



**KAPITEL 4/ CHAPTER 4 <sup>18</sup>**

**FROM EDM TO AI: TRANSFORMATION OF ELECTRONIC DOCUMENT MANAGEMENT IN THE CONTEXT OF IMPLEMENTATION OF THE EU ARTIFICIAL INTELLIGENCE ACT**

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## **Introduction**

Over the past five years, Europe has seen a significant transformation in approaches to information and document management. While in the early 2020s, Electronic Document Management (EDM) was seen primarily as a tool for digital archiving and automation of individual administrative procedures, by 2025 it had become a central element of corporate information systems, closely integrated with Big Data and Artificial Intelligence (AI) technologies.

Leading industries — industry, finance, telecommunications, retail, healthcare and energy — have not only automated processes, but also implemented intelligent solutions for classification, data extraction, forecasting and analytical processing of information. The key driver of these changes has been the development of artificial intelligence: from Intelligent Document Processing (IDP) and optical character recognition (OCR) technologies to the use of Large Language Models (LLM) capable of classifying, annotating and even interpreting complex documents.

Along with technological progress, the importance of regulatory regulation has increased. The European Union became the first jurisdiction in the world to adopt a Comprehensive Act on Artificial Intelligence (Artificial Intelligence Act, Regulation (EU) 2024/1689), which introduces a risk-based approach to the management of artificial intelligence systems, including their application in the field of electronic document management.

In the context of rapid digitalization of business, the public sector, and the transformation of management processes, the integration of AI into EDM systems is

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becoming not only a technological trend, but also a strategic challenge for organizations seeking to maintain competitiveness and compliance with European data management standards.

**Literature review.** Research on electronic document management (EDM) and artificial intelligence (AI) adoption has expanded significantly over the past decade, reflecting the global transition toward digitalization and data-driven governance.

Foundational principles of records management are defined by ISO 15489-1:2016 [10], which establishes the full life cycle of documents: creation, classification, storage, use, and disposal. Complementing this, the Generally Accepted Recordkeeping Principles [2] and AIIM standards [1] emphasize accountability, transparency, protection, and interoperability as the basis for building resilient and legally binding EDM systems.

The regulatory framework for digital trust and electronic identification has been shaped by the eIDAS Regulation (EU) No 910/2014 [4], which introduced legal recognition of electronic signatures and strengthened cross-border interoperability within the European Union. More recently, the Artificial Intelligence Act [3] has established the world's first risk-based regulatory model for AI, placing strict requirements on high-risk systems in healthcare, finance, and critical infrastructure [5]. Researchers note that this framework is rapidly becoming a global benchmark, with extraterritorial implications for companies outside Europe.

Empirical data confirms the rising adoption of AI in business processes. OECD (2025) [8] reports that nearly 70 countries have launched over one thousand AI-related public policy initiatives, and that adoption remains uneven: large enterprises and ICT-intensive industries lead, while traditional manufacturing and SMEs lag behind. OECD's ICT Access and Usage by Businesses dataset [9] shows exponential growth in AI use across Europe, with leaders such as Sweden, Luxembourg, and the Netherlands quadrupling adoption rates between 2020 and 2024. This trend is corroborated by Eurostat (2023–2024), which documents rising penetration of ERP and EDM/ECM platforms in European enterprises.

Industry reports further highlight sectoral dynamics. KPMG (2024, 2025) [7]



identifies finance and healthcare as leaders in AI adoption, driven by compliance requirements such as KYC/AML and clinical documentation standards. EY (2025) emphasizes the role of “document intelligence” in automating contract review, risk analysis, and compliance monitoring.

Despite significant progress in research on this issue, the literature review showed that comparative analysis of EDM and AI implementation in different regions (Europe, the USA and developing countries) is still limited, and the uneven distribution of benefits across firm sizes and industries highlights the need for further empirical research in the context of addressing these gaps by synthesizing technological, regulatory and industry perspectives on the evolution of EDM to AI.

