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Improving methods of commodity examination at the stage of customs control

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Abstract. In the context of growing international trade flows, the intensification of customs procedures, and increasing risks of smuggling and goods falsification, improving methods of commodity examination at the stage of customs control is becoming particularly important. The aim of the article was to provide a scientific rationale and to develop proposals for improving methods of commodity examination at the stage of customs control through the integration of modern instrumental, digital, and analytical technologies. This process involved increasing the accuracy, speed, and objectivity of expert procedures, harmonising national methodologies with international standards, and creating the preconditions for more effective functioning of the customs control system in Ukraine. The efficiency and accuracy of expert procedures determined the level of the state's economic security, ensure transparency of foreign economic operations, and contribute to the protection of the domestic market. However, existing examination methods did not always meet the requirements of efficiency, reliability, and adaptability to new challenges, which highlights the need for the implementation of innovative approaches. The study substantiated the possibilities of improving commodity examination at the stage of customs control through the use of instrumental and digital technologies capable of significantly increasing the effectiveness of expert

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procedures. A systematisation of modern expert analysis methods has been carried out and their compliance with the tasks of customs control has been assessed, and the prospects for the application of digital solutions and artificial intelligence in analytical processes have been identified. A set of practical recommendations has been developed to align national approaches with international standards. The creation of a unified electronic database of product samples, the use of mobile laboratories, and the development of standards adapted to global requirements were proposed, which will contribute to improving the efficiency of customs control and expanding Ukraine's integration opportunities in global trade. The practical significance of the study lies in the possibility of applying its results to modernise the customs control system, optimise the operation of customs laboratories, improve electronic databases, and implement internationally harmonised methods of examination, thereby strengthening the state's economic security and stimulating the development of foreign trade

Keywords: standard; customs duty; commodity assessment; regulation; digitalisation

Introduction

The issue of improving customs control and developing commodity examination is widely addressed in contemporary academic research. M. Ghidotti *et al.* (2021) highlighted the growing role of instrumental analytical methods (FTIR spectroscopy, X-ray fluorescence analysis, chromatography) in ensuring the accuracy of goods identification. The authors demonstrated that energy-dispersive X-ray fluorescence (ED-XRF) is a versatile and rapid instrumental method that requires virtually no sample preparation and enables multi-element analysis of various materials for the needs of customs laboratories. Researchers P. Bergey *et al.* (2024) emphasised the importance of digital technologies and blockchain solutions for verifying product origin and ensuring supply chain transparency. The authors noted that the integration of blockchain can not only optimise operational activities and strengthen consumer confidence in the authenticity of goods, but also promote more ethical, sustainable and responsible practices within the global supply chain. O. Amel *et al.* (2023) proposed a new multimodal approach for automatically predicting HS codes in customs declarations based on a combination of textual and visual features using deep neural networks. Experimental results showed that their model, using the proposed MultConcat fusion method, achieved high classification accuracy compared to existing approaches, highlighting the effectiveness of using multimodal data for this task. O. Punda & D. Arziantseva (2019) and Makedon *et al.* (2024) noted the importance of modernising customs laboratories, expanding technical equipment and harmonising examination methods with international standards, emphasising the need to improve procedures for appointing and conducting customs examinations to reduce organisational and methodological errors. The researchers emphasised that without systematic upgrading of laboratory infrastructure and staff training, the introduction of modern technologies would not deliver the expected results.

In the study by S. Petrukha *et al.* (2022), the post-war potential and regulatory capabilities of rural local authorities in forming cluster-based and integrated agri-food value chains were analysed. The authors emphasised the importance of integrating local economies and improving customs regulation to enhance the competitiveness of the agricultural sector. A. Grainger (2024) highlighted that modern systems of tariff classification of goods in customs practice were increasingly utilising auxiliary digital technologies to improve the accuracy and consistency of decision-making. In the author's view, the introduction of automated decision-support tools will help reduce the human factor, harmonise interpretations of HS codes and speed up customs clearance procedures. A similar position was held by O. Ozturk (2024), who examined the potential of artificial intelligence in the field of international trade. The author noted that the application of artificial intelligence systems, in particular predictive analytics, automated document verification and intelligent risk assessment, will improve the efficiency, transparency and controllability of cross-border operations.

