

Mapping the Intellectual Structure and Thematic Evolution of the Integrated Digital Asset Loan Workflow Model (IDALWM)

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Abstract—Convergence of finance technology, asset management systems, workflow automation, artificial intelligence, and blockchain technologies has resulted in drastic changes in the management of the ecosystem associated with digital asset loans. Though many studies on the above-mentioned issues have emerged recently, fragmentation prevails, thereby making it difficult to grasp the intellectual structure and progression of knowledge in the respective fields. The purpose of this paper is to examine the evolution of knowledge architecture and emerging themes of the Integrated Digital Asset Loan Workflow Model through bibliometric analysis. A total of 237 documents were found from the Scopus database following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) approach. VOSviewer and Bibliometrix were used in the course of performance analysis, co-citation analysis, bibliographic coupling, keyword co-occurrence analysis, and network analysis. It was established that since 2015, there has been an increase in the number of scholarly papers related to integrated digital ecosystems of finance and asset management due to their relevance. Five major theme clusters have been revealed, namely (1) digital lending and financial technology, (2) artificial intelligence and workflow automation, (3) blockchain and governance technologies, (4) asset management systems and life cycle governance, and (5) interoperability and digital integration platforms. Additionally, a significant trend towards technological convergence has been discovered with respect to intelligent automation, explainable AI, digital twin, and blockchain-based governance. As a result, this study will contribute to the development of the IDALWM as an integrative conceptual model, which will help bridge the gap in the relevant literature. The proposed conclusions will be useful for academics and policy-makers in addition to financial institutions and technology providers.

Keywords: Integrated Digital Asset Loan Workflow Model (IDALWM); Digital Lending; Asset Management Systems; Workflow Automation; Financial Technology (FinTech)

1. INTRODUCTION

The fast-paced development of innovative solutions such as AI, blockchain, IoT, cloud computing, RPA, and digital twins has dramatically transformed financial systems, asset management platforms, and workflow automation environments. Modern-day digital ecosystems empower organizations to restructure processes and implement AI into traditional workflows. As empirical studies reveal, many organizations leverage integrated platforms to increase efficiency, transparency, quality of decisions, and effectiveness of services provided (Raviv & Desai, 2024; Zou et al., 2023; Espinoza et al., 2025). Digital lending systems belong to the most innovative and fast-growing area within the financial industry. Instead of legacy lending platforms, digital lending systems use AI, XAI, blockchain, cloud-native infrastructure, and automation of workflow engines in order to manage loans. According to recent research, AI-driven credit scoring models and other predictive analytics tools used by digital lending systems improve accuracy and efficiency of loan approvals (Munumum et al., 2025; Nayaka et al., 2024; Naveen et al., 2026). Moreover, blockchain provides enhanced security and transparency thanks to smart contracts (Raghavarthini et al., 2025; Abhishek et al., 2024).

In a similar manner, innovations are observed in asset management systems. Although these platforms were initially designed to facilitate asset management and asset inventory tracking, modern solutions include functionality aimed at managing asset lifecycle, predictive maintenance, integrations, and collaborations. In accordance with recent findings, implementation of IoT, RFID tagging, semantic models, and digital asset passports results in increased visibility, reduction of errors, and improved governance of asset management (Kumar et al., 2025; Crespo Marquez et al., 2026; Hamdan et al., 2025). At the same time, cloud computing allows for real-time synchronization of information related to assets and facilitates collaboration and scalability of solutions (Timons et al., 2025). Workflow automation technologies become increasingly relevant when it comes to integration of financial and asset management systems. Modern-day solutions provide companies with holistic workflow platforms including BPM, process mining, machine learning, hyperautomation, and RPA solutions in order to increase organization's performance and reduce inefficiencies in processes. According to previous research, BPM platforms based on AI improve agility, compliance with regulations, mitigation of inefficiencies, and minimization of human errors (Kozlova et al., 2026; Arce et al., 2026; Savu, 2025). Hence, there is considerable scope for further development of digital lending and asset management systems powered by workflow automation technologies.

The described convergence becomes the basis for the concept of the Integrated Digital Asset Loan Workflow Model (IDALWM). IDALWM is an example of a unified digital ecosystem which combines technologies typical for digital lending systems, asset management systems, and workflow automation solutions. The mission of IDALWM is to create interoperability between stakeholders, enhance transparency, foster decision-making in real-time, and guarantee flexibility and governance. While interest in each domain grows, there is relatively little research dedicated to analyzing

their convergence and future development. Therefore, it is important to study the evolution, structure, and further research direction in IDALWM.

