

Electronic scientific and practical journal
**INTELLECTUALIZATION OF LOGISTICS
AND SUPPLY CHAIN MANAGEMENT**

#33 (2025)
October '25



WWW.SMART-SCM.ORG

ISSN 2708-3195

DOI.ORG/10.46783/SMART-SCM/2025-33

ISSN 2708-3195



Electronic scientific and practical publication in economic sciences

Electronic scientifically and practical journal "Intellectualization of logistics and Supply Chain Management" included in the list of scientific publications of Ukraine in the field of economic sciences (category "B"): **Order of the Ministry of Education and Culture of Ukraine dated October 10, 2022 No. 894 (Appendix 2)**

Field of science: Economic.

Specialties: C1 (051) – Economics; D3 (073) – Management

ISSN 2708-3195

DOI: <https://doi.org/10.46783/smart-scm/2025-33>

The electronic magazine is included in the international scientometric databases:

Index Copernicus, Google Scholar

Released 6 times a year

№ 33 (2025)
October 2025

Founder: Viold Limited Liability Company

Editor in Chief: Hryhorak M. Yu. – Doctor of Economics, Ass. Professor.

Deputy editors-in-chief: Koulyk V. A. – PhD (Economics), Professor.
Marchuk V. Ye. – Doctor of Tech. Sci., Ass. Professor.

Technical editor: Harmash O. M. – PhD (Economics), Ass. Professor.

Executive Secretary: Davidenko V. V. – PhD (Economics), Ass. Professor.

Members of the Editorial Board:

SWIEKATOWSKI Ryszard – Doctor of Economics, Professor (Poland);

POSTAN M. Ya. – Doctor of Economics, Professor;

TRUSHKINA N. V. – PhD (Economics), Corresponding Member of the Academy;

KOLOSOK V. M. – Doctor of Economics, Professor;

ILCHENKO N. B. – Doctor of Economics, Ass. Professor;

SOLOMON D. I. – Doctor of Economics, Professor (Moldova);

ALKEMA V. H. – Doctor of Economics, Professor;

Henryk DŹWIGOŁ – PhD (Economics), Professor (Poland);

SUMETS O. M. – Doctor of Economics, Ass. Professor;

STRELCOVÁ Stanislava – PhD (Economics), Ass. Professor, (Slovakia);

RISTVEJ Jozef (Mr.) PhD (Economics), Professor, (Slovakia);

ZAMIAR Zenon – Doctor of Economics, Professor, (Poland);

GRITSENKO S. I. – Doctor of Economics, Professor;

KARPENKO O. O. – Doctor of Economics, Professor;

PATKOVSKYI S. A. – Business practitioner. (USA)

The electronic scientific and practical journal is registered in international scientometric data bases, repositories and search engines. The main characteristic of the edition is the index of scientometric data bases, which reflects the importance and effectiveness of scientific publications using indicators such as quotation index, h-index and factor impact (the number of quotations within two years after publishing).

In 2020, the International Center for Periodicals (ISSN International Center, Paris) included the Electronic Scientific and Practical Edition "Intellectualization of logistics and Supply Chain Management" in the international register of periodicals and provided it with a numerical code of international identification: ISSN 2708-3195 (Online).

Recommended for dissemination on the Internet by the Academic Council of the Department of Logistics NAU (No. 7 of February 26, 2020). Released 6 times a year. Editions references are required. The view of the editorial board does not always coincide with that of the authors.

Electronic scientifically and practical journal "Intellectualization of logistics and Supply Chain Management" included in the list of scientific publications of Ukraine in the field of economic sciences (category "B"): ***Order of the Ministry of Education and Culture of Ukraine dated October 10, 2022 No. 894 (Appendix 2)***

Field of science: Economic.

Specialties: C1 (051) – Economics; D3 (073) – Management

DOI: <https://doi.org/10.46783/smart-scm/2025-33>
e-mail: support@smart-scm.org

t.me/smart_scm
facebook.com/Smart.SCM.org
twitter.com/ScmSmart

тел.: (063) 593-30-41
<https://smart-scm.org>

Contents

INTRODUCTION	7
BUGAYKO D.O. Doctor of Science (Economics), Professor, Academician of the Academy of Economic Sciences of Ukraine, Corresponding Member of the Transport Academy of Ukraine, Vice - Director of ES International Cooperation and Education Institute, Instructor of ICAO, Professor of the Logistics Department, Leading Researcher, State University "Kyiv Aviation Institute" (Ukraine), SHEVCHENKO O.R. PhD in Economics, Professor (Associate) Director of ES International Cooperation and Education Institute, Professor (Associate) of Marketing Department State University "Kyiv Aviation Institute" (Ukraine), BUGAYKO D.D. Student of Air Transportation Department State University "Kyiv Aviation Institute" (Ukraine)	
<i>OPERATIONAL ACTIVITIES OF UKRAINIAN AIRLINES DURING THE WAR: CHALLENGES AND PROACTIVE MANAGEMENT STRATEGIES</i>	8 – 19
HRYPHORAK M. Yu. Doctor of Sciences (Economics), Professor (Associate), Academician of the Academy of Economic Sciences of Ukraine, Professor of Department of International Business and Logistics of National Technical University of Ukraine 'Igor Sikorsky Kyiv Polytechnic Institute' (Ukraine), MARCHUK V.Ye. Doctor of Engineering, Professor, Professor of Department of International Business and Logistics, National Technical University of Ukraine 'Igor Sikorsky Kyiv Polytechnic Institute' (Ukraine), HARMASH O.M. PhD (Economics), Associate Professor, Associate Professor of Department of International Business and Logistics, National Technical University of Ukraine 'Igor Sikorsky Kyiv Polytechnic Institute' (Ukraine)	
<i>ENHANCING THE RESILIENCE, ADAPTABILITY, AND ANTIFRAGILITY OF DEFENSE INDUSTRY SUPPLY CHAINS UNDER CONDITIONS OF HIGH TURBULENCE</i>	20 – 42
MARCHENKO V.S. Postgraduate student, State University «Kyiv Aviation Institute» (Ukraine)	
<i>MAIN CHALLENGES ON THE WAY OF IMPLEMENTING «GREEN» TECHNOLOGIES IN THE LOGISTICS SPHERE</i>	43 – 55
SHCHEKHOVSKA L.M. PhD in Economics, Associated Professor, Department of logistics of State University «Kyiv Aviation Institute» (Ukraine)	
<i>HYBRID PROJECT MANAGEMENT METHODOLOGIES IN LOGISTICS</i>	56 – 61

GRYTSENKO S.I. Doctor of Economics, Professor, Professor of Logistics Department State University «Kyiv Aviation Institute» (Ukraine),
HONCHARUK A.M. Master's degree applicant of State University «Kyiv Aviation Institute» (Ukraine)

ANALYTICS IN CONSOLIDATED CARGO TRANSPORTATION

62 –75

SMERICHEVSKA S.V. Doctor of Economics, Professor, Professor of Logistics Department State University «Kyiv Aviation Institute» (Ukraine), **TSYMBAL D.S.** Student of the Logistics Department State University "Kyiv Aviation Institute" (Ukraine), **TSYMBAL N.A.** Senior Lecturer of the Logistics Department State University "Kyiv Aviation Institute" (Ukraine)

DIGITALISATION OF LOGISTICS BUSINESS PROCESSES IN SUPPLY CHAIN MANAGEMENT AGAINST THE BACKGROUND OF GLOBAL TRENDS

76–92

POZNIAK O.V. PhD (Economics), Associate Professor, Associate Professor of Logistics department of State University «Kyiv Aviation Institute» (Ukraine),
KHARAKHASH N.M. IRS Certified Tax Preparer (AFSP), Chief Accountant, Business Manager, Taxflow Solutions LLC (Hollywood, FL, USA),
SUVOROVA I.M. PhD in Economics, Associate Professor, Associate Professor of Department of Industrial Marketing of National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute (Ukraine)