The study by I.M. de Artiñano *et al.* (2023) was empirical in nature and demonstrated the potential of using machine learning algorithms and large language models (LLMs) for the automatic classification of goods in international trade. The results showed that such models can correctly identify HS codes with an accuracy of over 90%, significantly reducing the time and labour costs of customs experts. B. Dangsawang & S. Nuchitprasitcha (2024) expanded on previous work, focusing on the problem of detecting customs fraud. In their study, the authors applied unstructured data analysis and machine learning algorithms to create a risk management system capable of rapidly identifying suspicious trade declarations. The researchers concluded that intelligent analytics could become an effective preventive tool in the fight against smuggling and customs duty evasion. S. Vijayakumar (2025) examined the integration of artificial intelligence technologies from the perspective of supply chain management and trade security. The researcher demonstrated that combining real-time risk analysis systems with digital data-sharing platforms between customs authorities and logistics operators formed a "smart border ecosystem", which simultaneously facilitated trade and enhanced national security. This approach was consistent with the principles of the

WCO SAFE Framework of Standards (Mikuriya, 2021) and reflected a shift towards a new model of proactive customs administration. The analysed sources indicated a steady trend towards the digital transformation of customs examination worldwide. Researchers emphasised that artificial intelligence, machine learning and analytical tools had become integral elements of modern customs control, ensuring greater transparency, efficiency and the compatibility of national systems with international standards. The aim of the study was to identify conceptual approaches and practical directions for improving commodity examination in the customs sector, taking into account global trends in digitalisation, the development of instrumental methods and the standardisation of customs control procedures.

Materials and Methods

The study was based on an analysis of current practices regarding commodity examination during customs control in Ukraine and European Union countries – specifically Poland, Germany, Lithuania and the Czech Republic. These countries were selected due to the presence of effectively functioning customs laboratories and the implementation of innovative technologies in accordance with the recommendations of the WCO (World Customs Organization) and ISO standards. The study took into account the provisions of the Customs Code of Ukraine No. 4495-VI (2012) and Regulation (EU) No. 952/2013 (2013). Furthermore, data from the standards DSTU ISO 9001:2015 (2016), ISO/IEC 17025:2017 (2017) and the guidance documents of the World Customs Organization (2022; 2023), which define the procedures for the identification, classification and valuation of goods, were examined. A set of complementary methods was applied during the research, ensuring a comprehensive examination of the issue. A comparative legal analysis made it possible to investigate the differences between the Ukrainian and European regulatory frameworks in the field of customs regulation, identify gaps in the organisation of expert procedures, and propose directions for harmonising the Ukrainian system with international standards. Instrumental methods – FTIR spectroscopy and X-ray fluorescence analysis (XRF) – were used to determine the qualitative characteristics and origin of goods. As part of the experimental section, 12 product samples were examined that were most frequently subject to customs examination: food products (olive oil, coffee, chocolate), textiles (cotton fabric, denim, polyester), electronic goods (smartphones, power banks, headphones) and chemicals (varnishes, solvents, cosmetics). The samples came from various countries – Ukraine, Poland, Italy, Turkey and China – ensuring the representativeness of the sample and the ability to assess the effectiveness of the methods for products from different markets. FTIR spectroscopy was used to identify organic compounds and polymeric materials present in food, cosmetic and textile products. The method enabled the chemical composition to be determined and the authenticity of the products to be confirmed by comparing spectra with reference databases (Open Spec Database, EU Customs Laboratory Network). XRF was used to determine the elemental composition of metal components, dyes and impurities in the samples, which made it possible to identify non-compliance with international safety requirements (the presence of lead, cadmium and nickel). The application of the proposed methodology ensured the comprehensiveness of the study, the reproducibility of the results obtained, and the possibility of practical application of the developed recommendations in the activities of customs authorities. It also created a basis for further harmonisation of Ukrainian methods of commodity examination with international requirements and for improving the efficiency of customs control in the context of the digital transformation of trade.

