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Trends in blockchain in finance: unveiling latent research topics using a structural topic modelling approach

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Introduction: Technological advances, such as blockchain, have revolutionized the finance sector by providing a secure, transparent, and efficient system for transactions.

Methods: The present study utilized the Latent Dirichlet Allocation (LDA) method to analyse 2,401 scholarly pieces using Python, to explore the research areas in the domain of finance.

Results: The results of the study show 15 important topics in blockchain and finance. Later, these topics were grouped into five clusters to identify future research avenues. We have also proposed research questions under each cluster aimed at filling the research gap.

Discussion: The study offers suggestions to future researchers by uncovering the existing gaps in the body of knowledge in blockchain in finance, along with documenting the emerging trends in the domain of finance.

KEYWORDS

blockchain, finance, Latent Dirichlet Allocation (LDA), literature review, structural topic modelling (STM)

1 Introduction

In 2008, Satoshi Nakamoto (a presumed pseudonymous) introduced the term “Blockchain”, in a white paper that described a decentralized, cryptographically secured public ledger where every validated transaction is recorded in an ordered chain of blocks (Nakamoto, 2008). This technology was capable of providing secure, immutable, decentralized, and transparent data services, thereby increasing the speed of business transactions and reducing the cost for a variety of stakeholders in business networks (Weerawarna et al., 2023).

Blockchain is a decentralized network that makes sure that everyone has access to a synchronized ledger. This builds trust and lowers the risks of fraud and manipulation by stopping data changes (Tseng and Shang, 2021). By eliminating the need for a central authority and reducing dependency on intermediaries, blockchain can also streamline several procedures, including record-keeping, settlement, and verification.

TABLE 1 Recent literature review on blockchain.

S. No.	Author(s)	Title	Methodology	Limitations	Research gap
1	Sheikh et al. (2025)	Blockchain technology in the banking sector: a content analysis	214 articles from four databases, from 2021 to 2025. Applied Latent Dirichlet allocation (LDA) and content analysis	Focus is banking only. Limited time period	The study covers a niche domain of application of blockchain in the banking sector over the last 5 years. It does not cover "Finance" nor the broader time period
2	Alshdaifat et al. (2025)	Emerging technologies in accounting and finance field: A bibliometric review and agenda for future research	Bibliometric analysis of 1,102 articles using Vosviewer. Articles extracted based on keywords. Database Scopus from 2012 to 2024	All the technologies. No statistical tool used. No specific approach for extracting articles	The article has considered technologies in general, using bibliometric research. The study does not cover blockchain specifically, nor does it use STM methodology
3	Norbu et al. (2024)	Factors Affecting trust and Acceptance for blockchain adoption in digital payment systems: a systematic review	Initial selection of 1859 and final selection of 48 articles using SLR and PRISMA model Database: Web of science, IEEE, ACM, and Scopus	Only digital payment. No statistical test. Time period of 2016–2023	The article presents the factors impacting trust, but it does not offer any future themes for the researchers. It is also limited to digital payment. Further, it does not use the STM method
4	Dashkevich et al. (2024)	Blockchain financial statements: innovating financial reporting, accounting, and liquidity management	A combination of design science research methodology and domain-driven design is used to create blockchain technology for finance and business	A lot of investment, optimization of scalability and usability	This research gives an application of blockchain Financial Statement for accounting. However, it does not cover the extant literature on blockchain in finance
5	Prokopenko et al. (2024)	Development of blockchain technology in financial accounting	A combination of qualitative, thematic and quantitative statistical techniques is used. Sample of eight organisations from different sectors	Scalability and complicated technical issues	This paper addresses challenges such as scalability, technical issues that hinder the adoption of blockchain technology in finance. However, it does not present the extensive literature of blockchain in finance, nor does it present the themes for future researchers
6	Rijanto (2024)	Blockchain technology roles to overcome accounting, accountability and assurance barriers in supply chain finance	Multi-case study and qualitative methods were employed. Ten blockchain projects in SCF and 29 interviews with participants were used for analysis	Diverse contexts, requirements of cross-industry, selection bias, and integrating quantitative measures	The study is qualitative in nature and in the area of supply chain finance. It does not map the literature of blockchain in finance
7	Saxena (2024)	Blockchain technology in Finance: A review of use cases and implementation	Qualitative research design, NVivo software. 50 articles identified and 12 selected for further review. IEEE database. Period 2015–2023	Very few articles were studied, and some other databases were used. No statistical tool used, only content analysis performed	The study presents a need for regulation of blockchain, along with challenges to be addressed. However, the study does not use a systematic literature review to present the gaps in blockchain in finance
8	Weerawarna et al. (2023)	Emerging advances of blockchain technology in finance: a content analysis	Content analysis of 50 articles filtered out of 1846 articles using PRISMA. Database referred to Scopus/Jstor/WoS, etc., period from 2008 to 2022	The period is longer; however, the number of articles reviewed is less. No statistical or advanced techniques were used for analysis	The study uses content analysis of the articles from 2008 to 2022; however, the study does not use advanced methodology to present the research gaps. It also misses the recent papers
9	Gong et al. (2024)	Innovation adoption of blockchain technology in supply chain finance	Analysis of multiple case studies based on secondary data of supply chain finance (SCF)	Adapt by modifying processes and working methods to deal with issues arising at the initial stages	The article presents the result using case studies (secondary data) by applying innovation adoption theory in blockchain technology adoption. However, the study is limited to supply chain finance