INTEGRATION OF ARTIFICIAL INTELLIGENCE AND ELECTRONIC DOCUMENT MANAGEMENT IN LOGISTICS: COMPARATIVE ANALYSIS OF UKRAINE, EUROPE, AND THE USA

93 –109

BOLDYRIEVA M.O. PhD student, State University "Kyiv Aviation Institute" (Ukraine), **SHEVCHUK D. O.** Doctor of Sciences (Technology), senior scientific researcher, Professor of Air Transport Organization Department, Acting Dean of the Air Transportation Management Department of State University "Kyiv Aviation Institute" (Ukraine)

AIR CARGO TRANSPORTATION AS AN ELEMENT OF THE RESTORATION OF THE AVIATION SECTOR IN UKRAINE AGAINST THE BACKGROUND OF MILITARY OPERATIONS

110 –115

LIAMZIN A.O. Doctor of Technical Sciences, Professor, Air Transportation Management Department, State University "Kyiv Aviation Institute" (Ukraine),
HODOVANIUK S.P. PhD (Technical Sciences), Associate Professor (Ukraine),
BORETS I.V. PhD (Pedagogical Sciences), Associate Professor, Air Transportation Management Department, State University "Kyiv Aviation Institute" (Ukraine),
KLYMENKO V.V. PhD in (Economic Sciences), Associate Professor, Air Transportation Management Department, State University "Kyiv Aviation Institute" (Ukraine)

MATHEMATICAL MODEL OF DECISION MAKING DURING SEARCH AND RESCUE OPERATIONS AT SEA

116 –126

HARAZHA O. P. Doctor of Sciences (Economics), Professor, Professor of the Air Transportation Organization Department of Faculty of Transport and Logistics of State Non-Commercial Company «State University «Kyiv Aviation Institute» (Ukraine),
SHEVCHUK D. O. Doctor of Sciences (Technology), senior scientific researcher, Professor of Air Transport Organization Department, Acting Dean of the Air Transportation Management Department of State University "Kyiv Aviation Institute" (Ukraine)

INSTITUTIONAL BASIS OF AIR TRANSPORT ORGANIZATION: CURRENT STATE AND DEVELOPMENT PROSPECTS

127 –139

DAVYDENKO V.V. PhD (Economics), Associate Professor, Associate Professor Department of Administrative Management and Foreign Economic Activity, National University of Life and Environmental Sciences of Ukraine (Ukraine),
KARPUN O.V. PhD (Economics), Associate Professor, Associate Professor of Department of International Business and Logistics, National Technical University of Ukraine «Igor Sikorsky Kyiv Polytechnic Institute» (Ukraine)

THE DEVELOPMENT AND SIGNIFICANCE OF INDUSTRIAL SYMBIOSIS IN UKRAINE

140 –146

UDC 004.89:005.94:658.7(477+4+73)
JEL Classification: O33, M15, L87, R41, D83.
Received: 16 September 2025

Pozniak O.V. PhD (Economics), Associate Professor, Associate Professor of Logistics department of State University «Kyiv Aviation Institute» (Ukraine)

ORCID – 0000-0003-0701-9698
Researcher ID – S-7110-2018
Scopus author id: –
E-Mail: Poznyak_ov@ukr.net

Kharakhash N.M. IRS Certified Tax Preparer (AFSP), Chief Accountant, Business Manager, Taxflow Solutions LLC (Hollywood, FL, USA)

ORCID –
Researcher ID –
Scopus author id: –
E-Mail: tax.kharakhash@gmail.com

Suvorova I.M. PhD in Economics, Associate Professor, Associate Professor of Department of Industrial Marketing of National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute (Ukraine)

ORCID – 0009-0009-3271-6242
Researcher ID –
Scopus author id: –
E-Mail: irina_suvorova@ukr.net

INTEGRATION OF ARTIFICIAL INTELLIGENCE AND ELECTRONIC DOCUMENT MANAGEMENT IN LOGISTICS: COMPARATIVE ANALYSIS OF UKRAINE, EUROPE, AND THE USA

Oksana Pozniak, Natalia Kharakhash, Irina Suvorova. *«Integration of Artificial Intelligence and Electronic Document Management in Logistics: Comparative Analysis of Ukraine, Europe, and the USA».* The article examines the role and effectiveness of integrating artificial intelligence and electronic document management in logistics, with an emphasis on its strategic function of ensuring speed, reliability, and global connectivity in multimodal supply chains. The integration of artificial intelligence (AI) into electronic document management (EDM) systems represents a key stage in the digital transformation of logistics. Over the past five years, the logistics sector in Europe and the United States has shifted from traditional digital archiving toward intelligent automation and predictive data management. The study aims to examine the interaction between AI technologies and EDM solutions in logistics and to compare the technological, regulatory, and organizational approaches of Ukraine, the European Union, and the United States. The research applies a comparative and

analytical methodology based on official EU and OECD reports, KPMG and ACCA industry analyses, and Ukrainian digitalization frameworks. The results demonstrate that in Europe, the integration of AI and EDM is strongly influenced by the EU Artificial Intelligence Act (Regulation 2024/1689), which establishes a risk-based approach to AI governance. In the United States, innovation is driven by private investment and sectoral standards, while Ukraine is still at an early stage of AI adoption, facing infrastructure and regulatory challenges. The findings confirm that AI enhances the efficiency, traceability, and compliance of logistics document flows, automates reporting and verification, and supports strategic decision-making. The article identifies the main barriers to implementation — technical barriers, regulatory barriers, and personnel and organizational barriers that lead to technological fragmentation, data interoperability issues, and skills shortages. Special attention is paid to comparing regulatory barriers to implementing AI-generated documents in Europe, the USA, and Ukraine, which provides an opportunity to adapt legislation not only to national requirements, but also to take into account the experience of best legislative practices. Proposes a conceptual model for harmonizing AI-based document management systems in logistics, forms an intelligent ecosystem of logistics data, in which electronic document flow acts not only as a tool for information exchange, but also as an active analytical resource for managing logistics processes. The results contribute to understanding how AI-driven EDM can improve transparency, sustainability, and competitiveness in global logistics chains.

Keywords: artificial intelligence; electronic document management; logistics; digital transformation; data management; AI regulation; logistics supply chains

Оксана Позняк, Наталія Харахаш, Ірина Суворова. «Інтеграція штучного інтелекту та електронного документообігу в логістиці: порівняльний аналіз України, Європи та США». У статті розглядається роль та ефективність інтеграції штучного інтелекту та електронного документообігу в логістиці, з акцентом на його стратегічну функцію забезпечення швидкості, надійності та глобальної зв'язності в умовах мультимодальних ланцюгів постачання. Інтеграція технологій штучного інтелекту (ШІ) в електронні системи документообігу (ЕДМ) становить ключовий етап цифрової трансформації логістичної галузі. Протягом останніх п'яти років у Європі та США спостерігається перехід від традиційного електронного архівування до інтелектуальної автоматизації та предиктивного управління даними. Метою дослідження є визначення закономірностей взаємодії між технологіями ШІ та системами ЕДМ у логістиці, а також порівняння технологічних, регуляторних і організаційних підходів України, Європейського Союзу та Сполучених Штатів Америки. Методологічною основою дослідження є порівняльний і аналітичний підхід, що базується на офіційних звітах ЄС і ОЕСР, аналітиці компаній KPMG та ACCA, а також нормативних документах України у сфері цифровізації. Результати показують, що в ЄС інтеграція ШІ та ЕДМ відбувається в контексті впровадження Регламенту ЄС 2024/1689 «Акт про штучний інтелект», який установлює ризик-орієнтовану модель регулювання. У США розвиток відбувається під впливом приватних інвестицій та галузевих стандартів, тоді як Україна перебуває на початковій стадії імплементації таких рішень, стикаючись із технологічними та інфраструктурними бар'єрами. Доведено, що використання ШІ підвищує ефективність, прозорість і відповідність логістичних інформаційних (документних) потоків, автоматизує звітність і перевірку, сприяє ухваленню стратегічних рішень. У статті визначено основні перешкоди для впровадження — технічні бар'єри, регуляторні бар'єри, а також кадрові та організаційні бар'єри, що призводять до технологічної фрагментації, проблем сумісності даних та дефіциту кваліфікованих кадрів. Запропоновано концептуальну модель гармонізації систем ЕДМ на базі ШІ у логістичних процесах. Отримані результати сприяють формуванню розуміння ролі ШІ у підвищенні стійкості, прозорості та конкурентоспроможності глобальних логістичних ланцюгів.