Results and Discussion

Commodity examination at customs plays a key role in ensuring the state's economic security, protecting the domestic market from counterfeit goods, unsafe products, and evasion of customs payments. Modern practice in Ukraine has relied both on organoleptic methods (visual inspection, labelling, packaging) and on certain instrumental approaches (analysis of samples in customs laboratories). However, in the context of increasing volumes of international trade and the emergence of new groups of goods, traditional methods have been losing their effectiveness. Table 1 outlines the problems of modern commodity examination that arose at the stage of customs control.

Table 1. *Main problems of modern commodity examination at the stage of customs control*

Problem	Characteristics	Consequences
Slowness of procedures	Lengthy laboratory analysis of samples	Delays, queues, and reduced efficiency of foreign economic activity
Limited equipment	Presence of outdated instruments, lack of modern methods	Uneven quality of examination across regions
Insufficient digitalisation	Absence of unified databases and integration	Classification errors, duplication of work
Lack of analytics	ML and AI are not used in goods classification	High risk of subjectivity and inaccuracies
Low harmonisation with international standards	Non-compliance with ISO and WCO recommendations	Risk of non-recognition of examination results by international partners

Note: *ML – machine learning, AI – artificial intelligence*
Source: *Regulation (EU) No. 952/2013 (2013)*

Thus, one of the main problems was the slowness of expert procedures. The examination of qualitative characteristics of goods in laboratories took a considerable amount of time, which led to delays in customs clearance and created conditions for the accumulation of queues at the border, reducing the competitiveness of enterprises and complicating international trade. Another issue was the limited technical equipment of customs laboratories. In most cases, the equipment did not meet modern international standards, such as Regulation (EU) No. 952/2013 (2013), DSTU ISO 9001:2015 (2016), and ISO/IEC 17025:2017 (2017), while the use of instrumental methods such as FTIR spectroscopy or XRF was restricted to large customs centres only, creating uneven quality of examination depending on the region. An important challenge was the insufficient digitalisation of processes. Databases of reference samples, classifiers, and reference materials were, in most cases, not integrated into a unified information system, which complicated rapid access to information for experts. The absence of a centralised digital database led to duplication of procedures, reduced accuracy, and increased risk of incorrect classification of goods (World Customs Organization, 2022). Another significant issue was the insufficient use of analytical technologies – decision-support systems, machine learning algorithms, and artificial intelligence. While EU countries, the USA, and China actively used automated systems for classifying goods according to HS codes, in Ukraine these technologies were still only at the stage of testing. There was also the problem of insufficient harmonisation of national procedures with international standards. Although Ukraine has integrated into the global trading system and cooperates with the WCO, the level of implementation of international recommendations in customs examination practice remained insufficient, creating risks of non-recognition of examination results in international courts or in bilateral trade disputes.

The analysis of data on the organisation of customs control, the structure of customs laboratories, technical equipment, level of digitalisation, and methodological approaches to commodity examination in European Union countries – Poland, Germany, Lithuania, and the Czech Republic – was important for understanding international experience in customs control practice. The functioning of customs laboratories in these countries demonstrated a high level of technological modernisation and the implementation of innovative solutions. In particular, Germany and Poland actively applied FTIR spectroscopy, XRF, chromatographic methods, and mass spectrometry, ensuring the accuracy of goods identification at the level of 95–99%. In Lithuania and the Czech Republic, mobile laboratory complexes were widely used, allowing rapid analysis directly at customs posts (European Commission, 2025; European Commission, n.d.a; n.d.b). In all four countries, a unified electronic network for the exchange of laboratory data was in operation, integrated with EU systems (EU Customs Laboratory Network, TRACES, ICS2). As a result of the analysis of the characteristics of customs examination of goods, the main organoleptic properties and compliance with the technical characteristics of products most frequently subject to customs examination were identified (Table 2).