According to bibliometric analysis, interdisciplinary integration has become the dominating paradigm in digital transformation studies. Scholars now focus on using technologies of artificial intelligence, blockchain, Internet of Things (IoT), cloud computing, and workflow automation to resolve organizational problems. Evidence from empirical studies demonstrates that companies deploying interdisciplinary digital architecture have higher productivity rates, better transparency, and more resilience than firms that use separate technology (Microsoft Architecture Team, 2025; Fernandes et al., 2023; Yousif et al., 2024). A second trend is the emergence of studies about the significance of artificial intelligence and advanced analytics as a basis of intelligent digital ecosystems. The role of explainable artificial intelligence (XAI), hybrid machine learning, federated learning, and predictive analysis grows to promote trust, accountability, and regulatory compliance. XAI tools, including SHAP and LIME, are frequently utilized in credit scoring and other applications to make algorithms explainable and reduce concerns about bias (Alharad et al., 2024; Ferrili et al., 2025; Temchenko, 2025). Blockchain and decentralized technologies form yet another major area of scholarly inquiry. According to previous studies, the use of smart contracts, DeFi platforms, and decentralized ledgers makes it possible to achieve transaction safety and greater transparency (Kowsar & Minto, 2025; Raghavarthini et al., 2025; Wang et al., 2020). Additional evidence suggests that blockchain integration facilitates asset tracking, ownership confirmation, and workflow automation, making it especially relevant in the context of integrated asset-lending environments.

Interoperability and middleware form another emerging theme that attracts much interest among scholars. It is claimed that the integration of technologies requires a common set of standards, shared asset models, interoperable semantic structures, and cloud-native middleware infrastructure. Empirical studies conducted using OpenBIM, ISO standards, and shared asset models demonstrate that interoperability is considered the key factor in the success of digital transformations (Brahmadekne et al., 2024; Crespo Marquez et al., 2026; Albayati et al., 2025). Without a proper interoperability framework, organizations experience issues concerning data silos, fragmentation of processes, and lack of uniform information governance. The socio-technical aspect of digital transformation has also gained significant attention in recent years. Studies highlight the need to consider the role of human factors and organizational culture in technology success, as human and technological aspects are tightly interconnected. Consistently, research reports that stakeholder engagement, phased implementation plans, and staff training are crucial for the success of automation initiatives (Redlicharia et al., 2021; Crawford et al., 2024; Kherbachi, 2023).

In spite of considerable progress in research about digital lending, asset management, and workflow automation, present research works lack integrative approaches to the subject matter. Indeed, most studies deal with separate innovations, such as lending based on artificial intelligence, blockchain technology use, BPM platforms, asset management via the Internet of Things, or cloud infrastructure use. While valuable findings were produced, there is a lack of knowledge concerning the contributions made by all innovations into integrated asset-loan workflows. Present bibliometric analysis of the FinTech sphere also lacks a focus on integrated solutions that may be offered by combining FinTech with such innovations as AI, blockchain technology, or digital transformations. So far, there has been no bibliometric study aimed at exploring the intellectual structure and dynamics as well as trends related to the Integrated Digital Asset Loan Workflow Model (IDALWM). Accordingly, this study addresses the following research questions:

RQ1: How has IDALWM-related research evolved over time?

RQ2: What thematic clusters characterize the intellectual structure of IDALWM research?

RQ3: Which authors, institutions, countries, and publications exert the greatest influence within the field?

RQ4: What emerging technologies and future research directions are shaping the evolution of IDALWM?

In attempting to answer these queries, the present study seeks to accomplish the first-ever bibliometric mapping of the IDALWFM and create a groundwork for further scholarly exploration of theory and practice related to the model.

The rise of digital lending ecosystems represents one of the most important advances in the study of financial technology. Unlike conventional lending systems based heavily on manual operations and centralized decision-making, digital lending ecosystems leverage artificial intelligence, cloud computing, predictive analytics, and workflows automation for the delivery of intelligent and adaptive financial solutions. According to recent literature, digital lending systems are characterized by changes in onboarding procedures, creditworthiness evaluation, and loan processing, as well as repayment management with the help of machine learning algorithms and automated decision engines (Munumum et al., 2025; Nayaka et al., 2024; Naveen et al., 2026). Such advancements allow financial organizations to decrease operational expenses, increase accuracy of evaluations, and improve customer experience. Furthermore, the rapid evolution of FinTech ecosystems has led to the creation of lending platforms that can link customers, financial institutions, supervisors, and technology companies within integrated digital environments (Jafri et al., 2025; Nasir et al., 2021). Such platforms offer easy communication and transparency while increasing the accessibility of financial products. The results of bibliometric analysis demonstrate the convergence of research on digital lending with topics related to artificial intelligence, blockchain technology, and regulatory technology (RegTech), implying an increase in the degree of integration of digital lending platforms (Bajwa et al., 2022; Sharma, 2024). Digital lending cannot be seen as a separate financial operation anymore; it needs to be viewed as part of a larger ecosystem. One of the emerging trends in the lending industry is associated with using explainable artificial intelligence (XAI) within lending systems. Machine learning models commonly used by lending organizations often function as "black boxes" limiting explainability and accountability of automated decision-making processes. The importance of using approaches such as SHAP or LIME in

creating transparent automated lending systems has been highlighted recently (Ferrili et al., 2025; Alharad et al., 2024). Such advances have become especially important for financial markets with strict regulations.