(Continued on following page)

TABLE 1 (Continued) Recent literature review on blockchain.

S. No.	Author(s)	Title	Methodology	Limitations	Research gap
10	Patel et al. (2022)	Blockchain in banking and Finance: A bibliometric review	Meta bibliometric analysis using qualitative and quantitative techniques. 154 papers from Scopus and WoS, period is 2009–2021	Only bibliometric analysis, no statistical tool used; the number of articles is less for an extensive review	The research proposed that there is a need to empirically assess the blockchain technology in the future and its regulatory aspects using bibliometric analysis. The study does not employ statistical methods and also misses the recent studies
11	Gan et al. (2025)	A critical review of blockchain applications to banking and finance: a qualitative thematic analysis approach	Bibliometric review and Qualitative thematic analysis of 76 research papers. From 2016 to 2020	The data was considered for a limited period and a small number of sample articles. Not specified database	The study explored the various research topics of blockchain, but it missed the emerging trends in blockchain after 2020. Also, it used limited research that is qualitative
12	Pal et al. (2021)	Blockchain technology in financial services: a comprehensive review of the literature	A systematic review, bibliometric analysis and study of qualitative and quantitative reviews. The number of articles was 77, covering 2016–2020	Sample selection and more bibliometric details, qualitative and quantitative studies	The research uses a systematic and bibliometric review of blockchain in financial services. However, the study lacks comprehensive coverage of the literature. The study covered articles till 2020; thus, the recent literature is missing

Blockchain has the potential to transform the way business is conducted around the world. However, it also has certain limitations, such as huge energy consumption (Truby, 2018), privacy concerns (Feng et al., 2019), user trust concerns (Shin, 2019), and regulatory issues (Yeoh, 2017), that may hinder its widespread adoption (Chang et al., 2020; Weerawarna et al., 2023). In addition, blockchain is still in its nascent stage of development, which poses challenges for the regulatory authorities to control its use (Chang et al., 2020). These mixed benefits and drawbacks have led scholars and industry experts to debate the feasibility of blockchain adoption.

In the field of finance, blockchain is widely recognized as a revolutionary innovation that has the potential to transform the whole financial sector. As the traditional finance system follows a centralized transaction system, where each transactions between the parties are verified by a financial intermediary, such as banks, however, through blockchain, all the parties involved in a transaction can access the transaction records and verify it without needing the assistance of the intermediaries (Chang et al., 2020). Therefore, financial services have become a major focus for blockchain adoption.

Despite significant interest, the existing body of literature is still dispersed. Previously, authors have focused narrowly on particular blockchain applications, such as payments or cryptocurrencies (Ahmed and Alabi, 2024; Mohanty et al., 2022; Norbu et al., 2024), specific technologies such as smart contracts (Crisostomo et al., 2025; Liu et al., 2024), or regulatory responses (Akanfe et al., 2024; Benson et al., 2024; Wronka, 2024). However, there is a scarcity of research that systematically outlines the evolution of research themes within the broader application of blockchain in finance. This gap makes it difficult for researchers and practitioners to determine whether the focus of research is on practical problems or fundamental topics. Arslan et al. (2025) reviewed blockchain and AI in sustainable finance and identified the general trends for its

application in sustainable finance. Sharma et al. (2024) systematically reviewed the application of blockchain in finance and suggested that there is a need for methodological development and a theoretical foundation in the area. The research gap is highlighted in Table 1, identified from an extensive literature review.