Table 2. *Analysis of various product samples subject to customs examination*

Category of goods	Product name	Country of origin	Main organoleptic properties	Presence of foreign impurities	Safety analysis	Compliance with technical characteristics
Food products	Olive oil	Italy, Turkey	Characteristic colour, smell, and viscosity meet the standards	No impurities detected (FTIR)	Acidity and peroxide value indicators are within the norm	Complies with declared data
	Coffee	Poland, Italy	Uniform colour, aroma without signs of spoilage	No cereal impurities detected (HPLC)	Safe, no toxic substances detected	Caffeine content corresponds to labelling
	Chocolate	Ukraine, Turkey	Homogeneous texture, cocoa smell	Vegetable fats detected in Turkish samples	Complies with safety standards	Turkish samples – partial non-compliance with composition
Textiles	Cotton fabric	Turkey, China	Even weaving, no foreign odour	Up to 15% polyester in the Chinese sample	Safe colourants	Chinese sample does not correspond to declared 100% cotton
	Denim	Turkey	Density and strength within the norm	Not detected	Meets standards	Full compliance with labelling
	Polyester	China	Uniform structure	No impurities detected	No hazardous colourants (REACH)	Complies with declared data
Electronics	Smartphones	China	n/a (organoleptic assessment not applicable)	No hazardous metal impurities detected (XRF)	Pb, Cd, Hg – within RoHS limits	20% of samples – non-compliance with technical parameters

Table 2. Continued

Category of goods	Product name	Country of origin	Main organoleptic properties	Presence of foreign impurities	Safety analysis	Compliance with technical characteristics
	Power banks	China, Poland	n/a	n/a	Safe, no overheating detected	Chinese samples: capacity lower by 25–30%
	Headphones	Ukraine, China	Sound without distortion	n/a	No hazardous materials detected	Full compliance with labelling
Chemicals	Nail varnish	Poland, Ukraine	Uniformity, characteristic colour	No impurities detected	VOC – within EU limits	Complies with technical documentation
	Solvents	China, Turkey	Transparency, characteristic smell	In Chinese samples – up to 3% methanol	Exceedance of permissible limits in Chinese samples	Partial non-compliance with declared composition
	Cosmetics	Ukraine, Italy	Consistency and smell within the norm	Not detected	pH meets standards, no toxic substances detected	Complies with labelling

Note: *VOC – Volatile Organic Compounds*
Source: *DSTU ISO 9001:2015 (2016), ISO/IEC 17025:2017 (2017), World Customs Organization (2022; 2023)*

The analysis showed that EU countries have achieved a high level of digitalisation in their expert procedures. The use of electronic registers of reference samples, automated product classification, blockchain technologies for verifying product origin, and machine learning systems for analysing declarations has significantly reduced the risk of errors, accelerated data processing, and stood in stark contrast to the current situation in Ukraine, where such digital and technical integration was only at the stage of gradual implementation. The comparative analysis also revealed that Poland, Italy and Turkey had already fully harmonised their methodologies with the international standards DSTU ISO 9001:2015 (2016), ISO/IEC 17025:2017 (2017), as well as the World Customs Organization's guidance documents (2022; 2023), which ensured mutual recognition of examination results within the EU and reduced the number of trade disputes. In Ukraine, the level of such harmonisation has been partial, confirming the need for standardisation of laboratory procedures and updating of the regulatory framework.

Modern customs analysis has gradually shifted from traditional organoleptic methods to the use of high-precision instrumental technologies. One of the most promising areas has been the introduction of spectroscopic analysis methods (FTIR spectroscopy, UV-visible spectroscopy, XRF). These have enabled the rapid and reliable determination of the chemical composition of materials, which is crucial when inspecting products that may be counterfeit or hazardous to health. For example, using FTIR spectroscopy, EU customs laboratories successfully determined the authenticity of polymers in plastic products, specifically identifying low-density polyethylene (LDPE) and polyvinyl chloride (PVC) in batches of packaging imported from South-East Asian countries. This enabled the rapid detection of material substitution with cheaper alternatives not specified in the documentation. XRF has been widely used to monitor the safety of metal goods; for example, when testing children's toys from China, XRF made it possible to detect lead levels exceeding the permissible limit in the paints used for coating, thereby preventing the import of hazardous products. The use of portable XRF analysers has made it possible to carry out such checks directly at customs posts (Intertek, n.d.).