Blockchain technology has proven to be fundamental in current digital assets ecosystems because of the ability to keep records of transactions that are highly secure, transparent, and tamper-proof. Various empirical studies suggest that use of blockchains ensures increased trustworthiness, reduces instances of frauds and improves efficiency of transactions and other related processes (Kowsar & Mintoo, 2025; Gupta et al., 2023). It allows keeping track of the history of asset ownership and transactional histories while ensuring minimal reliance on intermediary entities. Blockchain technology not only enables recording of transactions, but also facilitates automation of smart contract terms based on the fulfillment of specified criteria. There are empirical pieces of evidence showing how the use of smart contracts greatly enhances workflow efficiency by minimizing the burden of administrative work and delays as well as guaranteeing consistency of process executions (Raghavarthini et al., 2025; Abhishek et al., 2024). Those capabilities are very relevant for the digital asset loans ecosystem where the asset issuing process, approval, management and return should be executed smoothly. Apart from the benefits of blockchain technologies, recent researches also focus on the significance of decentralized finance or DeFi in transforming traditional practices associated with lending and asset governance. By implementing the blockchain and distributed ledgers, DeFi provides an opportunity for peer-to-peer financial transactions with no intermediary entities involved which brings new possibilities, as well as risks, associated with financial inclusion, regulatory compliance, and cybersecurity (Wang et al., 2020; Zetsche et al., 2020). Therefore, the use of blockchain technologies is crucial for IDALWM system design.

Modern asset management systems have moved from simple inventory trackers to sophisticated IT solutions that can manage asset life cycle, predict maintenance requirements, and provide strategic insights into organizational operations. Recent research works on asset management focus on such important aspects as IoT technologies, cloud computing, machine learning, and semantic modeling as key means for improving asset visibility and enhancing their operational effectiveness (Stanimirović et al., 2025; Ametepey et al., 2024). One of the essential innovations in asset management is the creation of Digital Asset Passports (DAPs) which refer to standardized digital documents containing asset attributes, ownership history, maintenance procedures, and sustainability indicators throughout the whole life cycle of assets (Hamdan et al., 2025). The use of DAPs allows organizations to facilitate interoperability and ensure regulatory compliance. Similarly, modern RFID technology, IoT sensors, and monitoring software tools allow companies to track their assets continuously and predict possible problems, thus minimizing their downtime and making more effective use of resources (Kumar et al., 2025). Other recent findings also highlight the increasing importance of SAMs and semantic interoperability approaches that may help organizations collaborate effectively with one another. By using shared data models, organizations can simplify communication and reduce redundancy, improve decision-making processes, and execute workflows more efficiently (Crespo Marquez et al., 2026; Albayati et al., 2025). Overall, these developments show clearly that asset management systems play an important part in building integrated ecosystems.

Workflow automation is one of the critical facilitators of digital transformation since it allows for the efficient coordination of processes, technologies, and stakeholders in the organization. In most cases, classical workflow systems were oriented towards process standardization and task routing. With new advancements in the development of artificial intelligence, RPA, process mining, and hyperautomation, the functionalities of workflow systems have been extended considerably (Kozlova et al., 2026; Savu, 2025). Hyperautomation refers to the simultaneous implementation of several automation technologies aimed at streamlining entire end-to-end business processes. According to empirical studies, hyperautomation systems can help increase the level of operational efficiency, process consistency, and organizational agility and decrease the number of errors made and administrative burden (Arce et al., 2026; Kozlova et al., 2026). In the field of finance, workflow automation can be used to manage processes such as loan origination, compliance monitoring, customer onboarding, and asset life cycle management. As a result, process mining is becoming an important innovation for the improvement of workflows as it helps analyze event logs to detect process deficiencies and inconsistencies (Savu, 2025). Therefore, process mining and AI-based decision systems allow for constant process improvement and adaptation of workflows.

One of the key problems associated with digital transformation projects relates to the need to ensure interoperability across multiple technologies and systems. The existing empirical literature on the topic emphasizes that interoperability is one of the key requirements for a successful implementation of digital ecosystems (Brahmadekne et al., 2024; Albayati et al., 2025). Without effective interoperability, companies experience difficulties related to fragmented data structures and repeated information processing. The use of middleware allows organizations to overcome such barriers and establish communication channels between different software products, databases, and services. Recent academic research proves that cloud-based middleware systems significantly improve the performance of digital ecosystems (Timons et al., 2025). Such concepts as OpenBIM models, semantic interoperability approaches, and SOA architectures are helpful in facilitating consistent information sharing and making collective decisions (Crespo Marquez et al., 2026). Finally, modern digital integration platforms have facilitated the development of financial systems, asset management environments, and workflow automation tools. This approach enables organizations to coordinate their activities effectively while ensuring proper levels of governance, security, and compliance. Thus, interoperability and middleware should be regarded as necessary infrastructure elements of the IDALWM model.

Based on the synthesis of the literature, this study proposes the Integrated Digital Asset Loan Workflow Model (IDALWM) as a multidimensional framework comprising five interconnected dimensions:

- a. Digital Lending Infrastructure;
- b. Asset Management Systems;
- c. Workflow Automation and Process Intelligence;
- d. Blockchain and Governance Technologies;
- e. Interoperability and Digital Integration Platforms.

In such a context, the digital lending infrastructure is viewed as the main layer that governs transactions related to loan origination, evaluation, processing, and monitoring. The asset management systems are considered the asset lifecycle layer that focuses on asset tracking, usage, maintenance, and returning. Workflow automation becomes a part of the orchestration layer enabling coordination of activities for the benefit of all stakeholders involved. Blockchain technology allows ensuring transparency, reliability, and security by way of recording transactions immutably and executing smart contracts. Last but not least, interoperability platforms provide for communication between all components mentioned above. In other words, the interplay between these layers leads to the formation of an integrated ecosystem that is able to ensure intelligent asset-loan processes. Consequently, the IDALWM framework can be regarded as a theoretical foundation for analyzing the development of digital asset lending ecosystems.