#### **4.1 Electronic document management: definition, generally accepted principles of document flow, evolution of EDM and AI**

Electronic Document Management (EDM) is a system of processes and technologies that allow to create, store, process and execute documents in digital form. Unlike traditional paper-based document management, EDM ensures the continuity and transparency of information flows in organization [2].

Electronic document management (EDM) is based on internationally recognized principles of document and records management. It is based on ISO 15489-1:2016, Information and documentation – Document management, which establishes the life cycle of a document: creation, classification, storage, use and destruction.

According to the Generally Accepted Recordkeeping Principles, a modern document workflow must ensure accountability, integrity, security, compliance, accessibility, retention reliability, and transparency.

AIIM (2020) industry standards emphasize the need for interoperability, the use of metadata for rapid search and analytics, and the integration of EDM with key business processes. These principles are the foundation for building electronic document management systems and ensure the legal force, manageability and stability of corporate documentation.



Electronic document management is determined by the key functions of electronic processing, which are defined in Table 1.

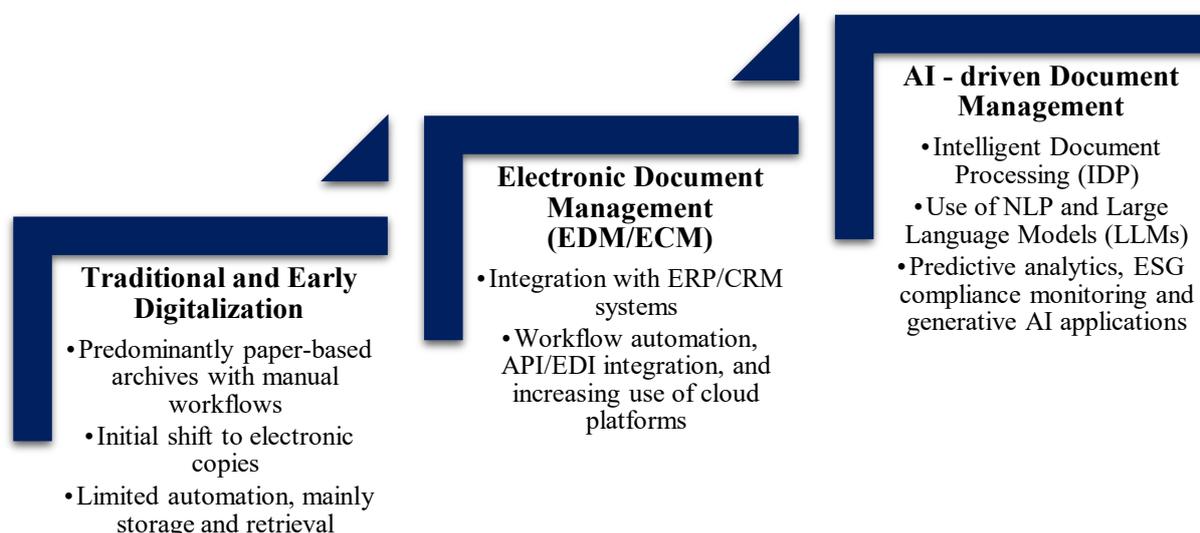
**Table 1 - Key functions of electronic processing**