Another promising area has been gas and liquid chromatography, which has enabled the accurate detection of impurities, additives or prohibited substances in foodstuffs, medicinal products or chemical materials. In particular, in the practice of German customs laboratories, gas chromatography coupled with mass spectrometry (GC-MS) was used to detect illegal flavourings and synthetic preservatives in consignments of coffee and chocolate imported into the EU (German Federal Institute for Risk Assessment, n.d.). Similarly, liquid chromatography was used to detect counterfeits in perfumery products: it enabled the detection of cheap alcohol mixtures in place of the declared essential components (Intertek, n.d.). The digitisation of expert processes has also become an important aspect. The use of centralised databases containing digital reference standards (spectral characteristics, photographs, descriptions of quality indicators) has enabled the rapid identification of goods and helped to avoid classification errors. The implementation of such databases, integrated into international systems (e.g., the WCO Data Model), will facilitate the harmonisation of national methodologies with international standards and simplify data exchange with the customs administrations of other countries. The application of AI and ML in the process of commodity examination has become a promising development. ML algorithms can automatically analyse large volumes of data (images, spectra, technical descriptions) and classify goods according to HS codes with a high degree of accuracy, which will reduce the subjective element in the expert's work and

shorten decision-making times. By 2025, text and image recognition systems were being successfully used worldwide for the automated verification of product labelling (Magai & Ilomo, 2024). Another area of focus is the implementation of blockchain technologies to track the supply chain of goods. Thanks to decentralised data storage, customs authorities have been able to verify the authenticity of certificates of origin and quality guarantees without the risk of forgery, which has significantly reduced the risks of fraud, smuggling and the falsification of documents accompanying the goods.

An important component of the digital transformation has been the creation of mobile laboratories and rapid testing stations. These have made it possible to conduct preliminary examinations directly at the customs post, using portable devices and rapid test systems. This approach reduced the workload on central laboratories, cut waiting times for businesses and ensured rapid decision-making during customs inspections. The application of AI and ML algorithms in customs practice has opened up new possibilities for the automated classification and identification of goods. Traditional methods, based on manual document checks and organoleptic assessment, could not keep pace with the growth in international trade volumes and the diversity of goods flows (Makedon *et al.,* 2025). In this context, AI is capable of significantly improving the efficiency, accuracy and speed of expert decision-making (Table 3).

Table 3. *Potential for the use of AI/ML in customs examination*

Area of application	Example of technology	Expected effect
Automatic classification	ML models for coding goods according to HS codes.	Reduction in the number of errors, acceleration of processing
Goods identification	Computer vision, image recognition	Detection of counterfeits, rapid product recognition
Documentation analysis	NLP for customs declarations and certificates	Identification of inconsistencies and falsifications
Risk management	Predictive analytics algorithms	Automatic identification of "high-risk" consignments
Integration with instrumental methods	AI-based analysis of spectral data	Improved accuracy of goods composition examination

Note: *NLP – Natural Language Processing*
Source: *ISO/IEC 17025:2017 (2017)*

Thus, one of the promising areas has become the automated recognition and classification of goods according to HS codes. ML models, trained on large datasets of customs declarations, product samples and their characteristics, can automatically assign goods to the appropriate category, which has reduced the frequency of errors caused by human error and accelerated the cargo clearance process. The use of computer vision was of significant importance. Thanks to image analysis, the system was able to automatically identify goods by their external characteristics: shape, colour, labelling and packaging structure. Combined with spectral characteristics (for example, from FTIR analysis or X-ray fluorescence), ML algorithms are capable of generating a comprehensive product profile for rapid authenticity verification. The application of natural language processing (NLP) to analyse accompanying documentation has also become important. AI was able to automatically verify customs declarations, certificates of origin and certificates of conformity, identify discrepancies between the declared and actual characteristics of goods, and predict the risks of document forgery. Furthermore, AI technologies held potential in the field of risk management.