To advance the discussion beyond subjective evidence and limited sample analysis, the current study uses Structural Topic Modelling (STM) to analyse the emerging trends in blockchain and finance research. To analyze the trend, 2,401 research articles were extracted from the Scopus database. The metadata of these articles was cleaned using natural language processing, which includes tokenization, normalization, stemming, and removal of stop words, punctuation, and domain-irrelevant terms.

The findings show that blockchain research prioritizes core foundational technologies like smart contracts, decentralization, data management, and security to maintain trust and system resilience. However, the focus is shifting to financial applications like digital lending, Decentralized Finance (DeFi), managing liquidity, and risk governance, signalling that blockchain is not limited to payments in the broader financial infrastructure.

The remainder of the paper is organized as follows. Section 2 presents the theoretical framework of the study, while Section 3 provides an overview of the existing body of knowledge in this domain through a literature review. Section 4 outlines the research methodology employed in this study. The results of the study are presented in Section 5, while Section 6 discusses these results. The study's implications, limitations, and future research directions are outlined in Section 7, followed by the conclusion.

2 Theoretical framework

The recent research trend in the finance sector hovers around the digital currency, Bitcoin (Inani et al., 2023). Domains such as

healthcare, academics, energy, supply chain, and more use blockchain technology effectively (Rosli et al., 2024). These rapid advancements give rise to a need to comprehend the data, understand the principal points, and the tools utilized. The LDA (Latent Dirichlet Allocation) was engaged for this purpose (Hu et al., 2024). LDA further extends to STM (Roberts et al., 2014), which gives a deeper insight into metadata (Dolhopolov et al., 2025; Su and Duan, 2025), mechanism (Rezazadeh and Bohnsack, 2025; Vella et al., 2025), scalability (Zhao et al., 2025), and application (Li and Wang, 2025). The advantage of STM is that it can be applied to numerous disciplines and categories. STM enables analysis considering the trends and variations in research (Pečiulis et al., 2024; Song et al., 2025; Yin et al., 2025) and provides a detailed understanding of how the structural factors evolve the blockchain (Choi et al., 2020; Rana et al., 2021). Thus, STM tests connections between themes and provides information about close and less closely related themes.

Connectedness between themes can be studied and interpreted through the construction of a map or dendrogram (Ijlal and Youssef, 2025; Shukla et al., 2024). This map can be created by collecting relevant articles from databases using keywords to search the databases, and by applying filters (Thakral et al., 2023). Analysis of the dataset generated using LDA furnishes trends of topics and categories on which research has been carried out. Also, the relationship between topics can be explored. The proximity between topics reveals interconnectedness or overlaps in research. The distant themes are less investigated and are potential points for further research.

3 Literature review

Blockchain technology has stepped into healthcare, administration, finance, and many other domains. Application of blockchain technology is most successful when it is performed with adequate knowledge, supported by required infrastructure, and abiding by rules and regulations (Asare et al., 2024). The blockchain technology, jointly with fuzzy neural networks, provides trustworthy feedback to abate financial risk in medium and small companies. Blockchain technologies facilitate the preservation of records, monetary information, and transactions, and deliver an accurate risk assessment. This leads to sustainable and rapid economic development (Kumar et al., 2022). Blockchain technologies help us perceive the supply chain of carbon trading and emission depletion, and the fiscal details of the stakeholders. Adopting blockchain for the green supply chain enhances revenue for all stakeholders (Deng et al., 2024).

In the finance sector, decentralized finance is an emerging technology that utilizes blockchain. The blockchain technology is used in peer-to-peer lending. Such transactions are conveniently performed over a laptop or a mobile phone. Blockchain technologies are thus widely employed in the finance sector (Pise and Patil, 2025). Healthcare insurance is a complicated process involving transparency and privacy of data and proper accessibility, while observing rules and regulations. However, blockchain technologies handle these challenges, thus revolutionizing the healthcare insurance field (Susana and Srividya, 2025).