Ключові слова: штучний інтелект; електронний документообіг; логістика; цифрова трансформація; управління даними; регулювання ШІ; логістичні ланцюги постачання

Introduction. Document management systems have come a long way from traditional paper-based to modern electronic platforms designed to optimize business processes and increase the efficiency of information management.

The COVID-19 pandemic in 2020 became a turning point for the global economy and a catalyst for accelerated digitalization. The logistics business, which largely depended on paper document management, faced paralysis of key functions: signing contracts, exchanging primary documentation, accounting and tax accounting were under threat. Under these conditions, electronic document management (EDM) turned from a promising area into a vital element of corporate infrastructure.

In the period 2020–2025, the EDM market demonstrated stable growth in all regions, but the nature of its development was different:

- Ukraine - decentralized model based on private operators ("Вчасно", EDIN, M.E.Doc).
- Europe - Centralized model through eIDAS regulation and the Peppol network.
- USA – Corporate Leadership of Global Providers (DocuSign, Adobe, Microsoft, OpenText).

For ACCA members and professionals, these topics are critically important: they define not only current practice, but also the requirements for competencies that are valued and recognized internationally.

Today, the next stage comes to the fore - the integration of artificial intelligence (AI) in various industries, as well as in logistics, which radically changes the very nature of document management, moving from simple digitization to the creation of an intelligent digital ecosystem.

Analysis of the latest research and publications. In recent years, the integration of artificial intelligence (AI) with electronic

document management (EDM) systems has emerged as a core component of digital transformation across various sectors, including logistics. According to the Association of Chartered Certified Accountants [1], technological innovation and automation are reshaping information management processes, moving from basic electronic archiving toward intelligent data-driven ecosystems. The ACCA Smart Alliance Report [2] emphasizes that the convergence of human professional expertise and machine intelligence enables more adaptive and sustainable management models, particularly in data-intensive industries.

Helen Brand [3] argues that the trustworthiness and transparency of AI systems are fundamental prerequisites for their widespread adoption in operational environments. Her research highlights the importance of AI assessments in strengthening confidence in digital ecosystems. Complementing this, Brand and Van Onselen [4] explore the ethical dimension of AI implementation, linking responsible adoption with the ESG (Environmental, Social, and Governance) framework, which is of particular relevance to sustainable logistics and global supply chain operations.

From an applied business perspective, KPMG [8] demonstrates that the integration of AI in financial and operational management has led to significant efficiency improvements, primarily through automation of document flows, risk assessment, and predictive analytics. These findings can be directly extended to logistics, where similar document-heavy workflows—such as shipment documentation, customs forms, and supplier records—require intelligent processing and compliance assurance.

The technological foundations of AI-enhanced EDM systems are described in the study by SmartPoint DMS [12], which outlines the transformation from traditional EDM to

intelligent document processing (IDP) platforms integrating optical character recognition (OCR), natural language processing (NLP), and large language models (LLMs). Similarly, The Insight Partners [13] analyze the European electronic signature software market, noting that the European Union demonstrates leadership in ethical AI adoption and regulatory harmonization, particularly under the EU Artificial Intelligence Act (Regulation (EU) 2024/1689). By contrast, the United States emphasizes technological scalability and innovation-driven competition, resulting in distinct trajectories of AI development between the two regions.

At the national level, Onuchak [11] investigates the role of digital workflow automation in Ukrainian enterprises, emphasizing that automation of routine documentation tasks significantly enhances operational efficiency. However, the author points out challenges related to interoperability, data security, and the limited integration of AI tools in logistics and supply chain documentation.

Despite the substantial body of literature examining AI adoption in business and administrative processes, there remains a notable research gap in understanding the integration of AI-driven EDM systems within logistics operations, particularly through an international comparative lens.

Existing research primarily addresses:

- technological and organizational aspects of EDM transformation (SmartPoint DMS, 2025; KPMG, 2024);
- ethical and governance frameworks for AI adoption (Brand & Van Onselen, 2021; Helen Brand, 2024);
- regional market and policy analysis in Europe and the USA (The Insight Partners, 2025).

However, these studies do not sufficiently explore the mechanisms by which AI-enabled EDM transforms logistics workflows, documentation accuracy, and decision-making processes, the regulatory and infrastructural differences between Ukraine,

the European Union, and the United States in supporting AI-based logistics documentation and the interoperability and data governance challenges that impede AI adoption in supply chain document management.

Thus, the unresolved problem lies in the lack of a holistic comparative framework that evaluates the integration of AI and EDM in logistics across different regulatory environments. Addressing this gap can contribute to the development of a unified model for digital transformation and intelligent automation in global supply chains.

Objectives statement. The primary objective of this study is to analyze the integration of artificial intelligence (AI) into electronic document management (EDM) systems within the logistics sector, and to conduct a comparative assessment of implementation strategies, technological maturity, and regulatory frameworks in Ukraine, Europe, and the United States.

Basic material and results. Recent years have been an unprecedented Electronic document management (EDM) is a comprehensive system that ensures the creation, transfer, signing, storage and processing of documents in digital format. The main goal of EDM implementation is to optimize business processes, reduce time and financial costs, and reduce the risks associated with errors and the human factor.

In modern business, EDM covers a wide range of documents: from financial and accounting forms to HR documentation and corporate solutions. The transition to electronic formats allows organizations to significantly speed up the exchange of information, ensure the legal force of documents and increase the transparency of processes. Table 1 shows the main categories of documents that are converted into electronic format, as well as the mechanisms used for signing in Ukraine, Europe and the United States

Table 1. Types of document and signature in EDM

No.	Category of documents	UKRAINE	EUROPE	USA
1.	Financial	Invoices Payments Reports	Invoices Payments Reports	Invoices Payments Reports Contracts
2.	Legal of contracts	Supply Contracts Leases Service Contracts	Contracts	Contracts Agreements
3.	Staffing	Employment Contracts Timesheets Applications	Employment Contracts HR Documentation	Employment Contracts HR Documentation
4.	Tax	Tax Returns	Tax Returns	Tax Returns
5.	Logistics	Invoices Shipping Documents Delivery Documents	Invoices Delivery Documents	Invoices Shipping Documents Delivery Documents
6.	Corporate Management	Board Minutes	Board Minutes Management Reports Resolutions	Board Minutes Management Reports Resolutions

Source: compiled by the authors

Thus, EDM not only optimizes internal processes, but also becomes a strategic factor in increasing competitiveness, which is especially important in the context of global digitalization and the integration of AI in data management.

Electronic document management (EDM) offers significant economic benefits (see Figure 1) by reducing costs through lower paper and storage expenses, increasing productivity with faster access and automated workflows, and mitigating financial risks via improved security and compliance. It also contributes to higher profitability by allowing employees to focus on higher-value tasks and by improving operational efficiency through streamlined processes.

Accordingly, automation of document flow in business has become a trend in recent years. Companies in various business sectors use digital tools to work with documents faster and spend less time on routine. For

example, electronic document flow services automate the entire life cycle of an electronic document - from creation to archiving. Let's consider the main trends in the implementation of a certain technology in the context of different regions. In Ukraine, there is no single state provider of services for business, so the EDM market is formed at the expense of private operators.