By predicting the likelihood of violations in specific consignments (based on historical data, country of origin, product category and behavioural factors of foreign trade participants), the system was able to automatically determine which consignments required more detailed inspection, and which could be cleared under a simplified procedure, thereby reducing the workload on customs authorities and optimising resources. The use of artificial intelligence and ML in the automated classification and identification of goods created the conditions for improving the efficiency of customs control, reducing the level of smuggling and counterfeiting, and integrating Ukraine into the global system of "smart" customs. Thus, improving commodity examination methods at the customs control stage required a comprehensive approach combining technical modernisation, process digitalisation, staff training and integration into the international standards system.

The issue of harmonising examination methods with international standards became crucial. The Ukrainian customs system must be guided by the requirements of ISO/IEC 17025:2017 (2017), which regulate the competence and impartiality of laboratories; and by the recommendations of the World Customs Organization (Mikuriya, 2021) regarding security and trade facilitation. Attention should also be paid to EU regulations set out in Regulation (EU) No. 952/2013 (2013) and to the provisions of the Agreement on Trade Facilitation, which established the principles of transparency and simplification of customs procedures (Protocol Amending the Marrakesh Agreement…, 2014). Their consistent implementation into national legislation and the working practices of customs laboratories has laid the groundwork for the mutual recognition of examination results, a reduction in the number of trade disputes, and

the deepening of Ukraine's integration into the global trading system. It has become advisable to introduce a system of regular audits to ensure that examination methods comply with international requirements. It is worth noting the training of personnel and the development of experts' professional competence. Training in modern instrumental and digital methods, internships at international customs organisations, and participation in joint scientific and practical programmes with the EU will contribute to professional development and the creation of a unified professional environment. The first step should be to upgrade the technical infrastructure of customs laboratories: the introduction of FTIR spectroscopy, X-ray fluorescence analysis, gas chromatography and other high-precision methods that have already been successfully used in EU countries, which will enable faster and more accurate determination of the quality characteristics of goods. The implementation of these measures will enhance the transparency and effectiveness of customs control, reduce the level of smuggling and contribute to Ukraine's integration into the global foreign trade system.

The works of contemporary researchers reveal a clear trend towards the digitalisation and automation of customs control processes, which has influenced the development of commodity examination. Scholar E. Oluwagbade (2025) emphasised the need to integrate algorithmic classification into global trade compliance systems, which enabled the automation of the goods identification process and reduced the number of human errors. V. Marinova (2024) emphasised that artificial intelligence is not merely an innovative tool but also a practical component of customs authorities' operations, enhancing the speed of decision-making and the accuracy of controls. Research by Y. Liu *et al.* (2025) drew attention to the development of a network of lower-tier customs laboratories, their technical equipment, and the need to standardise examination procedures in accordance with the requirements of ISO/IEC 17025:2017 (2017), which laid the foundation for harmonising approaches to goods identification. An important area identified in the study by A. Dziubynskyi *et al.* (2025) was the digital transformation of customs laboratories, based on the experience of the Republic of Korea and the EU. The authors demonstrated that the modernisation of the technical infrastructure and the digital integration of laboratories contributed to the standardisation of examination procedures and enhanced confidence in their results within the international community. S. Vijayakumar (2025) focused on deep neural networks for classifying goods in the e-commerce sector, where the high volume of data required automated solutions based on machine learning. Researchers K. Houssini *et al.* (2025) and Y. Zhao *et al.* (2025) highlighted the importance of creating intelligent decision support systems in international supply chains, enabling customs authorities to assess risks promptly, ensure compliance with standards and reduce transaction costs. Thus, the research demonstrated an interdisciplinary approach to the development of customs examination – ranging from technical improvements to laboratories and the implementation of IoT technologies to the creation of digital risk management ecosystems and automated goods classification. Thus, an analysis of scientific sources has confirmed that the global scientific community is moving towards the creation of "smart" customs control systems based on the use of artificial intelligence, big data and standardised protocols. For Ukraine, this means the need to adapt international practices, develop the digital infrastructure of customs laboratories and train highly qualified specialists capable of working with intelligent technologies in their expert activities.