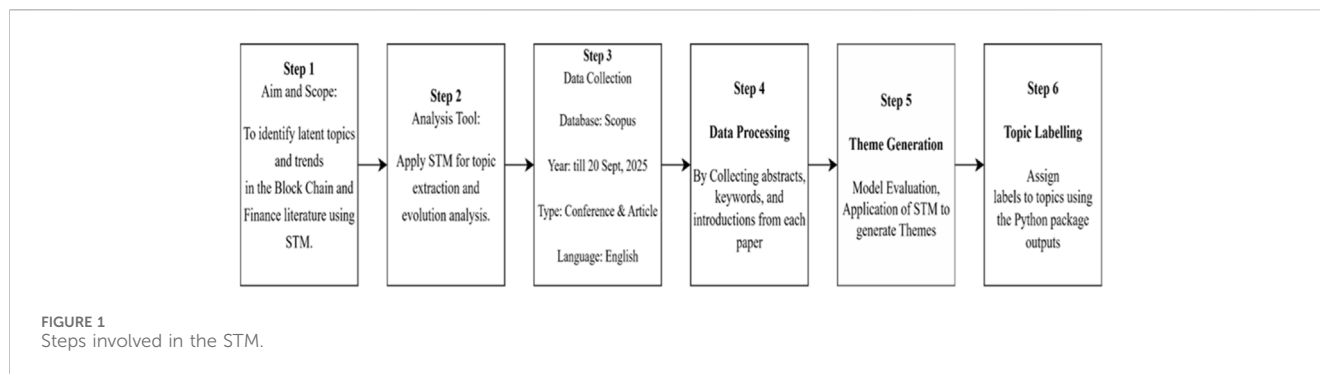
Fintech platforms and inventory asset-related fiscal matters are preferably conducted using blockchain to ensure security, feasibility, and affordability (He et al., 2025). Blockchain finds its application in the banking domain, including Bitcoin. It is likely that in the upcoming times, the economic transactions and platforms will be completely governed by blockchain (Rai et al., 2025). In the real estate section, blockchain creates a decentralized system for transparent deals followed by their verification (Sorathi et al., 2025).

Structural topic modelling has grown rapidly over the last few decades. Applying topic modelling techniques to determine the optimal number of topics or meaningful topic clustering words (Wang and Hsieh, 2023). It has been used for 20 years to track changes in literature (Wu and Zhang, 2021). Large datasets have been analysed using Structural Topic Modelling (STM) to identify thematic clusters across various industries, including finance. STM is used in the study of different domains to determine the trend of research in that domain. Lindstedt (2019) utilized the STM in social studies to examine discussions in society, group behaviour, and new social issues by analyzing vast amounts of social media data. A study by Cao et al. (2023) found that the extensive body of COVID-19 research literature has been investigated using STM to identify critical research topics. Experts can quickly grasp the structured morphology of recent research in the health and medical fields. Das and Saccani (2025) found that STM is being used to discover themes and obstacles in sustainable supply chains, with an emphasis on digital technologies such as IoT, Big Data, and Cloud Computing.

The study of blockchain technology has been ongoing for a long time and has yielded significant research in the literature on the subject. There are different methods utilized to study blockchain technologies and their application in the literature. A Study by Sharma et al. (2024) identifies that blockchain technologies are providing decentralised data storage solutions for sectors like banking and healthcare. As Healthcare records are conserved on Blockchain-integrated storage that provides protected data storage and unique management solutions. A study by Singh and Leelasankar (2022) exhibits the ability of blockchain to bridge the gap between Peer-to-Peer lending and business transactions through qualitative analysis.

Patel et al. (2022), in their study, highlighted the research stream in the application of blockchain in the Finance sector. Blockchain can enhance transparency and provide security in financial transactions Prokopenko et al. (2024). Sharma et al. (2024) highlighted the advantages of blockchain as speed, transparency, and cost savings that have brought a digital revolution in the financial sectors. However, certain challenges related to regulation, cybersecurity, and scalability limit its mass adoption (Ortiz et al., 2025).

Various studies have focused on the existence of an association between Blockchain technology and the financial sector. However, the application of STM to study the application of blockchain in financial sectors is not available. According to Song et al. (2023), the researcher shall focus on the development of a comprehensive theoretical framework with the application of STM in the blockchain-based financial sector. The use of STM for studying the application of blockchain in the financial sector would provide several benefits, such as identifying hidden themes, including metadata, improving sentiment analysis, and making precise conclusions from studies. These strengths, limitations, and



opportunities led the researchers to discuss the application of Blockchain in the financial sector.

