminal proceedings or the prosecutor about a change of residence or place of work;

4) Do not communicate with certain people and visit certain places;

5) Undergo treatment for mental, behavioral disorders (diseases) associated with the use of psychoactive substances;

6) Wear electronic tracking devices.

This list of restrictions, as we see it, can be:

1) Supplemented by:

- The obligation of the suspect, accused, defendant to personally periodically appear at a certain time to the pre-trial investigation body or other body supervising their behavior;
- A ban on leaving the Republic of Kazakhstan with the imposition of an appropriate restriction by the court;
- Confiscation of the suspect, accused, defendant's passport and other documents entitling them to travel outside the Republic of Kazakhstan;
- The obligation of the suspect, accused, or defendant to undergo chipping in order to monitor their movements;

2) placed under judicial control due to a significant restriction of a number of constitutional rights and freedoms of man and citizen.

In the science and practice of Kazakhstan's criminal procedure, the issue of introducing, along with remote interrogation in video communication mode, of victims and witnesses (Article 213 of the Criminal Procedure Code of the Republic of Kazakhstan), a confrontation and presentation for identification in videoconferencing mode is being discussed.

Of course, within the framework of the digitalization of evidence tools, these innovations will entail the rationalization and acceleration of pre-trial proceedings in criminal cases, a reduction in procedural costs on the part of the state, and a reduction in the costs for participants in investigative actions.

With regard to both the proposed additions and the current norm, the problem of identifying the identity of those being interrogated and identified remains. At present, in practice, a visual presentation of an identity document and a video recording of the image of the participant are sufficient. However, the person conducting the investigative action may still have doubts about the authenticity of the document and the identity of the participant.

In supporting this proposal, we believe it is advisable to introduce such a mandatory component as Face ID biometric technologies for recognizing a person by face into the procedure of remote investigative actions. Biometric identification will allow for the automatic identification of the data subject based on the characteristics of universality, uniqueness, inalienability, non-falsification, stability, measurability, authentication, and verification.

The legal basis for this proposal is Part One of Article 1 of the Law of the Republic of Kazakhstan "On Personal Data and Their Protection," dated May 21, 2013, No. 94-V, which refers to biometric personal data "data that characterize the physiological and biological characteristics of the subject of personal data, on the basis of which his identity can be established " [18].

In the context of modern digitalization of criminal proceedings in Kazakhstan, the proposed measures, including the use of artificial intelligence and biometric technologies, represent an important step towards increasing the efficiency and transparency of criminal proceedings. The proposal to chip criminal prosecution officers and monitor suspects and defendants using electronic tracking devices is aimed at reducing cases of misconduct, including torture, and ensuring proper control over compliance with the terms of preventive measures.

However, the introduction of such technologies requires special attention to legal and ethical aspects, as they can significantly limit the constitutional rights and freedoms of citizens. Therefore, the proposals must be accompanied by increased judicial control and careful legal regulation in order to avoid abuses and protect human rights.

The introduction of biometric identification, such as Face ID, into remote interrogation and identification procedures will improve the accuracy and reliability of identifying participants in investigative actions, reduce procedural costs, and speed up pre-trial proceedings. This innovation contributes to the rationalization of criminal proceedings and the reduction of costs associated with investigative activities.

Thus, digitalization and the use of innovative technologies in criminal proceedings can significantly improve the quality of justice, while requiring clear legal regulation and compliance with legal standards to ensure a balance between the effectiveness of law enforcement and the protection of citizens' rights.

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