CENTRALIZED DOCUMENT STORAGE AND ACCESS CONTROL	All company documents are stored in a single electronic archive, access to which is provided through a system of rights and roles. This eliminates file duplication, reduces the risk of data loss, and protects information from unauthorized access.
DECISION MONITORING AND CHANGE LOGGING	The system records every change in the document: who edited it and when, which version is up-to-date. Thanks to this, employees always work with the latest version of the document, and the organization maintains transparency and accountability of actions.
USE METADATA FOR QUICK DEFINITION AND ANALYTICS	Metadata (date, author, project, keywords) is attached to each document. This allows to find the right files in seconds and use analytical tools to organize large amounts of information.
DOCUMENT ROUTING AND EXECUTION CONTROL	Documents are automatically sent to responsible employees or departments depending on the business process (for example, contract approval or application approval). The system records deadlines and notifies you of delays, which ensures discipline and efficiency.
INTEGRATION WITH E-SIGNATURES (EIDAS)	Documents can be signed with a qualified electronic signature. Such a signature gives them legal force, which makes it possible to use electronic documents in courts, inspections and official procedures.
SUPPORT FOR LONG-TERM RETENTION STANDARDS	The EDM ensures that the documents are still available for many years to come. Long-term storage formats (such as PDF/A) preserve the structure, content, and legal validity of documents, regardless of changes in technology.

*Source: compiled by authors*

EDM has become a digital transformation: it connects enterprise systems (ERP, CRM, HRM) with analytics tools and provides integration with persistent platforms via API and EDI. With the growth of information and regulatory requirements for transparency (GDPR, CSRD), electronic document management has evolved from an auxiliary tool to a key element of data management [1].

The development of electronic document management (EDM) in Europe and beyond in the period 2020-2025 reflects the overall digital transformation of the economy and the growing integration of artificial intelligence (AI) into data management and business processes. According to the Online Browsing Platform [10], EDM has gone through three key stages during this period: from a digital archive and a supporting tool to data exchange platforms and, finally, to the integration of AI as the core of corporate information systems. The evolution of EDM and AI is presented in Figure 1.



**Figure 1 - Evolution of EDM and AI from 2020 to 2025**

*Source: compiled by authors based on [10]*

The main stages within the defined evolutionary process are considered in more detail below.

#### 2020: Structuring and Digitalization.

At the beginning of the decade, EDM in Europe served as an electronic archive and basic document management tool. The main emphasis was on the implementation of ERP systems, support for electronic signatures, as well as on the partial digitalization of document management in the public sector and large corporations. Despite the rise of cloud solutions, many processes remained paper-based, especially in industry and healthcare [4].

#### 2021-2023: Transition to Big Data Exchange.

As data volumes grew, companies began to move to integrated EDM/ECM platforms. Main trends:

- Consolidation of storage and metadata;
- Support for APIs and microservice architectures;
- Implementation of business intelligence (BI) systems for processing arrays of documents;
- First AI pilots for automatic document classification and routing.

Accelerated transition to cloud-based EDM platforms due to the COVID-19



pandemic, which forced enterprises to massively transfer document workflow to an online environment.

### 2023-2025: Integrating AI as the core of EDM.

Starting in 2023, the development of generative AI and large-scale models has changed the nature of EDM. Now AI has become a key component of workflow architecture. The use of OCR-free models (Donut, LayoutLMv3) has increased the accuracy of data extraction. AI is used for semantic search, automatic summarization of documents, risk analysis in contracts. In leading industries, the main role of AI implementation is as follows:

- in healthcare, AI systems have begun to automatically encode diagnoses (ICDs) and assist doctors in compiling records;
- in financial services, AI is implemented for KYC/AML and fraud analytics;
- in industry, AI analyzes product passports, quality certificates, and ESG reporting.

Thus, over a five-year period, EDM has transformed from a tool for storing and structuring information into complex AI-oriented ecosystems, where automation and intelligent analysis have become the basis for ensuring efficiency, transparency, and regulatory compliance.

To illustrate the dynamics of this transformation, Table 2 presents a comparative overview of the evolution of Electronic Document Management (EDM) and Artificial Intelligence (AI) integration across leading industries during 2020–2025.

The table highlights the transition from basic automation and digitization processes to the implementation of intelligent systems capable of autonomous decision-making and predictive analytics. The summarized data in Table 2 demonstrate that the convergence of EDM and AI technologies has become a defining factor of digital transformation strategies in most European industries during the analyzed period.