The studies highlighted in [Table 1](#) indicate some prominent literature on blockchain adoption in finance, their limitations, and the research gap derived from it. As presented in [Table 1](#), Literature is available on the application of blockchain in different sectors, while the synthesis of those is missing. Thus, there is a need for the blockchain-finance research community to methodically uncover the themes, gaps and trends in the evolving research. Hence, in this study, we intend to answer the following research questions that will help future researchers and provide directions to them:

- RQ1: How can a systematic and scientific research methodology be employed to synthesize the existing literature on blockchain in finance?
- RQ2: What does the existing literature inform us about the focus areas and topics related to blockchain technology in Finance?
- RQ3: What emerging trends can help shape the scenarios for blockchain research in finance?

4 Materials and methods

We have employed the STM method to explore the emerging trends and themes in blockchain and finance. The study follows a structured approach of STM to investigate the evolution of blockchain and finance research as outlined in [Figure 1](#). The first step is the identification of the scope of the study, followed by the application of STM to extract topics. This is further followed by the pre-processing of data using abstracts, keywords, and introductions of the selected articles. Finally, STM and cluster analysis are performed to uncover the emerging topics and classify the topics into clusters.

4.1 Data collection

Data was collected from the Scopus database. The primary reason for selecting the Scopus database was that it stores a vast amount of scientific research ([Falagas et al., 2008](#); [Madzik et al., 2025](#)). The search terms were “blockchain”, “block-chain”, “blockchain”, and “Finance” within the title, abstract, and keywords. The analysis focuses on articles and conference papers,

indexed in Scopus between 2016–2025. This resulted in 2,439 articles. We applied two filters, namely “document type” and selected papers published in conference papers and articles; secondly, the English Language was used as another criterion. This resulted in 2,401 articles, which were further analyzed. The file was downloaded from Scopus on 20 September 2025, containing author details, title, publication year, source title, abstract, author keywords, index keywords, etc.

([Şakar and Tan, 2025](#)) used 5,127 articles to perform an STM in the area of gifted education, while ([Madzik et al., 2025](#)) used 4,049 articles to study blockchain technologies in the sustainable supply chain. Another study performed by [Shukla et al. \(2024\)](#) employed a dataset of 2,360 articles to perform STM in the area of blockchain technology. Considering the extant literature, the number of articles selected for the present study is justified, especially for the emerging field of blockchain technology in finance.

4.2 Data processing

The textual data (abstracts, keywords, and introductions) have to be pre-processed before the analysis ([Hvitfeldt and Silge, 2021](#)). The data were cleaned using natural language processing techniques. It involves tokenization, normalization, stemming, and removal of stop words, punctuation, and domain-irrelevant terms. All the capital letters were converted into small letters as part of normalization, while words were reduced to their root form for stemming. Words such as “the”, “is”, and “at” are classified as “Stop words” in natural language processing, and these words were removed as they do not contribute to the topic identification approach. Additionally, we removed all the punctuation and numbers to make the data clean and usable for analysis. To validate the model, the quantitative validation was evaluated at various levels, denoted by K, from 10 to 15 topics using coherence and exclusivity following [Röder et al. \(2015\)](#).

- A. Topic Modelling: We applied STM to explore evolving themes in existing literature using Python. We included journal name, author affiliation, publication year, etc., to identify the differences in the topic distribution. The major advantage of STM is that it includes covariates such as author, publication year, location, etc., in the topic model, which allows the topic prevalence to be dependent on the