In Ukraine, the following operators are accredited for the exchange of electronic documents that work with QES (Qualified Electronic Signature) and integration with the Tax system:

- M.E.Doc;
- Вчасно;
- Paperless;
- EDIN (e-TTN);
- Cota (iFin, Liga: REPORT);
- Dubidoc.

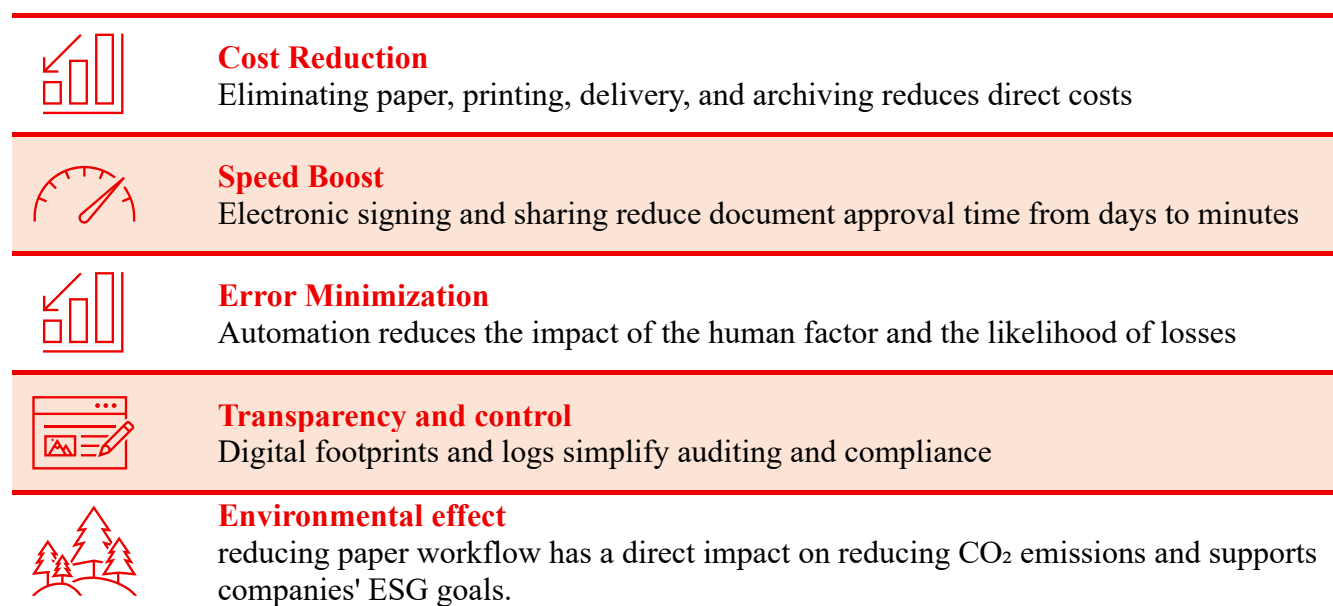


Figure 1 – Comprehensive economic benefits of EDM to business

Source: compiled by the authors

Figure 2 presents the platforms that are leaders in usage on the Ukrainian market.

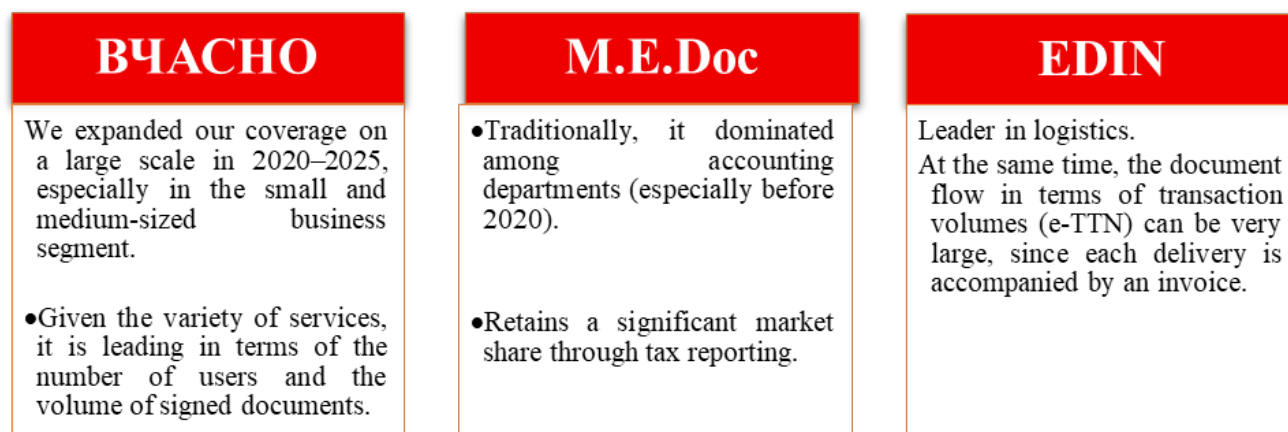


Figure 2 – The leaders in EDM industry in Ukraine

Source: compiled by the authors

Each of these platforms provides solutions for creating, exchanging, signing and storing legally significant electronic documents using a qualified electronic signature (QES), in accordance with the requirements of Ukrainian legislation.

For the state, there is the state platform Diya. The platform works mainly for citizens and partly for government agencies. This platform, although widespread among

citizens, is only partially integrated into the business environment.

Thus, the EDM market in Ukraine is developing rapidly, but remains fragmented, decentralized and applied inconsistently on a selective basis. Each company (EDIN, M.E.Doc) develops its own AI modules, there is no single standard. The war and remote work have increased the demand for sustainable digital solutions.

AI is mainly applied as a supporting tool and is not yet widely adopted due to regulatory restrictions on the use of qualified electronic signatures (QES).

In the EU, the situation is closer to centralized.

In contrast to decentralized or predominantly market-based models, the European framework for the implementation of EDI relies on institutional standards and regulatory support that ensure a high degree of legal reliability and cross-border interoperability.

The key regulatory document defining the framework for working with electronic documents in the EU is the eIDAS (Electronic Identification, Authentication and Trust Services) regulation. It establishes the legal status of electronic signatures and classifies them into levels of trust - from basic (SES) to qualified (QES), which are equated to a handwritten signature in court.

An additional element of the infrastructure is the Peppol (Pan-European Public Procurement Online) network, which provides a standardized exchange of electronic invoices and contracts between organizations from different EU countries. This is critical for companies operating in multiple jurisdictions and interacting with public procurement or corporate partners at a pan-European level.

The industry leaders in Europe are the following platforms:

- Adobe,
- DocuSign,
- OneSpan,
- Thales.

The European Commission's strategic documents (including Digital Decade 2030 and the European Data Strategy) envisage further consolidation of digital systems, the

creation of pan-European data spaces, and the strengthening of the role of AI in document management. The focus is on creating a single digital environment where the exchange of electronic data and documents will take place transparently, safely and legally reliable.

In the United States of America, electronic document management (EDM) has evolved as part of the market's digital transformation, rather than as a result of centralized regulation. Unlike the EU or individual countries with an active role of the state, the American model is based on the initiative of the private sector and the adaptability of business to technological trends. This has made the United States a global leader in the commercialization of EDM and the introduction of artificial intelligence (AI)-based systems.

The development of EDM in the United States is closely related to technology corporations that provide cloud-based, scalable, and integrable document management solutions.

The industry leaders in the USA are the following platforms, the main functionality of which is shown in Figure 3.

- DocuSign,
- Adobe,
- OpenTex,
- Microsoft,
- IBM,
- Oracle

The U.S. forms the backbone of the global DMS market, including SaaS export solutions and the development of industry standards.

Unlike eIDAS in the EU, the U.S. does not have a single federal law governing electronic signatures and document management.



Figure 3 – The leaders in EDM industry in USA

Source: compiled by the authors

The main regulatory acts governing the activities of these platforms are:

- ESIGN Act (2000) - recognizes the legal force of electronic signatures.
- UETA (Uniform Electronic Transactions Act) - Applied at the state level.

