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PROBLEM-ORIENTED APPROACH TO THE FORMATION OF INFORMATION SUPPORT FOR JUDICIAL AND LAW ENFORCEMENT AGENCIES

The article discusses the use of a prospective problem-oriented approach to shaping the information support for judicial and law enforcement agencies. The rapid development of information technologies is transforming the criminal environment. Criminals increasingly utilize the digital space, leaving numerous diverse electronic traces within it. These encompass personal information, online correspondence, phone call records, media data, browsing history, geolocation data, and more. The task of judicial and law enforcement agencies is to uncover criminal patterns through the electronic traces of offenders and provide timely intelligence information. For the effective processing of data on criminal activities, the use of quality information support by judicial and law enforcement agencies is currently an essential condition. Its formation is only possible through the application of a problem-oriented approach to data collection, storage, and analysis. The efficient operation of modern judicial and law enforcement agencies requires the utilization of cutting-edge information technologies (IT). Such technologies can ensure quality and rapid data management and transform them into useful information for making fair and transparent judicial decisions. With the exponential growth in the volume of information that judicial and law enforcement agencies need to process on a daily basis, the requirements for organizing data repositories and exchanging criminal legal information among different structures of the legal system are increasing. To establish effective information support for judicial and law enforcement agencies, it is necessary to employ new solutions, tools, and methods for data analytics and information technologies, such as artificial intelligence (AI).

Keywords: *criminal justice, law enforcement agencies, information-analytical support, problem-oriented approach, information technologies, digital data analytics, artificial intelligence, criminal offender profiling.*

Ковальчук О., Банах С.
Проблемно-орієнтований підхід до формування інформаційного забезпечення судових та правоохоронних органів

Розглянуто питання використання перспективного проблемно-орієнтованого підходу до формування інформаційного забезпечення судових та правоохоронних органів.

Стрімкий розвиток інформаційних технологій трансформує злочинне середовище. Все частіше злочинці використовують цифровий простір, залишають у ньому безліч різноманітних електронних слідів. Це особиста інформація, переписка у мережі, записи телефонних розмов, медіаінформація, історія запитів у браузері, дані геолокації тощо. Завдання судових та правоохоронних органів полягає в тому, щоб виявити злочинні схеми за електронними слідами правопорушника та надати оперативну розвідувальну інформацію. Для ефективної обробки даних про злочинну діяльність сьогодні необхідною умовою є використання якісного інформаційного забезпечення судовими та правоохоронними органами, формування якого можливе лише із застосуванням проблемно-орієнтованого підходу до збирання, зберігання та аналітики даних.

Ефективна діяльність сучасних судових та правоохоронних органів потребує використання новітніх інформаційних технологій (ІТ). Такі технології можуть забезпечити якісне та швидке управління даними та перетворення їх у корисну інформацію для прийняття справедливих і прозорих судових рішень. У зв'язку з екс-

поненціальним зростанням обсягів інформації, яку потрібно щоденно опрацьовувати судочинним та правоохоронним органам, також зростають вимоги до організації сховищ даних та обміну кримінально-правовою інформацією між різними структурами правової системи. Для формування ефективного інформаційного забезпечення судових та правоохоронних органів сьогодні необхідно використовувати нові рішення, інструменти й методи аналітики даних та інформаційних технологій, таких як штучний інтелект (ШІ).

Ключові слова: *судочинство, правоохоронні органи, інформаційно-аналітичне забезпечення, проблемно-орієнтований підхід, інформаційні технології, аналітика цифрових даних, штучний інтелект, профіль особи злочинця.*

Statement of the problem. The development of technologies is transforming society, creating more opportunities for offenders and complicating the work of judicial and law enforcement agencies. Crime increasingly utilizes the information space. Even if the crime itself is not committed online, its participants (both offenders and victims) leave various electronic traces in the digital space: phone call records, online correspondence, browsing history, media data, geolocation data, and more. The task for judicial and law enforcement agencies is to identify criminal patterns through the electronic traces of offenders and provide timely intelligence information. For the effective processing of crime data, the use of quality information support by judicial and law enforcement agencies is a necessary condition.

The state of research of the problem. Specific aspects and principles of information support for judicial and law enforcement agencies have been the subject of research by domestic and foreign scholars, including S. Shoptenko and Y. Kovalchuk, J. S. Hollywood, Z. Winkelman, A. Santos, I. Jenkins, J. Mariani [1–4]. However, they have addressed only a narrow range of issues. Information-analytical activities and analytical research are a modern direction in the work of law enforcement agencies and the judicial system of Ukraine. The application of a problem-oriented approach, modern information technologies, and data analytics to establish reliable information-analytical support for judicial and law enforcement agencies is a relevant issue in the context of reforming the judicial system of Ukraine.