From the bibliographic synthesis, one can state that the advancement of digital asset loan workflow systems is facilitated by the growing convergence between financial technology, asset management systems, workflow automation, blockchain architecture, and interoperability systems. Instead of being separate areas, they become integrated into larger digital ecosystems. The literature implies that for digital transformations to succeed, a number of technological, organizational, and governance aspects have to be combined to create sustainable operational performance (Vial, 2021; Jafri et al., 2025; Nasir et al., 2021). From a theoretical perspective, IDALWM is based on three complementary streams. First, BPM theory sheds light on the process optimization that can be achieved through the use of standardized processes, automation, and improvements (Kozlova et al., 2026; Savu, 2025). Second, the socio-technical approach to digitalization highlights the relationship between technological components, organizations, and people involved in using the technological capabilities, which requires balancing technological potential with user needs (Redlicharia et al., 2021; Crawford et al., 2024). Third, digital transformation theory helps understand how digital capabilities affect organizational operations, business models, and governance (Vial, 2021; Fernandes et al., 2023). The above approaches suggest that the digital asset loan workflow cannot be approached as a linear transaction system but as an ecosystem. Therefore, IDALWM is a multidimensional model encompassing interactions between technological platform, workflow intelligence, asset governance, and digital integration mechanisms.

Based on the bibliometric evidence, five major dimensions constitute the IDALWM framework.

- a. Dimension 1: Digital Lending Infrastructure

The digital lending infrastructure refers to the technological and procedural systems that form the foundation of the application process, risk analysis, decision-making process, document handling, and repayment tracking. Several research papers have noted that the use of AI and machine learning models significantly enhances the quality and efficiency of decision making in the lending context (Munumum et al., 2025; Nayaka et al., 2024; Temchenko, 2025).

- b. Dimension 2: Asset Management Systems

Asset Management Systems provide means to identify, allocate, monitor, maintain, return assets, and manage their lifecycle. Research studies have found that monitoring through IoT technology, digital asset passports, radio-frequency identification technology, and predictive maintenance systems contribute to improving asset management effectiveness (Hamdan et al., 2025; Kumar et al., 2025; Stanimirović et al., 2025). This dimension forms the operational part of the proposed framework.

- c. Dimension 3: Workflow Automation and Process Intelligence

Work flow automation consists of combining the processes of BPM, RPA, Process Mining, and HyperAutomation to align organizational actions with process optimization. The latest research shows that with AI-enabled automation, there is a significant increase in efficiency while maintaining flexibility and regulatory compliance (Arce et al., 2026; Kozlova et al., 2026; Savu, 2025). This represents the orchestration level for all work flow activities.

- d. Dimension 4: Blockchain and Governance Technologies

The blockchain technology provides the basis for transparency, security, trust, and automatic implementation using the use of distributed ledgers and smart contracts. Numerous empirical studies have shown that blockchain technology improves transactions' integrity, audit, and compliance management in the digital environment (Kowsar & Mintoo, 2025; Gupta et al., 2023; Raghavarthini et al., 2025).

- e. Dimension 5: Interoperability and Integration Platforms

The interoperability frameworks allow communication among heterogeneous systems, parties involved, and databases. The Shared Asset Model (SAM), the OpenBIM framework, middleware technologies, and the cloud-native technology infrastructure make sure that information is easily transferred (Albayati et al., 2025; Crespo Marquez et al., 2026; Timons et al., 2025). This particular dimension works as the integration level.

According to the conceptual model outlined above, interoperability will serve as the underlying basis upon which the integration of the digital ecosystem is possible. Interoperability capabilities allow for communication between digital lending, asset management, blockchain technology, and automation technologies. Automation becomes the driver that turns various capabilities into organizational processes through the use of process intelligence and automation. Using automation and process intelligence, organizations can align their lending processes, asset management, and requirements for governance within different organizations. Blockchain technologies offer transparency and security, making sure that

workflow processes can be monitored and verified. At the same time, the digital lending capability facilitates the ability to make transactions, whereas the asset management capability controls the use of assets in the process. It is only through the interplay of all these factors that digital ecosystem is formed. Based on the literature synthesis, the following propositions emerge from the IDALWM framework:

P1: Digital lending infrastructure is positively associated with workflow efficiency and service effectiveness.

P2: Asset management systems enhance transparency and lifecycle governance within digital lending environments.

P3: Workflow automation strengthens process integration and organizational agility.

P4: Blockchain technologies improve trust, security, and compliance performance across digital asset workflows.

P5: Interoperability platforms facilitate ecosystem integration and collaborative decision-making.

P6: The combined interaction of digital lending, asset management, workflow automation, blockchain, and interoperability capabilities forms the foundation of an effective Integrated Digital Asset Loan Workflow Model (IDALWM).

These propositions are not tested empirically within the current bibliometric study; rather, they provide a theoretical foundation for future empirical investigations using SEM, PLS-SEM, case studies, or mixed-method approaches.