**Table 2 – Evolution of EDM and AI (2020–2025) in leading industries**

SECTOR	EDM IMPLEMENTATION (2020)	CHANGES 2020–2025	AI IMPLEMENTATION
INDUSTRIAL MANUFACTURING	The use of ERP, EDI, digitalization of individual workflow processes, and paper invoices remained the norm.	Transition to a <i>digital supply chain</i> , digital product passports, ESG reporting.	AI for the analysis of quality certificates, predictive analytics (AI + IoT + EDM bundle).
FINANCIAL SERVICES	EDM as an archive, use of e-signature (eIDAS, ESIGN), partial automation of KYC.	AML/KYC strengthening, transition to WORM storage, digitalization of client dossiers.	AI for IDPs in KYC/AML, fraud analytics, contract analysis, automated audits.
TECHNOLOGY, MEDIA & TELECOM (TMT)	A high level of digitalization, EDM is integrated with contract and legal document management.	EDM integration with APIs, flexible formats, cloud platforms for content storage.	AI for auto contract generation, semantic search, license management (IP).
CONSUMER & RETAIL	Electronic procurement systems and contracts, some of the logistics documents are paper.	Mass automation of purchases and returns, transition to <i>paperless supply chain</i> .	AI for certificate verification, chatbots for document management, IDP in AP/AR.
HEALTHCARE & LIFE SCIENCES	Use of EHR/EMR, HL7 integration, a significant proportion of paper questionnaires.	Mass adoption of <i>Clinical Documentation Improvement (CDI)</i> , the growth of telemedicine, and the transition to digital case histories.	AI for NLP and Diagnosis Coding (ICD), auto generation of clinical records.
ENERGY, NATURAL RESOURCES & CHEMICALS	Documents on licenses, contracts, and environmental reports were often kept in paper or hybrid format.	Implementation of ESG reporting, digital inspection acts, digitalization of contracts.	AI for the analysis of environmental reports, forecast of non-conformities, automation of compliance.

Source: compiled by authors based on [5, 7, 8, 9]

## 4.2 Legislation of AI implementation in the EU

In August 2024, Regulation (EU) 2024/1689 – the Artificial Intelligence Act came into force, becoming the world's first piece of legislation to comprehensively regulate the use of artificial intelligence [5].

According to the Organization for Economic Co-operation and Development



(OECD), as of January 2025, nearly 70 countries have implemented more than a thousand Area II public policy initiatives, including legislation, regulations, voluntary initiatives and agreements. Many of these initiatives include different kinds of AI assessments such as:

1. Governance assessments that determine whether there are internal governance policies, processes, and personnel in place for the AI management system, including in relation to the risks, effectiveness, and reliability of that system.

2. Compliance assessments that determine whether an organization's AI system complies with applicable laws, regulations, standards, or other policy requirements.

3. Performance evaluation, which measures the quality of the main functions of an AI system, such as accuracy, lack of churchliness, and reliability. Such assessments often use numerical metrics to assess individual aspects of the AI system. Oversight: Establishes a European Bureau for Artificial Intelligence, complies with monitoring, coordination, and compliance rules [8].

The international impact of the AI Act goes far beyond the EU. Global companies (including those from the United States and Asia) operating in the European market are forced to comply with the requirements of the AI Act.

Thus, the law is actually becoming an "exportable standard" of regulation, setting the global bar for trust in AI systems [3].

According to an OECD study (2025) [8], the level of AI adoption in companies remains uneven:

- large enterprises are significantly ahead of small ones, because they have resources, access to data and qualified personnel;
- AI intensity is higher in ICT and services, while traditional industry and small businesses are lagging behind.
- key barriers: lack of qualified personnel, difficulties in integrating with IT infrastructure and uncertainty ROI.