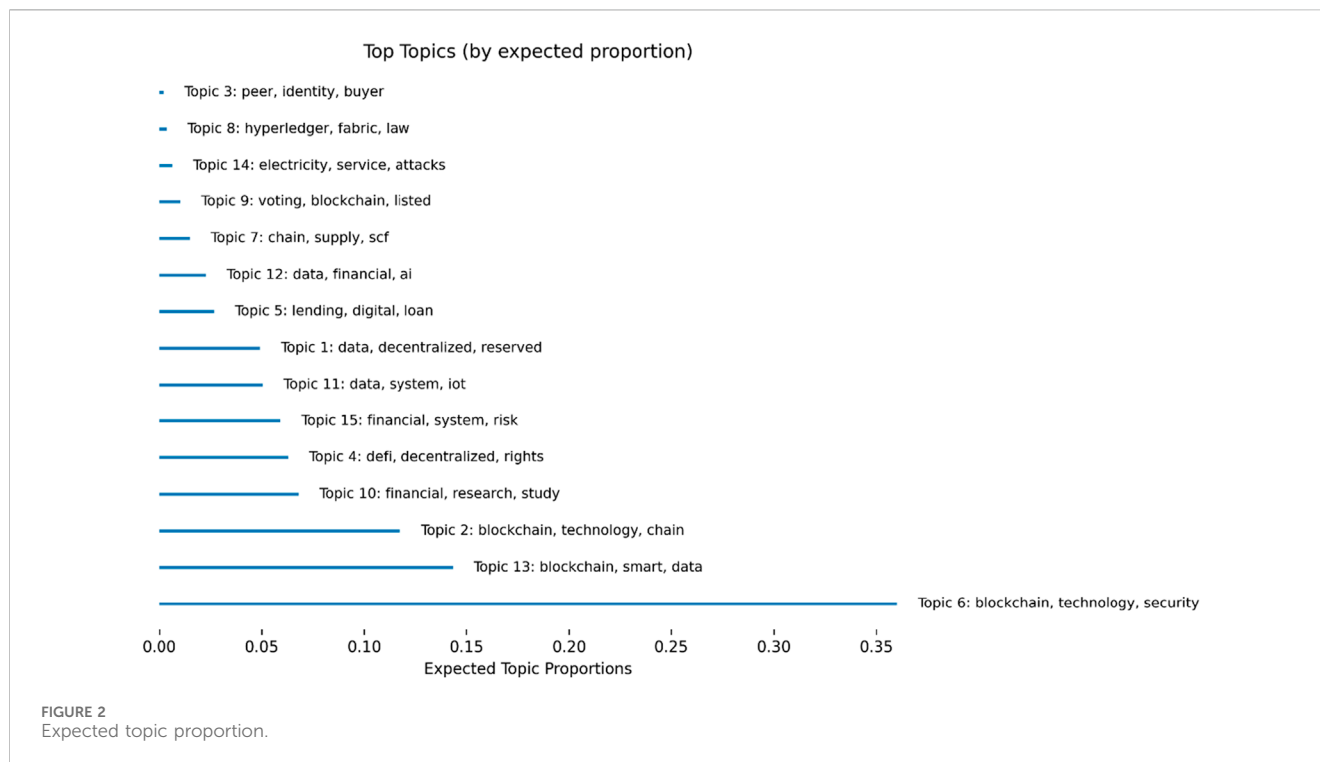
TABLE 2 Extracted topics.