This system provides companies with flexibility in choosing platforms, formats, and procedures, but requires businesses to be attentive to internal security policies and compliance with industry regulators (For example, IRS, SEC, HIPAA and others.).

The American EDM model is a commercially oriented ecosystem based on innovation, scalability, and user convenience. The U.S. is showing how the free market can quickly adapt to the demands of the digital age, while actively shaping global standards.

Unlike EDM, Artificial Intelligence (AI) is a technology that combines machine learning, automatic image and speech recognition, and data analysis. AI models are able to analyze large amounts of information in a very short time, draw conclusions, make decisions, and interact with the environment.

This opens up wide opportunities for the use of AI in various software solutions aimed at optimizing key business processes, improving efficiency, and increasing overall profitability. One of the most effective areas of

application of AI is document processing, especially when it comes to routine tasks typical of traditional document management. Sorting, classifying, extracting data, and transferring information to the accounting system are all tasks that require a lot of time and labor, and are prone to errors and duplication when done manually.

AI has different impacts on the development of industries; the role of AI in the development of EDM in specific countries in the period 2023–2025 is shown in Figure 4.

A key advantage of AI-powered document analysis is its ability to significantly reduce manual operations, improve data processing accuracy, and ensure consistent performance. With fully automated metadata extraction, these systems help speed up document registration and approval processes while ensuring full compliance with business rules, internal policies, and regulatory standards.

Implementing an AI-powered document management system is not just a step towards digital transformation, it's a strategic investment in the resilience, agility, and competitiveness of your business in the face of ever-increasing amounts of information and data processing requirements.

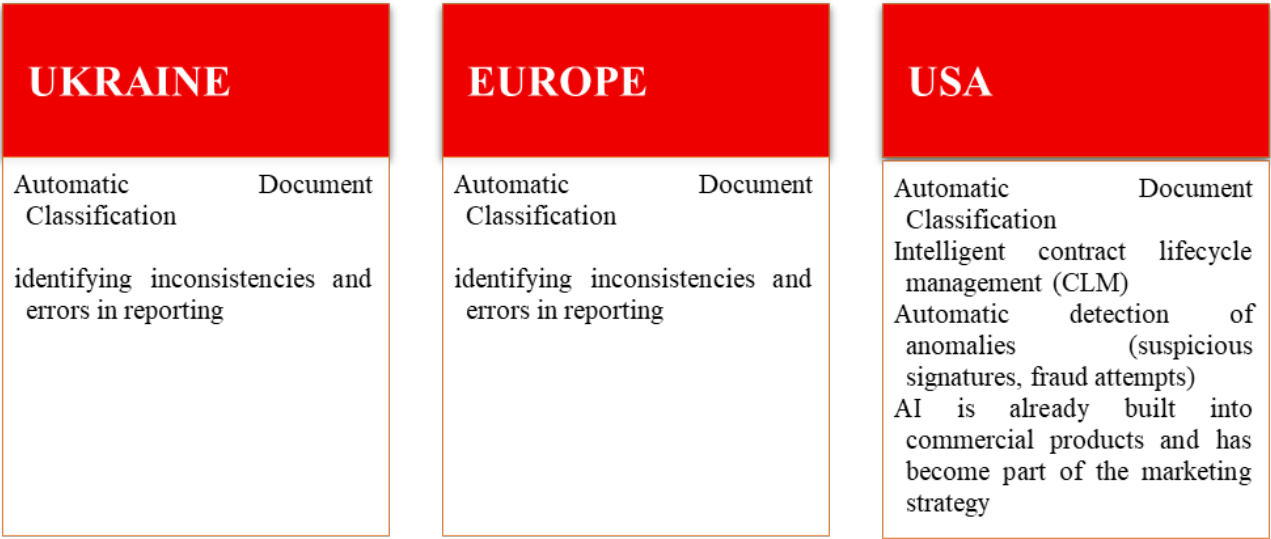


Figure 4 – The role of AI in development of EDM (2023–2025)
Source: compiled by the authors

Electronic document management and the introduction of artificial intelligence are becoming the most important factors in the transformation of business and the financial profession. However, the productivity of their application largely depends on the extent to which specialists have the same standards and rules of work.

Technology has the potential to revolutionize financial management practices, but its value is only realized if professionals have the knowledge and competencies to apply it effectively.

Professional training is becoming a key tool for adaptation. ACCA forms in accountants not only technical skills in working with EDM and AI, but also an ethical understanding of responsibility for the use of technology.

The future of the profession depends on the willingness of specialists to cooperate with artificial intelligence. The machine provides speed and scale; professionals ensure quality and trust.

Artificial intelligence (AI) has enormous potential to transform the way we work. However, as AI evolves, it presents both great opportunities and major challenges for accounting and finance professionals. For companies, it is critical that financial

professionals have the same training and understanding of the use of AI and digital technologies. Standardization of knowledge and practices reduces the risk of errors, ensures transparency and strengthens trust between counterparties.

Uniform qualifications allow accountants to "speak the same language", which makes it easier to implement AI tools and make them as productive as possible.

For auditors, the importance of training at ACCA lies in the ability to correctly assess the correctness of the use of AI in accounting and document management processes. Ethical principles and uniform standards are the basis for responsible AI implementation. Without them, trust in digital systems and analysis will be undermined. Thus, auditors need not only to be proficient in digital analysis tools, but also to be able to check whether the use of AI meets professional and ethical standards. EDM frees you from routine and transfers the role of an accountant to analytics and strategic consulting.

The USA is a leader in the development and implementation of AI in various industries, which is confirmed by the data in Figure 5.

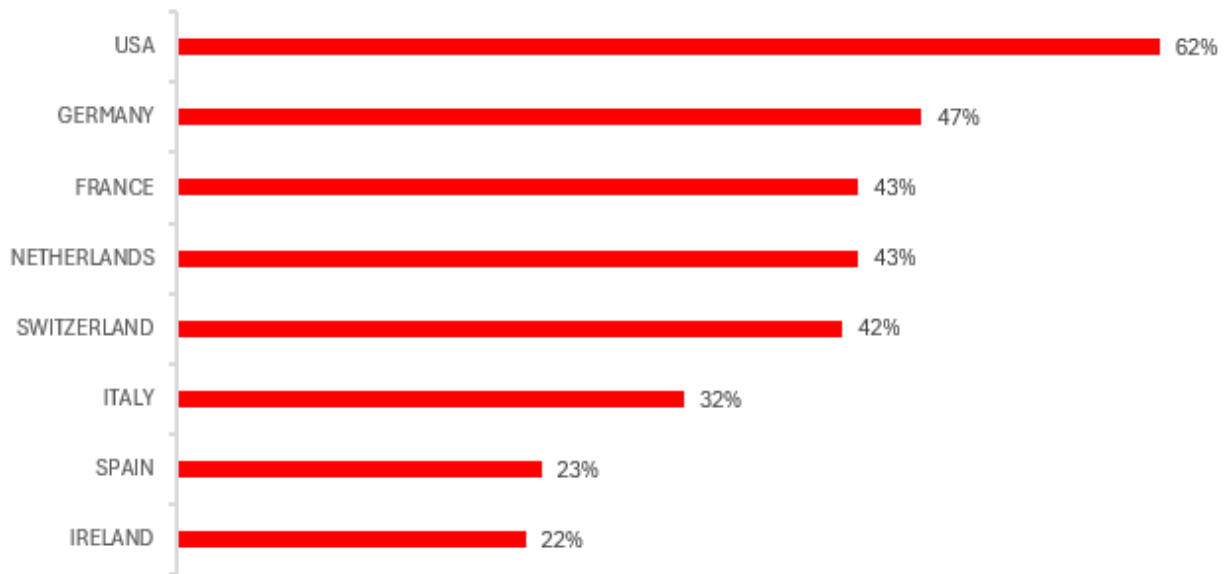


Figure 5 – US vs. other countries: moderate or large degree of usage.