The OECD study highlights that it is the barriers to adoption (lack of specialists, high cost of integration, lack of clear rules) that are the main obstacles for companies. In this context, the AI Act plays an important role: it reduces uncertainty and sets



standards of trust, allowing firms to assess risks and build strategies for implementing AI. At the same time, enterprises note that the most effective supporting measures are tax incentives, employee training and public-private partnerships [8].

All this indicates that the maturity of EDM directly affects the ability to integrate AI: companies without structured document management systems face great barriers in the transition to data intelligence.

The importance of building trust in artificial intelligence is also highlighted by Helen Brand, CEO of ACCA, who notes that *trust in AI technologies is essential to the public interest, particularly in overcoming the shortage of qualified professionals and ensuring sustainable business development* [7].

The adoption of Regulation (EU) 2024/1689 — the Artificial Intelligence Act (AI Act) represents a milestone in shaping the regulatory foundations of digital transformation. It is the world's first comprehensive legal framework governing the use of AI, based on a risk-oriented approach. The Act categorizes AI systems into four levels of risk: from those entirely prohibited (e.g., social scoring) to minimal-risk applications where free use is permitted (e.g., recommendation systems and gaming applications).

The significance of the AI Act lies not only in establishing binding rules for companies within the European Union but also in setting a global regulatory benchmark. Given its extraterritorial scope, the Act directly impacts international corporations integrating AI into document management, healthcare, finance, and manufacturing processes.

The main functional areas of AI governance defined by the EU Artificial Intelligence Act — forecasting, streamline operations, resource allocation, and personalization of digital assets— are presented in Figure 3, illustrating the systemic approach of the EU to regulating AI technologies.



### Forecasting

- AI systems allow you to analyze large amounts of data and make forecasts in the fields of healthcare, finance, and production. According to the AI Act, such applications in high-risk sectors must be certified and ensure the transparency of algorithms to ensure the accuracy of forecasts and eliminate discrimination.

### Streamline operations

- The use of AI to automate business processes (supply chain, document management, risk management) increases efficiency and reduces costs. Within the framework of the AI Act, such systems are classified according to the level of risk: for high-risk ones, there are strict requirements for human control and data security.

### Resource allocation

- AI algorithms are applied to the planning and allocation of resources in the energy, transportation, and public sectors. The AI Law requires developers to ensure the objectivity and non-discriminatory nature of such decisions, as well as the possibility of auditing and monitoring.

### Personalization of digital assets

- AI is widely used to create personalized services, from educational platforms to digital health. The AI Act classifies such systems as "limited risk," requiring users to be informed that they are interacting with artificial intelligence.

## Figure 3 - Key functional directions of AI under the EU Artificial Intelligence Act

Source: compiled by authors based on [3]