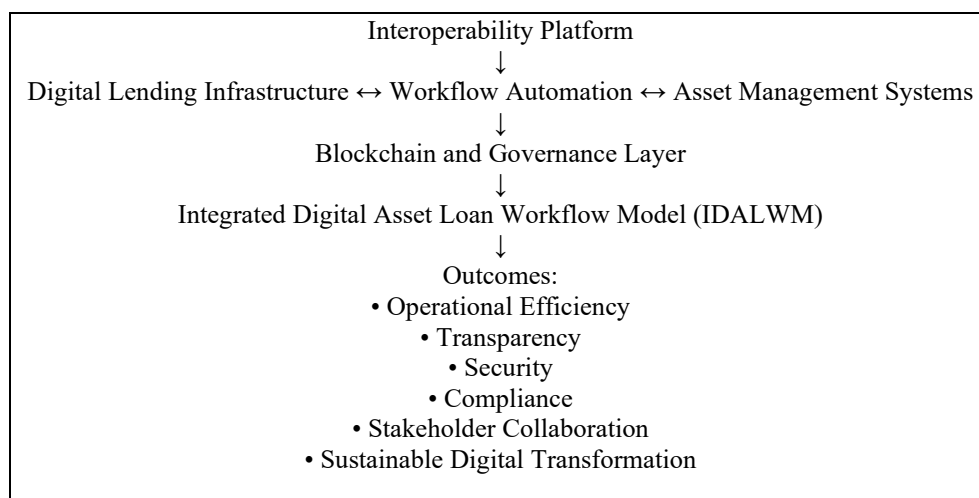


Figure 1: Conceptual architecture of the Integrated Digital Asset Loan Workflow Model (IDALWM).

The framework illustrates how multiple technological domains converge to create integrated digital ecosystems capable of supporting intelligent asset-loan lifecycle management.

2. RESEARCH METHODS

2.1 Research Design

In this research, a quantitative bibliometric approach will be applied to investigate the intellectual development, intellectual structure, and emerging topics of the IDALWM. In recent years, the use of bibliometrics has been acknowledged as one of the most acceptable research designs for synthesizing a vast body of scientific knowledge, allowing objective evaluation of publication trends, citation patterns, collaboration networks, and thematic evolutions within a research field (Donthu et al., 2021; Aria & Cuccurullo, 2017). Unlike literature review studies, bibliometric analysis provides a scientific methodology for analyzing important publications, influential authors, productive institutions and countries, and evolving research themes. The choice of a bibliometric methodology for this research topic would be suitable as the interdisciplinary nature of IDALWM includes such research areas as financial technologies, blockchain technology systems, asset management, business process management, workflow, AI, cloud computing, and digital governance, all of which require systematic investigation due to the fragmentation of knowledge structures. Thus, the bibliometric approach can be a helpful tool for investigating the evolution of the discussed research field. This research combines two different types of bibliometric analysis. First, there will be performed a performance analysis, including the analysis of productivity, citations, and influence of authors, journals, institutions, and countries. Second, there will be conducted a science map analysis, involving co-occurrence analysis, co-citation analysis, bibliographic coupling, and collaboration network analysis.

2.2 Data Source and Search Strategy

The bibliographic data set comprised only entries from the Scopus database. The reason for selecting Scopus lies in its reputation as one of the most diverse multidisciplinary databases containing citations from high-quality journals, conferences, books, and reviews on a large number of scientific fields (Mongeon & Paul-Hus, 2016). As opposed to other sources, Scopus contains information on a larger variety of interdisciplinary fields related to digital transformation,

fintech, workflow automation, and asset management systems. The search string was compiled based on the conceptual dimensions discovered in the course of the literature review. Keywords were taken from five main thematic categories: digital lending, asset management systems, workflow automation, blockchains, and interoperability platforms. Boolean operators such as AND and OR were used in order to improve the accuracy and depth of the search. The search string is presented below:

```
TITLE-ABS-KEY(
("digital lending" OR "loan workflow" OR "loan management")
AND
("asset management system" OR "digital asset management")
AND
("workflow automation" OR "business process automation" OR
"process mining")
AND
("blockchain" OR "smart contract" OR "distributed ledger")
AND
("artificial intelligence" OR "machine learning" OR "automation")
)
```

The search was conducted in March 2026 and initially identified 600 documents. The retrieved records included journal articles, conference proceedings, review papers, and book chapters published in English-language sources indexed by Scopus.

2.3 Inclusion and Exclusion Criteria

To maintain methodological reliability and applicability, pre-defined criteria of inclusion and exclusion were used in the selection process. A publication was considered appropriate if it was indexed in the Scopus database, written in the English language, concerned at least one of the five dimensions of IDALWM, added empirically, conceptually, through reviews, and methodologically, and had enough bibliographic data to be analyzed. A publication was considered inappropriate if it duplicated another publication in the sample, did not contain all bibliographic data, dealt with other technical fields, was an editorial note, correction, or some other non-academic material, and appeared to have little relevance to the aims of the research.