Conclusions

The modern system of commodity examination at the customs control stage has faced a number of challenges, including slow procedures, insufficient technical equipment in customs laboratories, limited digitalisation, and a lack of full harmonisation with international standards. This has led to delays in customs clearance, increased the risk of incorrect classification of goods, and created favourable conditions for the spread of counterfeit products. food products, textile materials, electronic products, and chemical substances) confirmed the presence of significant challenges in the practical work of customs laboratories. The findings confirmed that the introduction of modern instrumental and digital technologies (spectroscopy, chromatography, X-ray fluorescence analysis, electronic databases, blockchain solutions) can improve the accuracy and speed of expert procedures, create the conditions for more effective control, reduce the risks of counterfeiting, and ensure integration with international information systems. The use of artificial intelligence and machine learning algorithms has become a promising development, enabling the automation of goods classification, analysis of accompanying documentation, identification of products based on visual, spectral and structural characteristics, as well as the prediction of smuggling risks. This laid the groundwork for a transition to a flexible, intelligence-led model of customs control that aligned with global trends. The practical recommendations emphasised a comprehensive approach to modernisation: upgrading the technical infrastructure of customs laboratories, the widespread introduction of digital technologies, the application of artificial intelligence, the harmonisation of methodologies with international standards, and the development of systematic training and professional development for staff. The implementation of these measures will contribute to increasing the efficiency and transparency of customs control, reducing the level of smuggling and counterfeiting, and strengthening Ukraine's

economic security. Prospects for further research lie in the creation of an integrated "smart customs examination" platform, which will combine artificial intelligence algorithms, automatic image analysis modules, spectral databases and risk management systems, thereby ensuring the creation of a unified digital environment for customs control, compatible with the international systems of the EU and the WCO.

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Удосконалення методів товарознавчої експертизи на етапі митного контролю

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Анотація. В умовах зростання міжнародних торговельних потоків, інтенсифікації митних процедур та посилення ризиків контрабанди й фальсифікації товарів, особливого значення набуває удосконалення методів товарознавчої експертизи на етапі митного контролю. Метою статті стало наукове обґрунтування та розробка пропозицій щодо удосконалення методів товарознавчої експертизи на етапі митного контролю шляхом інтеграції сучасних інструментальних, цифрових і аналітичних технологій. Цей процес передбачав підвищення точності, швидкості та об'єктивності експертних процедур, гармонізацію національних методик з міжнародними стандартами та створення передумов для ефективнішого функціонування системи митного контролю в Україні. Ефективність і точність експертних процедур визначили рівень економічної безпеки держави, забезпечили прозорість зовнішньоекономічних операцій та сприяли захисту внутрішнього ринку. Проте, наявні методи експертизи не завжди відповідали вимогам оперативності, достовірності та адаптивності до нових викликів, що актуалізувало потребу у впровадженні інноваційних підходів. У дослідженні обґрунтовано можливості вдосконалення товарознавчої експертизи на етапі митного контролю шляхом використання інструментальних і цифрових технологій, здатних суттєво підвищити результативність експертних процедур. Проведено систематизацію сучасних методів експертного аналізу та оцінено їх відповідність завданням митного контролю, а також визначено перспективи застосування цифрових рішень і штучного інтелекту в аналітичних процесах. Сформовано комплекс практичних рекомендацій щодо узгодження національних підходів із міжнародними стандартами. Запропоновано створення єдиної електронної бази даних зразків товарів, використання мобільних лабораторій та розроблення стандартів, адаптованих до глобальних вимог, що сприятиме підвищенню ефективності митного контролю та розширенню інтеграційних можливостей України у світовій торгівлі. Практичне значення дослідження полягає у можливості застосування його результатів для модернізації системи митного контролю, оптимізації роботи митних лабораторій, удосконалення електронних баз даних і впровадження міжнародно узгоджених методів експертизи, що підсилить економічну безпеку держави та стимулюватиме розвиток зовнішньої торгівлі

Ключові слова: стандарт; мито; товарознавча оцінка; регулювання; цифровізація