S. N	Topic label	Top words (probability)	FREX	Semantic coherence (c_v)	Exclusivity
1	Data, decentralized, reserved	Data (0.019); decentralized (0.010); reserved (0.009); rights (0.009); DeFi (0.008); contracts (0.008); information (0.008); blockchain (0.008)	Defi data information contracts smart	0.3699	1.000
2	Blockchain, technology, chain	Blockchain (0.035); technology (0.035); chain (0.033); Financial (0.029); supply (0.021); Finance (0.018); development (0.013); information (0.013); application (0.011); rights (0.011)	Chain supply Financial development information	0.4048	0.964
3	Peer, identity, buyer	Peer (0.018); identity (0.007); buyer (0.007); Western (0.007); Monetary (0.006); Frame (0.005); Disseminated (0.005); facets (0.004); notarization (0.004); Singular (0.004)	Peer Western Frame facets notarization	0.5063	0.929
4	Defi, decentralized, rights	Defi (0.029); decentralized (0.017); rights (0.011); ethereum (0.010); Market (0.010); reserved (0.010); Liquidity (0.010); trading (0.009); tokens (0.009)	Liquidity Defi tokens trading Market	0.4291	0.893
5	Lending, digital, loan	Lending (0.024); digital (0.016); loan (0.013); SMEs (0.011); money (0.010); Financial (0.010); Financing (0.010); platform (0.008); rights (0.008); credit (0.008)	Lending SMEs loan money Financing	0.4154	0.857
6	Blockchain, technology, security	Blockchain (0.039); technology (0.021); security (0.010); rights (0.010); reserved (0.009); smart (0.009); data (0.009); paper (0.009); system (0.007)	Blockchain technology smart security system	0.4063	0.821
7	Chain, supply, supply chain Finance (SCF)	Chain (0.035); supply (0.028); SCF (0.022); BCT (0.018); Financing (0.016); study (0.011); Supplier (0.010); rate (0.009); credit (0.009); block (0.009)	BCT Supplier SCF Financing rate	0.4457	0.786
8	Hyperledger, fabric, Law	Hyperledger (0.021); fabric (0.019); Law (0.013); revocation (0.013); Agents (0.011); product (0.008); Anytime (0.007); faults (0.007); repository (0.006); Metric (0.006)	Anytime Metric revocation faults repository	0.5817	0.750
9	Voting, blockchain, listed	Voting (0.029); blockchain (0.022); listed (0.011); companies (0.009); Mechanisms (0.008); consensus (0.008); vote (0.008); platform (0.007); mining (0.007); protocol (0.006)	Listed voting vote mining companies	0.2936	0.714
10	Financial, research, study	Financial (0.017); research (0.017); study (0.012); governance (0.012); rights (0.010); Fintech (0.010); reserved (0.009); Finance (0.008)	Fintech governance research Financial study	0.3369	0.679
11	Data, system, IoT	Data (0.021); system (0.018); iot (0.018); blockchain (0.018); devices (0.009); security (0.009); access (0.008); rights (0.008); decentralized (0.008); systems (0.008)	IoT devices access system data	0.4263	0.643
12	Data, Financial, AI	Data (0.064); Financial (0.041); AI (0.021); intelligence (0.016); artificial (0.013); services (0.010); privacy (0.010); trust (0.009); Fintech (0.009); big (0.009)	Ai Fintech intelligence big artificial	0.4049	0.607
13	Blockchain, smart, data	Blockchain (0.018); smart (0.015); data (0.010); contracts (0.010); Model (0.010); contract (0.009); reserved (0.009); rights (0.009); transactions (0.008)	Contract smart contracts Model transactions	0.3273	0.571
14	Electricity, Service, attacks	Electricity (0.025); Service (0.024); attacks (0.016); consortium (0.014); renewable (0.014); Ddos (0.011); risks (0.009); dos (0.008); Attack (0.007); threats (0.007)	Electricity renewable consortium	0.348	0.536
15	Financial, system, risk	Financial (0.023); system (0.020); risk (0.018); blockchain (0.016); data (0.016); Model (0.016); algorithm (0.009); based (0.009); proposed (0.009); rights (0.008)	Risk algorithm Model Financial system	0.3668	0.50

covariates rather than observational values (Fresneda et al., 2021).

B. Topic Estimation: A total of 15 topics were selected on the grounds of semantic coherence and predictive likelihood. We have used 15 topic coherence metrics using c_v measure. It is one of the best models among all (Zoya et al., 2021). The c_v metric relies on a sliding window approach, a single-set segmentation of the most significant words, and an indirect

confirmation measure that incorporates Normalized Pointwise Mutual Information (NPMI) along with cosine similarity (M'sik and Casablanca, 2020). The researcher should decide the number of topics based on judgment, along with statistical methods, as outlined in the literature (Berger et al., 2020; Weston et al., 2023). The researcher should not define too few topics, as it might lead to the omission of lower-frequency words (Şakar and Tan, 2025), while having



too many topics may lead to similar topics (Zhao et al., 2015). Therefore, the total number of topics is validated by existing literature.

- C. Cluster Analysis: We grouped the topics into five thematic clusters based on semantic coherence and exclusivity scores. It further helped in combining the topics into coherent groups to identify the inter-topic correlation and remove the duplication.

4.3 STM application and topic labelling

We used the STM package in Python to label topics with the help of the following metrics:

1. Highest Probability: It shows the probability of themes existing in the article or group of articles, along with their association with the article or group of articles.
2. Frequency-Exclusivity (FREX): It shows the frequency of a theme in the article or group of articles along with its exclusivity, i.e., how unique the theme is from other themes. So, FREX is a combination of common and unique themes.
3. Semantic Coherence: It shows the degree of similarity among the top words. The semantic coherence was found to be highest at 0.5817 for topic 8 (Hyperledger, Fabric, Law), while it was lowest at 0.2936 for topic 9 (Voting, Blockchain, Listed), as shown in Table 2.
4. Exclusivity: It shows the degree of difference, i.e., distinctiveness of terms relative to other topics. The highest exclusivity score was 1 for topic 1 (Data, Decentralized, Reserved), while the lowest exclusivity score was 0.50 for topic 15 (Financial, System, Risk), as given in Table 2.