2.4 PRISMA-Based Screening Process

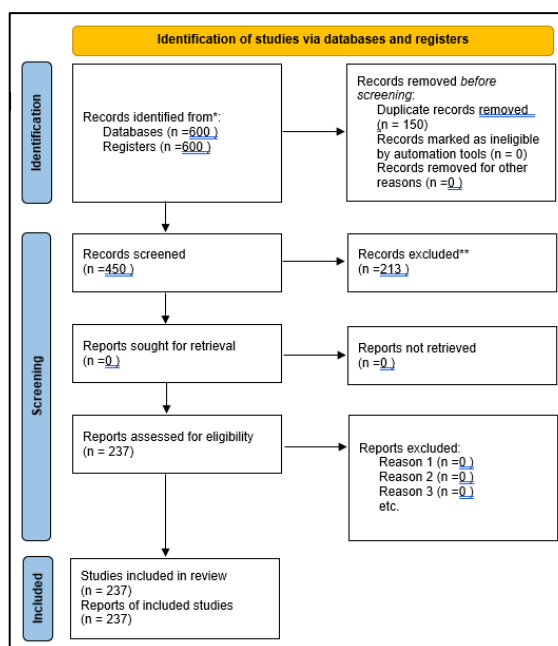


Figure 2. Prisma framework

The PRISMA model was used to select and evaluate papers for systematic, clear, and repeatable documentation collection. At the first stage, 600 documents on digital lending, asset management systems, automation of processes, blockchain technologies, and digital transformation were found in the Scopus database, and then exported in CSV and BibTeX formats. At the data cleansing step, 150 duplicates were eliminated using the titles, DOI numbers, authors' names, and metadata of the documents. This allowed obtaining a total number of 450 publications for the purpose of screening

titles and abstracts. Screening involved identifying and rejecting documents that were irrelevant to the topics of digital lending ecosystems, management of assets' life cycles, process automation, or digitalization platforms. After the screening, 237 relevant publications were selected and analyzed in terms of their full texts, including application of the developed criteria for inclusion/exclusion. As a result, another 213 documents were eliminated due to insufficient relevance, lack of required information, or incongruence with the research objectives.

2.5 Bibliometric Analysis Procedures

Bibliometrics were done using five different analyses in order to have an all-encompassing insight into the IDALWM body of work. These include Publication Performance Analysis, Citation Analysis, Keyword Co-Occurrence Analysis, Co-Citation Analysis, and Bibliographic Coupling Analysis. Publication Performance Analysis looked at annual trends in publication, source productivity, author productivity, institutional contribution, and geographical distribution, which shed light on the growth of IDALWM and its evolution as a field of study. Citation Analysis helped identify influential publications, influential authors, influential journals, and influential institutions based on the total number of citations, average citations per document, and Normalized Citation Impact. Keyword Co-Occurrence Analysis was used to look into the theme of IDALWM and the topics of research based on author supplied and indexed keywords. Co-Citation Analysis analyzed co-cited articles to look for important studies that influenced IDALWM. Finally, Bibliographic Coupling Analysis analyzed articles that cite similar sources in order to identify the current research community working on the field.

2.6 Network and Collaboration Analysis

Three hierarchical levels have been used for conducting collaboration network analysis: authors, institutions, and countries to study the social structure and knowledge diffusion among the research participants in IDALWM studies. Network visualization tools were applied to detect the collaboration patterns, key influential researchers and knowledge transfer between them, as well as knowledge transfer in general. The author collaboration network analysis has considered coauthorships and creation of research communities. In addition, institutional collaboration network analysis was carried out through studying relationships among universities, research centers, and industrial companies. Collaboration network analysis on the country level studied the collaboration on an international level. Several indicators of network analysis were calculated to assess the structure and strength of collaboration networks, including Degree Centrality, Betweenness Centrality, Network Density, Link Strength, and Cluster Membership. Overall, these indicators allow understanding the characteristics of collaboration in the IDALWM field.

2.7 Software and Analytical Tools

Three different software packages were utilized in this research to facilitate data processing, visualization, and bibliometric analysis. First, VOSviewer software version 1.6.20 was applied to build author collaborations, citation co-citation, bibliographic coupling, and keyword co-occurrences maps due to its high-end visualization features and popularity among bibliometric studies. Second, the R-based bibliometric package Bibliometrix/Biblioshiny was utilized to conduct bibliometric analysis, identify topic clusters, visualize topic evolution, and assess scientific performance. In addition, data cleansing, preprocessing, validation, and calculation of descriptive statistics were conducted using Microsoft Excel 365 before proceeding with bibliometric analysis. These software packages facilitated a sound methodological approach and accurate visual presentation of intellectual, theoretical, and social structures in the Integrated Digital Asset Loan Workflow Model (IDALWM).

2.8 Analytical Framework

In this study, an integrative approach is used, which involves using a combination of performance analysis methods and science mapping techniques for the purpose of analyzing the intellectual structure and evolution of IDALWM research. This framework uses four interrelated analysis dimensions. First, there is a document analysis that analyzes the publication dynamics, production, and evolution of the entire area of research. Second, there is a citation analysis that highlights key authors, publications, and citation influence. This way, it reveals the key actors and sources of knowledge for this field. Third, there is conceptual structure analysis that involves analyzing the co-word relationship and evolution of topics and themes. Finally, there is social structure analysis that focuses on analyzing scientific collaboration in terms of author networks, institutional networks, and country networks. Altogether, these dimensions provide a complete picture regarding the evolution, intellectual structure, topic structure, and future direction of IDALWM research.