Source: [1]

So, the development of artificial intelligence (AI) opens up new opportunities for the logistics industry, but its implementation is associated with a number of challenges, from cybersecurity to a shortage of qualified personnel. Many companies note that the limited skills of employees in working with AI are becoming one of the main obstacles.

The rapid development of Artificial Intelligence (AI) and Machine Learning (ML) has significantly transformed logistics and supply chain management, especially for sustainability and environmental efficiency [5].

The integration of Artificial Intelligence (AI) technologies into Electronic Document Management (EDM) systems is becoming one of the most significant trends in the digital transformation of logistics in 2020–2025. Document management, previously perceived as a supporting function, is now becoming the main source of data and management information that can affect the efficiency of the entire supply chain.

AI document management systems have radically changed the logic of logistics [9]:

- automated and predictive document processing processes;
- decisions are made based on real-time data;
- end-to-end transparency and cost reduction;
- sustainable growth and digital trust.

DHL [6] frames logistics competitiveness increasingly in terms of how fast organizations can interpret, reconcile and act on supply chain data, rather than purely how fast they can move physical goods. The integration of AI and EDM turns logistics networks into intelligent ecosystems, where each document becomes a source of value and management knowledge.

Current literature and industry reports [7] agree that the core of the transformation is formed by five technological areas of AI, each of which directly affects electronic document management.

1. *Advanced Analytics*. AI can help us analyze and interpret data using sophisticated tools and algorithms to gain actionable insights and predictions beyond the capabilities of traditional business intelligence. The data empowers businesses to plan more strategically, increase

operational resilience, and gain a competitive edge.

It's not just about reporting, but about mathematical models that analyze transactional documents (purchase orders, invoices, bills of lading), identify patterns and generate forecasts. Such models help plan capacity, procurement, and logistics resources, reducing supply volatility and making the network more resilient. Studies note that AI-powered predictive analytics improve demand forecasting, inventory management, and resource allocation, increasing supply chain competitiveness by reducing uncertainty.

2. *Generative AI (Gen AI)*. Generative models automatically generate text (delivery status reports, summaries of contract terms, explanations of delays), visual materials, and even audio instructions. Industry reports indicate that it is AI generating models that are becoming critically important for the automatic "translation" of complex logistics documents into a management solution that is understandable to management and the client.

AI today can autonomously generate new content – images, text, audio, or videos – based on patterns learned from existing data. Technology is on an explosive upward trajectory, growing by 50% in 2023, and is projected to compound this growth annually through 2030. We expect GenAI to have a huge near-term impact on logistics.

3. *Computer Vision*. Computer vision tools use cameras to capture photos or videos and AI algorithms to analyze the extracted data. Basic systems are trained to simply differentiate objects, while advanced systems can track objects across viewpoints and learn on their own. Recent breakthroughs even achieve prediction through pattern recognition, with a wealth of enticing use cases, especially in warehouse environments.

Computer vision links physical operations (warehouse, ramp, distribution center) to documents. Cameras record the condition of loading units, barcodes, seals, fill out electronic acts of acceptance/transfer and

automatically confirm compliance with the declared quantity.

4. *Audio AI*. Audio AI is about analyzing, synthesizing, and understanding audio signals. It allows machines to perceive, process, and interpret sound in a manner similar to human auditory systems. Audio AI encompasses techniques such as speech recognition, sound classification, and environmental noise detection to enhance human-computer interaction and support predictive maintenance, fatigue detection, process optimization, and more.

Voice interfaces and analysis of audio streams allow operators to dictate real-time data on delivery, cargo condition, damage, and deviations. The AI system transcribes the speech, structures it as an incident report document, and immediately embeds it into a digital archive [10].

5. *AI ethics*. As AI rapidly scales up, ethical considerations have become an important near-term trend that examines the implications of AI to ensure its responsible development and deployment. Legislative and regulatory responses are one aspect of this. The security of data and algorithms, bias, and transparency are others. The logistics industry will likely face heightened regulatory scrutiny in the coming years [6].

AI scaling inevitably leads to issues of algorithm transparency, bias, and control over the use of personal and commercially sensitive data. In the EU, these issues are already institutionalized through Regulation (EU) 2024/1689 (the EU Artificial Intelligence Act) and the GDPR; research papers from 2024-2025 emphasize that the credibility of AI and the legal acceptability of automatically generated documents are becoming as important as processing speed. This defines the requirements for auditing AI models and for the reproducibility of document-based solutions [7].

In Ukraine, the potential of AI systems in logistics is especially high, because since 2020, several processes have been going on at the same time: military and humanitarian logistics, restructuring of import/export

chains, and accelerated digitalization of business documents through state initiatives of electronic trust and Qualified Electronic Signature (QES) Law No 2155-VIII "On Electronic Trust Services".

The state policy of the digital state ("Дія") and the development of the electronic trust services market have created a regulatory and technical framework for the transition to end-to-end electronic document management.

The most promising areas for Ukrainian logistics operators are:

- automatic generation of applications for the search and approval of documents between branches and the central accounting department (centralized electronic archive);
- a legally significant electronic document with a QES instead of a paper acceptance certificate, recognized within the corporate supply chain and, over time, outside it;
- reconciliation of electronic documents with ERP using AI, which reduces the burden on accounting;
- integration of predictive analytics (forecast of delays, stock shortages, bottlenecks in transportation) into operational supply management, and not only into financial statements.

Despite the active development of artificial intelligence (AI) and electronic document management (EDM) technologies, their widespread introduction into logistics processes is largely constrained by the existing regulatory environment and structural constraints. The legislative regimes of Ukraine, the European Union and the United States of America form different levels of maturity and legal certainty, which directly affects the integration of AI systems into the electronic exchange of documents between participants in supply chains.

These barriers are conventionally divided into three groups, as presented in Figure 6.

Technical barriers are manifested in the definition of the following obstacles, namely:

1. *Lack of unified standards for electronic document interchange.* All three jurisdictions have the principle of recognizing electronic

documents as legally significant, but there is no single international standard for the exchange of logistics documents using AI.

In Ukraine, according to the Law "On Electronic Documents and Electronic Document Management" [14] No 851-IV (2003), an electronic document is recognized as equivalent to a paper one if there is an electronic signature. However, there are no uniform interoperability protocols with EU or US systems, which makes automated cross-border data exchange difficult.

In the EU, Regulation (EU) No 910/2014 (eIDAS) establishes requirements for qualified electronic signatures and trust services. However, this act does not contain specific provisions for AI logistics platforms and their interaction with automatically generated documents, which leaves a legal gap in the legal validity of AI-generated documents.

In the United States, the *Electronic Signatures in Global and National Commerce Act* (2000) recognizes the legal validity of electronic signatures and documents but does not regulate the algorithmic creation or processing of such documents using AI.

2. *Incompatibility of information systems and data quality.* The laws of all three regions enshrine the obligation to ensure the integrity and authenticity of electronic documents, but do not establish technical standards for their processing by AI systems. In the EU, this is reflected in the AI Act 2024/1689, which explicitly states the requirement of "appropriate quality and representativeness of data". However, there are no industry guidelines for logistics, which creates technical uncertainty, as these requirements are often defined by corporate regulations rather than state regulation. This makes it difficult to integrate with international AI platforms that require common metadata schemas, APIs, and trust protocols.

3. *Information security and infrastructure resilience.* In the EU, there is Directive (EU) 2022/2555 (NIS 2 Directive), which obliges companies in the transport and logistics sector to comply with cybersecurity measures. In the United States, a similar

requirement arises from the *Cybersecurity and Infrastructure Security Act* (2018).