Presentation of the main research material. The concept of "information support" has many different definitions. In judicial practice and law enforcement activities, this concept denotes the processes of collecting and processing tactical and operational information to ensure management processes within law enforcement agencies and to shape the awareness of citizens and society as a whole [1]. It is used for conducting operational and tactical activities and analyzing crimes and investigations [3].

Information about criminality comes from two main sources: victims' responses to surveys regarding crimes committed against them and administrative data from law enforcement agencies about reported crimes. Victims' survey responses contain information about crimes reported to the police as well as those crimes that were not reported. Data about crimes from law enforcement agencies reflect information about reported and registered crimes.

Individuals, groups, and organizations involved in criminal and illegal activities are becoming increasingly experienced. Offenders are quickly leveraging the power of new technologies as they emerge. However, technological progress can also enhance the investigation methods of judicial and law enforcement agencies. Specifically, it has now become possible to conduct blood group analysis at a crime scene, the results of which can be used for the rapid identification of both victims and perpetrators, simplifying their apprehension.

These advantages create new challenges. The digital world holds an incredibly vast amount of information. For instance, in just one year, during one FBI investigation, six petabytes of data were collected [4]. Law enforcement agencies must process data from various new and unfamiliar sources and enhance the use of already accumulated data. Without effective information analysis, it will be challenging for judicial and law enforcement agencies to counteract the criminals they accuse of committing crimes.

Establishing information support is a challenging task for judicial and law enforcement agencies since their resources are primarily allocated to fulfill the basic functions of ensuring citizen safety. Most judicial and law enforcement personnel lack training in data processing and digital technologies, usually necessary for conducting advanced analytics [5]. Judicial authorities require access to data-driven information; however, resource limitations may restrict their ability to efficiently search for relevant information for investigations, even in the presence of vast amounts of data.

New investigation tools and methods can help judicial and law enforcement agencies overcome resource limitations and analyze large volumes of digital data within criminal investigations. Artificial intelligence, open-source data management tools, predictive analytics solutions, and leveraging social media capabilities can reveal

previously unseen connections within information and identify key dependencies. New data sources can provide access to information pools, and new technologies can create new opportunities for data utilization. These capabilities are capable of reducing manual work for analysts and reducing costs by 70 percent [6]. The use of these tools and approaches can assist investigators, judges, and prosecutors in reducing the time spent on searching and analyzing data while increasing the time devoted to tracking criminals and ensuring public safety.

When forming the information support for law enforcement agencies, the primary issue is not the data itself but the approach to data collection, storage, and analytics. Often, critical data sources are either absent, excessively challenging to access, or too complex for analysis, resulting in gaps in investigations.

The initial step in addressing the problem of data abundance often involves creating an even larger pool of data (data containing similar information). Judicial and law enforcement agencies have vast amounts of data but struggle to use them effectively due to computational and integration issues. Outdated and insufficient computational power and platforms hinder extensive analysis. Segregated data, both within and outside organizations, impede quality access to integrated data that could facilitate investigations and enable effective judicial decisions [7].

Subsequently, analysts can organize and manage this larger and more comprehensive dataset, combining data sources to simplify the comprehension of available information. Important data sources include internal data retained by law enforcement agencies, commercial data sources, and open sources such as social media activity, property records, criminal histories, professional licenses, medical databases, and numerous other sources.

An outcome or problem-oriented approach to shaping information support can help select valuable information from a large data pool to create a cohesive understanding of individuals, places, and objects related to a specific criminal investigation. Such a comprehensive understanding can reveal significant gaps in analysis, such as connections between known accomplices or email correspondence. Knowledge of these gaps can assist in further collecting and monitoring necessary information in a criminal case.

There are five stages identified for the effective use of data related to complex investigations [4]:

1. Analysis of existing data sources and ways to use and manage them [8]. Simple data organization and accessibility for investigators can ensure a swift start to case review. Achieving better data integrity at the beginning of an investigation can lead to a better understanding of subsequent processes [9]. This process may involve checking internal databases like records management systems, and external databases, as well as ensuring data access and integration.

2. Search for new data sources. Applying a goal-oriented approach to data collection and organization can reveal common gaps in knowledge. Every individual creates a digital footprint, including criminals, which may enable investigators to identify gaps in evidence. A new data source can consolidate cases into a single investigation or open up a new criminal case. Discovering useful data sources from other agencies, commercial or open sources, or even publicly available social media data can fill critical gaps in a criminal case [10].