3. RESULTS AND DISCUSSION

3.1 Publication Growth and Scientific Production

Based on the bibliometric analysis of the 237 articles, there can be identified an evident increase in the level of scientific interest in the topic of the Integrated Digital Asset Loan Workflow Model (IDALWM), and its corresponding domains over the last twenty years. The development pattern of the annual number of publications is split into three periods. The first period (2005-2014) is marked by a significant increase in the amount of research conducted on the topic in relation to standalone asset management systems, enterprise workflow systems, and finance technologies. This growth in the

output of scholarly work is linked with the development of technologies for digital ecosystems and their applications in integrated digital loan management infrastructure, yet it should be noted that during this period of time, the amount of scientific papers was rather limited, as both types of technology were still in their initial phases of development. The second period of growth (2015-2020) is caused by a number of factors, including advancements in technologies, such as cloud computing, blockchain technologies, and machine learning. Moreover, the growth in scholarly interest in the domain is caused by the development of Industry 4.0 ideas, the growing interest in the deployment of automation technologies by corporations, and the rapid expansion of financial technology ecosystems (Nasir et al., 2021; Vial, 2021; Gomber et al., 2021). The third period (2021-2025) is marked by the explosive growth in publication frequency, with this period being the most productive one. There exist a number of reasons behind this trend: (1) organizations begin to use artificial intelligence and workflow automation technologies for improving their productivity; (2) blockchain-based solutions advance from cryptocurrency applications to digital asset management; and (3) in the aftermath of the pandemic, digital transformation accelerates investments into cloud computing, remote operation solutions, and intelligent workflow systems (Jafri et al., 2025; Temchenko, 2025; Gupta et al., 2023).

3.2 Most Influential Sources and Citation Performance

Based on the bibliographic analysis, the intellectual roots of IDALWM research can be traced to several related fields, such as FinTech, digital transformation, business process management, information systems, and blockchain governance. High citations are mainly related to the topic of digital transformation's effects on organizational performance, artificial intelligence in financial services, blockchain's ability to enable governance, and automation technologies. A number of influential papers helped develop the theory behind technological convergence in digital ecosystems. For example, Vial (2021) played an important role in advancing digital transformation theory by explaining the relationship between technological innovations and organization's structures, processes, and business models. Papers that focus on financial technologies (FinTech) have helped understand the effects that digital technologies may have on the financial sector and lending processes (Arner et al., 2020; Lee & Shin, 2021; Gomber et al., 2021). According to the bibliometric analysis, blockchain research has become increasingly influential in recent years. Specifically, there have been many studies dedicated to distributed ledgers, smart contracts, and financial transactions conducted in a decentralized manner (Kowsar & Mintoo, 2025; Gupta et al., 2023; Wang et al., 2020), which is important given the issues of trust, transparency, and governance. Publications that discuss automation through machine learning also enjoy high citations (Temchenko, 2025; Ferrili et al., 2025).

3.3 Keyword Co-Occurrence Analysis

Keyword co-occurrence clustering results demonstrate the presence of five primary thematic clusters that define the conceptual foundation of IDALWM studies. The first thematic cluster is concerned with fintech solutions, digital lending, credit scoring, loan management, customer experience, and digital banking. Keywords within this cluster reveal a strong academic interest in automation and intelligence-driven approaches to improving financial service delivery (Jafri et al., 2025; Nasir et al., 2021; Bajwa et al., 2022). Emerging trends within this theme include digital credit scoring, embedded finance, open banking, and AI-powered lending systems. The relevance of the specified terms proves digital lending to be one of the cornerstones of the IDALWM approach.

The second cluster is represented by such concepts as AI, machine learning, robotic process automation, hyperautomation, process mining, and intelligent workflows. Research within this cluster aims at using advanced automation technologies to increase the efficiency of business processes (Kozlova et al., 2026; Arce et al., 2026; Savu, 2025). The increased density of AI keywords suggests that automation is gradually becoming increasingly intelligent and adaptive, shifting from task automation towards orchestration of complex processes and decision-making based on intelligent performance prediction.

The third thematic cluster is comprised of such keywords as blockchain, distributed ledger technology, smart contracts, decentralized finance, digital trust, and cybersecurity. Research in this cluster centers around issues of transparency, security, traceability, and governance within ecosystems (Gupta et al., 2023; Kowsar & Mintoo, 2025; Raghavarthini et al., 2025). The relevance of blockchain-related keywords testifies to the increased awareness regarding the significance of governance technologies in integrated digital environments. In addition, smart contract use cases within the context of digital lending should be mentioned for the sake of completeness.

The fourth thematic cluster covers such themes as asset management systems, digital asset passports, predictive maintenance, IoT integration, RFID technologies, and lifecycle management. Studies within this cluster investigate approaches to improving visibility, efficiency, and resource optimization (Stanimirović et al., 2025; Hamdan et al., 2025; Kumar et al., 2025). Keyword clustering results suggest that asset management research has moved from fundamental tracking issues to intelligent systems for lifecycle governance enabling decision-making and predictive analytics.

Finally, the last thematic cluster includes such concepts as interoperability, middleware, OpenBIM, cloud computing, integration platforms, semantic models, and shared asset frameworks. Studies in this cluster emphasize the importance of communication between heterogeneous systems (Albayati et al., 2025; Crespo Marquez et al., 2026; Timons et al., 2025). Clustering results reveal interoperability to be an integral component of the ecosystem concept because, without appropriate tools, digital lending, asset management, and workflow automation solutions cannot integrate into ecosystems effectively.