### 4.3 Main trends in using AI in business in the EU

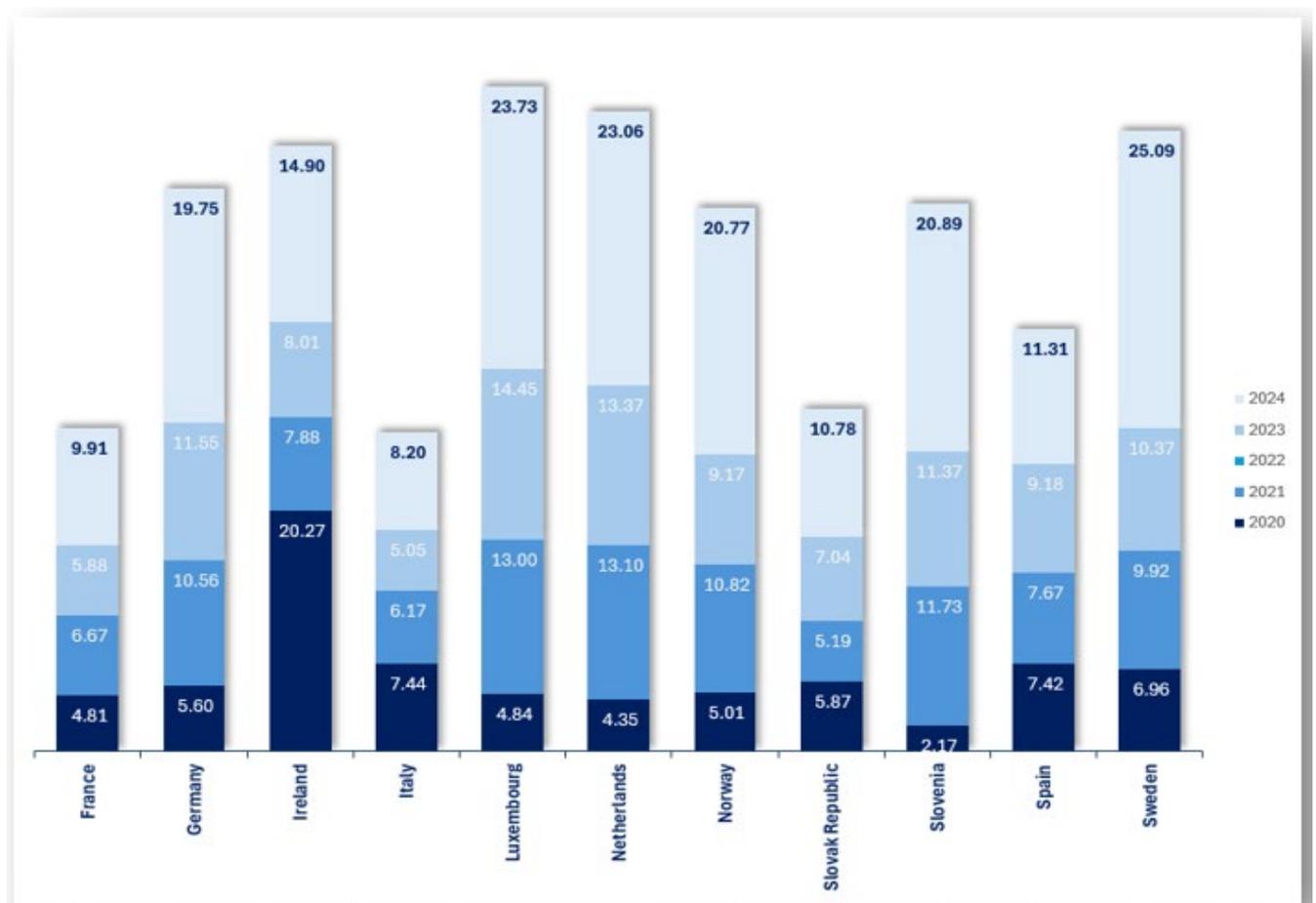
According to the OECD Data Explorer (2025) [8] and in 2020–2024 [7], European countries showed significant growth in the use of artificial intelligence (AI) in business.

The analysis of EDM and AI adoption would be incomplete without examining the broader dynamics of digital readiness and technological penetration across enterprises. One of the key indicators in this regard is the level of ICT access and usage by businesses, which directly determines the ability of organizations to integrate advanced solutions such as electronic document management and artificial intelligence.

The OECD and Eurostat datasets consistently highlight that differences in ICT infrastructure, cloud adoption, and digital skills create significant disparities in how

quickly firms are able to transition toward AI-enhanced business models. Countries with advanced ICT ecosystems demonstrate higher adoption rates of EDM and AI, while those with weaker infrastructure face slower diffusion of innovation and stronger dependency on regulatory or external incentives.

To better illustrate these differences, Figure 4 presents data on ICT access and usage by businesses across selected European countries. This evidence provides a contextual foundation for understanding not only the pace of EDM and AI integration but also the structural factors that shape their uneven adoption across industries and regions.