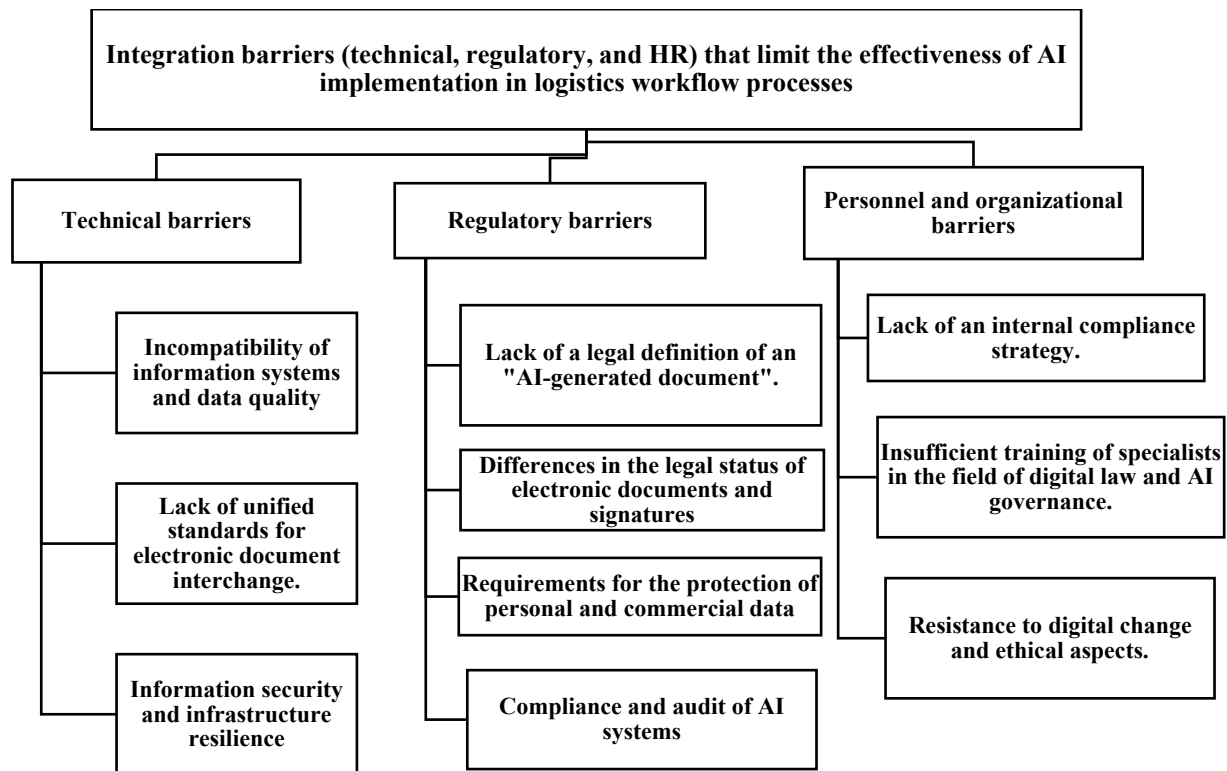


Figure 6 – Integration barriers (technical, regulatory, and HR) that limit the effectiveness of AI implementation in logistics workflow processes

Source: compiled by the authors

In Ukraine, there is no separate act regulating cybersecurity in logistics, which creates a gap in the integration of AI modules into critical document management processes.

Thus, technical barriers largely stem not from a lack of technology, but from the lack of globally interoperable standards for AI processing of electronic documents and data quality requirements in logistics.

Regulatory barriers are represented by the following problematic aspects:

1. *Differences in the legal status of electronic documents and signatures.* In Ukraine, the Law "On Electronic Trust Services" [15] No 2155-VIII (of 5 October 2017) is in force, which provides for state accreditation of trust service providers. However, its effect is limited by national jurisdiction: an electronic signature issued in Ukraine is not recognized as valid in the EU or

the United States, which creates barriers to international document flow in logistics [15].

In the EU, the mutual recognition mechanism is provided for by *eIDAS*, but it applies only to the member states of the Union. In the United States, the regulation of electronic signatures and documents (E-SIGN Act and Uniform Electronic Transactions Act (UETA) varies by state, which gives rise to heterogeneity of rules for cross-border supply chains.

2. *Lack of a legal definition of an "AI-generated document".* In the EU, for the first time, an attempt was made to legislate this issue in the *AI Act (2024/1689)*, which introduces categories of systems according to the level of risk and the responsibilities of AI operators for transparency and explainability of algorithms. However, the regulation does not give a clear answer whether a document created or processed by an AI system has

independent legal force without human confirmation.

There is no such definition in the legislation of the United States and Ukraine, which creates legal uncertainty for the use of automatic classification and electronic signing of documents without direct human involvement.

3. *Requirements for the protection of personal and commercial data.* The EU has *GDPR (2016/679)*, which restricts the automated processing of personal data if it leads to legal consequences. This directly affects the use of AI algorithms in logistics document management, where information about customers, cargoes, and financial transactions is recorded.

In the United States, data protection is regulated at the level of individual acts, such as *the California Consumer Privacy Act (CCPA)*, and does not have a single federal regulation.

In Ukraine, similar principles are enshrined in the *Law on the Protection of Personal Data (2023)*, but without detailed procedures for AI systems, which limits trust in the electronic processing of confidential logistics documents.

4. *Compliance and audit of AI systems.* In the EU, companies are required to demonstrate that AI systems comply with the principles of transparency and security, and operators of "high-risk" systems are subject to certification and external audits. This is provided by *AI Act 2024/1689* and *Directive (EU) 2022/2555*.

In Ukraine and the United States, similar requirements are still at the stage of formation: there are no procedures for mandatory certification of AI solutions in the field of document management.

These differences create barriers for companies operating in international logistics networks, which are forced to adapt solutions to different legal regimes.

Personnel and organizational barriers include the following issues:

1. *Insufficient training of specialists in the field of digital law and AI governance.* The legislation of Ukraine, the EU and the USA

does not have mandatory requirements for professional certification of specialists implementing AI document management systems. However, regulations require ensuring an "appropriate level of competence" of responsible persons:

- in the EU, this is enshrined in the *AI Act (Article 18 – "Human Oversight and Competence")*,

- In the U.S., AI governance is largely driven by soft-law instruments such as *NIST's AI Risk Management Framework (2023)*, rather than by a binding federal AI statute, which means that compliance obligations are often contractual and sector-specific rather than universally mandated,

- in Ukraine – in the methodological recommendations of the Ministry of Digital Transformation on the use of electronic trust services [14].

In practice, this means that the legal responsibility for the correct use of AI rests with the organization, but its employees often do not have the necessary qualifications.

2. *Lack of an internal compliance strategy.* The laws of Ukraine and the United States do not require the mandatory implementation of an AI risk management policy, unlike the EU, where such an approach is provided for by *the AI Act*. Therefore, Ukrainian and American companies often do not have internal audit procedures for AI-generated electronic documents, and the roles of those responsible for data quality control are not defined.

3. *Resistance to digital change and ethical aspects.* Although regulations do not directly regulate the cultural aspects of AI implementation, *the OECD Recommendation on Artificial Intelligence (2021)* and *the AI Act (EU)* emphasize the need to ensure human control and prevent discrimination in algorithmic processes. In logistics, this is expressed in the need to combine document automation with the preservation of control by specialists.

The conceptual model of harmonization of electronic document management (EDM) systems based on artificial intelligence in logistics processes, shown in Figure 7, can

potentially reduce the negative impact of the identified barriers.