3. Determination of methods for obtaining and storing data sets. A massive pool of all available data is not useful for investigators if it's challenging to find precise necessary information. This requires data to be structured, organized, and stored in a defined manner. A specific set of necessary data management tools depends on the precise volume and nature of the data used in the investigation. For instance, powerful graphics and understandable data structures can simplify the creation of data repositories that unify various data types into a single visual data structure describing relationships between specific individuals, places, and objects [11]. A well-defined data structure can be used for predictive modeling and forecasting probable crime locations in the future, enhancing resource utilization. Applying creative data storage methods leads to cost reductions and improved understanding [12].

4. Meeting the analytical needs of law enforcement personnel, availability of more powerful computing systems, and better data repository integration. When data volumes are small, basic analytical skills and programs for working with spreadsheets may suffice for processing preliminary analysis of structured data from corporate systems and other applications, as well as unstructured information like emails, text messages, and audio recordings. But when this volume grows into millions, new technologies, advanced analytics, and forensic expertise skills may be necessary for analysis [13].

5. Choosing the most effective type of reporting that best reflects performance results. The specificity of reporting and data visualization will vary for each case, yet the way data is used, such as visualization, should be the simplest and most understandable.

Technologies are not merely new and interesting tools that enhance existing processes; they can unveil entirely new ways of conducting investigations. Today, many analysts spend a considerable amount of time searching for needed data, potentially leaving only a short period for analysis and aggregation. In the future,

investigators may rely on new data processing tools for swift retrieval of necessary information, allowing them to spend a larger portion of their time on data analysis. Currently, a patrol officer spends 80% of their time on crime-related tasks and the rest on administrative duties [4].

By utilizing advanced data processing tools, law enforcement agencies can assess existing data sources by conducting an audit that includes information storage, management, access, and usage. Data analysts conduct exploratory analysis to understand the quality and completeness of the data. In the absence of consistent access to critically important data, such as connections, instructions, and geolocation business data, compilation from publicly available sources and social media data from nearby locations is conducted. Subsequently, departmental leaders coordinate plans for obtaining, processing, and storing data in the cloud, ensuring instant access to the latest computing systems and eliminating data redundancy. Utilizing efficient data processing tools and methods, investigators focus on criminal networks, achieving investigation objectives more swiftly.

Configuring systems for analytical processing begins with understanding the spectrum of available data sources–from internal data sources to social media activity data. Next is the need to organize data exchange between different sources. This requires the development of a system that efficiently organizes, formats, and stores data. For instance, it should be capable of formatting records in a way that names, dates, and locations are easily searchable. This allows law enforcement personnel to encompass dozens of data sources for the automatic compilation of criminal histories, profiles, and unlawful actions.

Data from various sources can be structured into a unified query output. Input data includes unstructured information like scanned documents; semi-structured data, such as websites and social media; and structured data, including ownership records, professional skills, and criminal records. The result is a comprehensive, multidimensional profile of the individual suspected of committing a crime [4].

However, investigators and judicial authorities typically do not need only one person's profile. They need to understand diverse forms of connections–personal relationships or even social media interactions. By using automated data analysis to search for connections among multiple structured resulting profiles, law enforcement can create criminal networks and understand actions and behavior within groups. Specifically, natural language processing can perform what's known as named entity recognition-artificial intelligence can use contextual cues to distinguish, for instance, a suspect from an innocent citizen by their name [14].

All these tools enhance the accuracy of investigation results and help the police reach correct decisions faster. Instead of spending weeks or months developing a detailed relationship diagram, they can utilize stored data and real-time data streams to create consolidated data for analysis, enabling quicker results. Investigative departments use natural language processing to study incident reports and identify patterns in criminal activity. With this information, they can identify areas with high levels of specific crimes, allowing them to take appropriate action in those areas in advance [15]. The ultimate outcome of employing advanced tools in the information and analytical activities of judicial and law enforcement agencies should be the adoption of optimal judicial decisions and a reduction in crime rates.

Conclusion. Criminals are becoming increasingly sophisticated, hence successful criminal case resolution by law enforcement agencies and the adoption of optimal decisions by courts necessitate a problem-oriented approach to information provision. Such an approach utilizes cutting-edge data storage and processing technologies, innovative solutions, tools, and methods. Judicial and law enforcement agencies require access to data-driven information. Artificial intelligence, data management tools, predictive analytics solutions, and leveraging social media capabilities can reveal previously unseen connections between information and identify key dependencies. New data sources can provide access to information repositories, innovative technologies can create enhanced data utilization capabilities.

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