**Figure 2 - ICT Access and Usage by Businesses**

Source: compiled by authors based on [9]

Empirical data demonstrate a consistent increase in the proportion of companies within the European Union that have adopted artificial intelligence technologies. Between 2020 and 2024, the share of enterprises utilizing AI systems grew from approximately 2–5% to 10–25%, depending on the industry sector and scale of



operation. A particularly notable acceleration in AI implementation occurred during 2021–2023, largely influenced by the COVID-19 pandemic, which intensified the transition to remote services and stimulated investment in digital transformation across multiple industries.

Furthermore, the obtained results corroborate the findings of the OECD (2025), which indicate that large enterprises demonstrate substantially higher levels of AI adoption compared to small and medium-sized enterprises (SMEs). This disparity highlights the persistent structural gap in technological capacity and investment potential within the EU corporate landscape.

Among the European Union member states, Sweden demonstrates the most substantial growth in artificial intelligence adoption — from 6.96% in 2020 to 25.09% in 2024. This dynamic expansion can be attributed to the country's high level of digital maturity, the systematic implementation of national AI strategies, and consistent governmental support for innovation-driven industries.

Luxembourg and the Netherlands also show rapid growth – more than 4-5 times over the period (up to 23-24% of companies in 2024). Germany has almost quadrupled its use of AI, from 5.6% (2020) to 19.75% (2024).

At the intermediate stage of artificial intelligence adoption, France and Italy demonstrate a moderate rate of development, with approximately 8–9% of enterprises integrating AI technologies by 2024. These indicators are generally consistent with the dynamics observed in Southern European countries, such as Spain (11.31%), reflecting a gradual but steady diffusion of AI solutions across various industries.

In contrast, Norway and Slovenia show notably higher adoption rates, reaching around 20% in 2024. This growth can be attributed to targeted national strategies aimed at accelerating digital transformation within both the public and private sectors, supported by strong institutional frameworks and investments in technological infrastructure.

The analysis of the main trends in using AI allows for several key conclusions regarding the dynamics of artificial intelligence implementation across European countries.



Firstly, the growth in the adoption of AI technologies within the European Union exhibits an exponential trajectory, particularly in economies characterized by robust digital governance frameworks — including Sweden, Luxembourg, the Netherlands, and Germany. These states have demonstrated the highest rates of AI integration, driven by proactive governmental strategies and sustained investment in innovation ecosystems.

Secondly, the data reveal a widening regional disparity in the pace of AI deployment. Scandinavian and Western European countries continue to assert clear leadership positions in terms of technological readiness and institutional support, whereas Southern and Eastern European regions display comparatively slower progress, primarily due to infrastructural and policy constraints.

Overall, these findings underscore the need for a coordinated European policy approach aimed at balancing digital development and ensuring equitable access to the benefits of AI across all member states.

#### **4.4 Implementation of artificial intelligence in leading US industries**

A KPMG study found that AI adoption in the U.S. has accelerated over the past six months. While in 2024 about 70-75% of companies reported using AI only in financial statements and related processes, by the fall, more than 90% of respondents reported progress in the field of AI in various business functions.

The acceleration of artificial intelligence (AI) integration in the corporate sector is primarily associated with the transition from pilot initiatives to applied, large-scale implementations, particularly within the domain of generative AI. This shift has been reflected in the automation of reporting, intelligent document summarization, and decision-support systems. According to KPMG (2025) [7], AI has evolved from an auxiliary technological component into a strategic instrument for business transformation and sustainable digital competitiveness.

In the Industrial sector, the adoption of AI is directed towards predictive maintenance, automated analysis of production data, and supply chain optimization.



KPMG reports an expanding use of AI-driven tools for environmental, social, and governance (ESG) analytics and digital product passport management, which contribute to enhanced operational efficiency and compliance.

The Financial industry remains the most mature sector in AI utilization. In 2024, financial institutions transitioned from conventional electronic document management (EDM) systems to AI-enabled platforms for Know Your Customer (KYC), anti-money laundering (AML) compliance, automated auditing, and fraud detection. Increasingly, organizations are employing generative AI models for automated report generation and risk management forecasting, marking a shift toward full-scale cognitive automation.