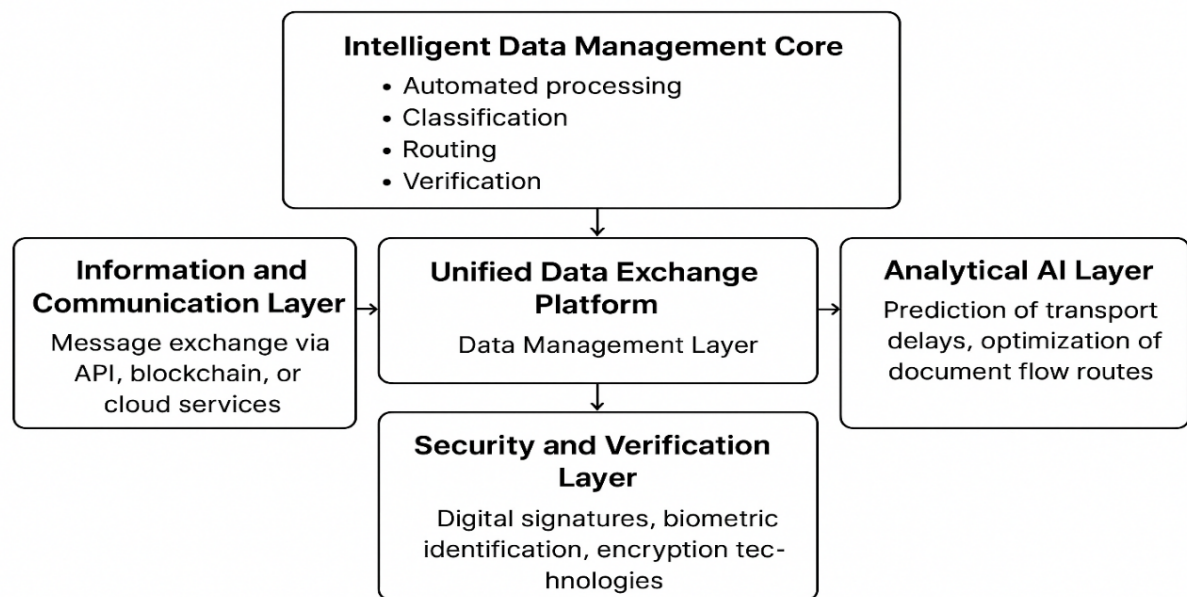


Figure 7 – Conceptual model for harmonizing AI-based Electronic Document Management (EDM) systems in logistics processes

Source: compiled by the authors

The conceptual model for harmonization of electronic document management (EDM) systems based on artificial intelligence in logistics processes involves the creation of a single integration space for the interaction of all participants in the logistics chain - suppliers, carriers, warehouses, distributors and consumers - through a unified data exchange platform.

The basis of the model is an intelligent data management core, which performs the functions of automated processing, classification, routing and verification of electronic documents using machine learning and natural language processing (NLP) algorithms. This ensures compatibility and harmonization of data formats between different corporate systems (ERP, WMS, TMS, etc.) and national or international EDM standards (e.g. EDIFACT, UBL, XML, eCMR).

The model includes the following structural components:

Information and communication layer – provides message exchange between the systems of the logistics chain participants via API, blockchain or cloud services.

Analytical AI layer – uses artificial intelligence algorithms to predict transport delays, optimize document flow routes and detect anomalies or duplications in documents.

Data management layer – provides integration, normalization and synchronization of information in real time between all system nodes.

Security and verification layer – implements digital signatures, biometric identification and encryption technologies to guarantee document integrity.

User interface – provides intuitive document management, analytics and communication between parties through personalized dashboards.

The functional logic of the model is based on the principles of harmonization: compatibility, transparency, standardization and adaptability. The use of AI provides dynamic coordination of heterogeneous document formats, automatic detection of discrepancies and generation of recommendations for their elimination. This increases the level of digital integration of

logistics processes, reduces document flow time, minimizes the human factor and ensures strategic transparency of the supply chain.

Thus, the conceptual model of harmonization of EDM systems based on AI forms an intelligent ecosystem of logistics data, in which electronic document flow acts not only as a tool for information exchange, but also as an active analytical resource for managing logistics processes.

Conclusions. Between 2020 and 2025, EDM has evolved from an "anti-crisis measure" into a core element of strategic business infrastructure.

The integration of AI represents next level of maturity, transforming EDM from a time-saving tool into an intelligent ecosystem.

Over the past five years, electronic document management has become a key driver of efficiency across regions:

- Ukraine has shown the ability to adapt quickly even in wartime conditions.
- Europe provides a model of harmonization through regulatory standards.
- The United States is a leader in the commercialization of EDM and AI adoption.

Looking ahead, the next stage will be the rise of smart ecosystems, where AI becomes a key element of document management, auditing, and sustainability reporting.

The integration of AI into electronic logistics document management systems takes place in conditions of legal heterogeneity.

Ukraine has a developed regulatory framework for electronic documents and signatures, but there are no regulations for AI technologies yet. The European Union has the most comprehensive regulatory system: eIDAS provides a trustworthy infrastructure, the GDPR protects data, and the AI Act introduces the responsibility of AI operators. In the United States, the approach is more flexible and decentralized: with the recognition of electronic documents, AI regulation is based on voluntary standards.

Thus, the effectiveness of the implementation of AI in logistics document management depends on the harmonization of technical standards, the coordination of the legal status of AI-processed documents and the training of qualified specialists who are able to ensure the compliance of systems with national and international requirements.

References

1. ACCA. (2023). Technology, innovation and the future of accounting. URL: <https://www.accaglobal.com/us/en/professional-insights/technology/digital-horizons.html>
2. ACCA. (2024). Smart Alliance Report: Accounting Expertise Meets Machine Intelligence. URL: <https://www.accaglobal.com/us/en/professional-insights/technology/digital-horizons.html>
3. Brand, H. (2024). AI Assessments: Enhancing Confidence in the Use of AI. London: ACCA. URL: <https://www.accaglobal.com/gb/en/professional-insights/technology/ai-assessments.html>
4. Brand, H., & Van Onselen, A. (2021). Ethics for Sustainable AI Adoption: Connecting AI and ESG. ACCA. URL: https://www.accaglobal.com/content/dam/ACCA_Global/professional-insights/nv-ai-ethics/PI-AI-ETHICS.pdf
5. Cornell University (2025). Designing and Deploying AI Models for Sustainable Logistics Optimization: A Case Study on Eco-Efficient Supply Chains in the USA. URL: <https://arxiv.org/abs/2503.14556>
6. DHL Delivered (2025). AI in logistics: 5 trends you need to know about. URL: <https://www.dhl.com/global-en/delivered/innovation/ai-trends-in-logistics.html>

-
7. Giovanna Culot, Matteo Podrecca (2025). AI in supply chain management: A systematic literature review of empirical studies and research directions. URL: <https://www.sciencedirect.com/science/article/pii/S0166361524000605>
 8. KPMG. (2024). AI in Finance: US Report. URL: <https://kpmg.com/us/en/articles/2024/ai-in-finance-us-report.html>
 9. McKinsey&Company (2025). Digital logistics: Into the express lane? URL: <https://www.mckinsey.com/capabilities/operations/our-insights/digital-logistics-into-the-express-lane>
 10. Oluwaseun Badmus, Shahab Anas Rajput, John Babatope Arogundade, Mosope Williams, 2024. AI-driven business analytics and decision making. World Journal of Advanced Research and Reviews, Issue. URL: <https://wjarr.com/sites/default/files/WJARR-2024-3093.pdf>.
 11. Onuchak, V. (2024). Document Workflow Automation in the Enterprise: How Digital Services Solve Routine Tasks. URL: <https://vchasno.ua/en/avtomatyzatsiia-dokumentobihu/>
 12. SmartPoint DMS. (2025). Applications and Prospects of AI Technologies in Electronic Document Management. URL: <https://dms.smart-it.com/en/blog-post/ai-document-management/>
 13. The Insight Partners. (2025). Europe Electronic Signature Software Market Size, Trends & Forecast (2025–2031). URL: <https://www.theinsightpartners.com/reports/electronic-signature-software-market>
 14. Verkhovna Rada of Ukraine (2025). «On electronic documents and electronic document management». URL: <https://zakon.rada.gov.ua/laws/show/en/851-15/ed20220105#Text>
 15. Verkhovna Rada of Ukraine (2025). «On Electronic Trust Services». URL: <https://zakon.rada.gov.ua/laws/show/2155-19/ed20171005#Text>