3.4 Co-Citation Analysis and Intellectual Structure

The co-citation analysis has revealed four main scholarly traditions, which represent the underlying theories in relation to IDALWM studies. First, the digital transformation and organizational change tradition deals with publications within this cluster, describing the changes in organizational processes, governance frameworks, and corporate strategies caused by new technologies (Vial, 2021; Fernandes et al., 2023). Such papers lay down the grounds for the conceptualization of technological convergence. Second, the FinTech innovation tradition is focused on the exploration of FinTech ecosystems, AI-based lending services, digital banking, and regulation technology (Arner et al., 2020; Lee & Shin, 2021; Nasir et al., 2021). Third, the blockchain governance and decentralized systems tradition is associated with distributed ledger technology, smart contracts, and trust models (Kowsar & Minto, 2025; Wang et al., 2020; Zetzsche et al., 2020). Fourth, the workflow automation, process intelligence, and business process management tradition highlights such aspects as automation and hyperautomation in order to improve organizational performance (Kozlova et al., 2026; Savu, 2025).

3.5 Collaboration Network Analysis

Collaboration networks analysis has shown an increase in international collaboration in the researches conducted by scientists studying topics related to digital transformation, fintech, and workflow automation. The strongest collaboration networks include the regions where North America, Europe, and Asia prevail; the importance of digital ecosystem technologies is thus underlined. As for countries, the US, China, the UK, Germany, and India turn out to be the most important countries involved in this kind of research, due to their high publication productivity and international links. Also, emerging economies become increasingly active in this respect. At the institution level, collaboration networks reveal many clusters with high connectivity rates including universities, research institutions, technological companies, and other sectors. It means that interdisciplinary collaborations contribute greatly to the productivity of scientific activities. Author collaboration networks suggest the existence of scientific communities dealing with artificial intelligence technologies, blockchain, asset management, and workflow automation.

3.6 Thematic Evolution and Emerging Research Trends

According to the thematic evolution analysis, there has been a trend from independent researches about specific technology to comprehensive analysis of whole digital ecosystems. The early stage was characterized by researches about traditional assets management systems, enterprise information systems, and workflow standardization. The intermediate phase was marked by an increase in research papers about digital transformation, cloud computing, and business process automation. Recently, there has been an emphasis on such emerging topics as artificial intelligence, blockchain governance, digital twins, interoperability frameworks, explainable artificial intelligence, hyperautomation, and human-AI interaction (Ferrili et al., 2025; Hamdan et al., 2025; Kozlova et al., 2026). It appears that there are several emerging trends with high potential of further development. First of all, the area of explainable artificial intelligence gained its popularity in recent years due to the increasing need for transparency and accountability of automated decisions. Secondly, technologies of digital twins become more and more relevant since they provide ways to simulate and monitor asset lifecycle processes. Thirdly, hyperautomation and process intelligence contribute to the development of dynamic and adaptable workflows. Fourthly, there is a growing interest in the development of interoperability frameworks and shared asset models because of the need to connect different types of technologies in digital ecosystems. Finally, blockchain governance becomes more and more popular since it increases transparency and security. Thus, based on these observations, one can conclude that future IDALWM research will focus on the creation of smart and adaptive digital ecosystems.

4. CONCLUSION

This study aims at exploring the evolution, theoretical underpinnings, and future directions for IDALWM by analyzing 237 relevant publications indexed by the Scopus database using bibliometrics techniques. The study highlights a significant increase in the volume of academic research, especially after 2015, indicating growing attention from academics and industry stakeholders regarding integrating digital lending, asset management system, workflow automation, blockchain technologies, and interoperability platform in practice. Keyword co-occurrence analysis and thematic clustering demonstrate the existence of five major research clusters, which are digital lending and financial technology; AI-based workflow automation; blockchain and governance technologies; asset management systems and lifecycle governance; and interoperability and digital ecosystem integration. These findings illustrate the maturing of IDALWM as a multi-disciplinary area of research characterized by strong technological convergence and ecosystem integration. This paper offers a theoretical contribution by proposing the IDALWM approach, which represents a conceptualization of the previously fragmented domains including FinTech, asset management, workflow automation, and digital governance into a coherent perspective. Moreover, the findings of the study highlight that digital transformation is indeed a multidimensional phenomenon impacted by a number of factors including intelligent technologies, processes, and governance mechanism. In terms of practical implications, the current study provides valuable insights suggesting the importance of combining AI, blockchain, workflow automation, and interoperability infrastructure in order to ensure high levels of transparency, efficiency, quality decisions, and lifecycle governance in the context of digital asset lending ecosystems. Despite its strengths, the current study suffers from some limitations.

Specifically, it is based on bibliometric analysis using the Scopus database that does not necessarily capture the contextual and practical aspects of individual research. As for future research directions, empirical validation of IDALWM using quantitative research techniques such as structural equation modeling and partial least squares-structural equation modeling is required. Other important research topics that can be further explored include, but are not limited to, explainable AI, digital twin technologies, blockchain-enabled governance, and interoperability across different domains.

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