Within the Technology, Media & Telecommunications (TMT) sector, AI applications are oriented toward intelligent information retrieval, content personalization, automatic contract generation, and license management. The rapid expansion of this sector is attributed to its high level of digital maturity and broad access to structured data, which collectively position it as a leading domain in AI adoption.

The Consumer and Retail industries demonstrate a robust growth trajectory in AI deployment, driven by the need to manage large volumes of transactional and behavioral data. AI systems are increasingly used in Intelligent Document Processing (IDP) for accounts payable and receivable, in supplier communication through chatbots, and for advanced consumer behavior analytics, thereby enhancing responsiveness and personalization.

Since the COVID-19 pandemic, the healthcare and life sciences sector has experienced a marked intensification of AI integration. Companies employ Natural Language Processing (NLP) technologies for diagnostic code classification (ICD), automated medical record generation, and clinical documentation support. According to KPMG (2025), the introduction of AI tools has contributed to a reduction in physician administrative workload by 30–40%, thereby improving service delivery and clinical efficiency.

In Energy, Natural Resources & Chemicals, AI technologies are utilized for environmental reporting, compliance automation, and predictive non-conformity



analysis. Integration of AI with Internet of Things (IoT) systems enables continuous monitoring and optimization of production processes, strengthening corporate sustainability and risk mitigation frameworks.

Thus, the implementation of artificial intelligence in leading US industries emphasizes that AI has become a cross-sectoral driver of innovation, enabling not only digital transformation but also the formation of adaptive, data-driven management models that respond effectively to economic uncertainty and regulatory evolution.

## **Conclusions**

The conducted research confirms that the transformation of electronic document management (EDM) systems in Europe during 2020–2025 represents a fundamental shift from traditional digital archiving to the formation of intelligent, AI-driven information ecosystems. This evolution reflects not only technological progress but also the adaptation of business processes to the growing demands of efficiency, transparency, and regulatory compliance in the digital economy.

At the initial stage of development, EDM solutions primarily served as auxiliary tools for digital storage and integration with enterprise resource planning (ERP) or customer relationship management (CRM) systems. However, by the mid-2020s, they had evolved into core infrastructural components of corporate digital environments, ensuring intelligent information processing, advanced analytics, and support for strategic decision-making.

A decisive factor in this transformation has been the integration of artificial intelligence (AI) technologies, which have fundamentally redefined the principles of information management. AI enables automation of routine and labor-intensive operations — including document classification, semantic search, metadata extraction, and predictive analytics — thereby reducing operational costs, minimizing human error, and increasing the overall quality and speed of document workflows.

Empirical data across leading industries — manufacturing, finance, telecommunications (TMT), retail, healthcare, and energy — demonstrate that AI



implementation contributes to improved business efficiency, optimization of resources, and enhanced corporate governance. Moreover, the integration of large language models (LLMs) and intelligent document processing (IDP) has established a new standard for digital documentation quality and data-driven management.

A critical milestone in this process has been the adoption of the EU Artificial Intelligence Act (Regulation (EU) 2024/1689), which introduced a risk-based framework for AI governance. This regulatory approach has defined clear criteria for the classification of AI systems, imposed strict requirements for high-risk applications (notably in healthcare and financial sectors), and strengthened the principles of transparency, accountability, and ethical use of AI technologies.

Unlike the United States and several other jurisdictions, the European Union emphasizes a human-centric and rights-based model of AI governance, focusing on privacy protection, explainability, and security. This strategy ensures not only technological innovation but also the sustainable and ethical integration of AI into public and corporate management systems.

Thus, the evolution from EDM to AI-driven document management signifies the beginning of a new stage in the digital transformation of organizations, where intelligent automation, legal compliance, and ethical responsibility form the foundation of sustainable business development within the European digital single market.