5 Results and analysis

5.1 Topic number estimate

To analyse the data, we have used STM using Python (Fresneda et al., 2021). STM is an advanced method developed on Latent Dirichlet Allocation (LDA). It helps to explore the hidden theme from the large data and visualize the data to explore the themes in depth. STM provides fast, clear, replicable analyzes that need a few priori assumptions (Roberts et al., 2014). STM pinpoints words with the highest per-topic weight, which represents the most pertinent words for each topic. After segments are created by clustering topic prevalence (and covariates), these relevant words can be linked to the identified segments to describe them (Fresneda et al., 2021). On the other hand, unsupervised approaches, such as employing STM followed by cluster analysis, can detect patterns in textual data without any pre-established limitations (Roberts et al., 2014). Using Python genism and scikit-learn, firstly, we estimated the topic proportion. We tested model by estimating 10, 15, and 20 topics, and we followed the recommendations of (Perelman et al., 2010) to find the optimal number of topics for the STM. While analyzing, we have taken care to select topics optimally, as reducing the number of topics may ignore uncommon themes, and increasing the number of topics may reduce semantic consistency (Griffiths et al., 2007).

We found 15 topics, as shown in Figure 2, to fit the STM model, which assigns the highest probability to each topic (Weston et al., 2023). The most important topic is Topic 6, Blockchain, technology, and security, which takes almost 35% of the data, and denotes that most of the studies have focused on blockchain infrastructure and security. The second most important topics are 2 and 13, which cover 15–20% of the data; in the mid-range are topics 10, 4, and 15,

which show that DeFi is the focus after the technical part. The contributions by topics 11, 1, 5, 12, and 7 are in decreasing order, which are niche but emerging topics. The contribution of topics 9, 14, 8 and 3 is very minimal and is less than 5% signifying that these topics are less researched. Overall, technology-related topics, such as technology, infrastructure, and security, account for around 60%; finance-specific topics, including DeFi, risk, and governance lending, comprise around 30%; and the remaining areas, including law, energy, and supply chain, contribute around 10%.

5.2 Topic modelling and labelling

Topics are labelled using FREX, Semantic Coherence (c_v), and Exclusivity. It helps to find the quality of the topics. FREX is Frequency + Exclusivity. Semantic coherence and exclusivity are the most important tools for understanding whether topics are meaningful and interpretable. The model with K (number of topics) = 15 topics, showing a balanced trade-off between semantic coherence (>0.30) and exclusivity (>0.50), was selected (Roberts et al., 2019). Higher semantic coherence denotes better results (Nunkoo et al., 2023), implying that top words co-occur in documents a greater number of times, and low coherence means top words have less co-occurrence (Mimno et al., 2011). Exclusivity refers to whether the top words are unique or overlap; high exclusivity indicates that the topic is distinct, while low exclusivity means it overlaps with many other topics. Weston et al. (2023) suggested that for that there is no single number threshold for STM. It depends on the number of topics. The increase in the number of topics reduces the coherence, and a smaller number of topics will increase coherence (Mimno et al., 2011). Instead, we have worked on various number of topics and selected the model that balances coherence and exclusivity to extract meaningful themes (Mimno and Lee, 2014; Röder et al., 2015).

A theme with high semantic coherence and exclusivity is the most reliable topic (Mimno et al., 2011). As shown in Table 2, topic 6 is blockchain, a technology that is very frequent in the data, but it is not exclusive. FREX is a smart security system that is distinct from the cluster. FREX explains blockchain technology in technical contexts, such as smart contracts, security, and systems. Semantic coherence is 0.4063, which is moderate, which means the co-occurrence is not very strong. It means this topic is broad. Exclusivity (0.821), which is medium to high, is the blockchain's most common word, whereas the distinct ones are "security" and "smart." Junior and Fileto (2025) analyzed short, texted documents and reported coherence (c_v) 0.25 to 0.75 with $K = 15$. Molavi et al. (2020) applied STM on Open Educational Resources (OER) and reported coherence c_v between 0.36 and 0.52 for K between 2 and 10. Stracqualursi and Agati (2022) have analyzed Tweet topics and sentiments relating to distance learning and found coherence (c_v) between 0.34 and 0.50 for topics between 2–9. Zoya et al. (2021) analyzed Urdu tweets text and testified c_v value between 0.46 and 0.52 for k between 9 and 25. Similarly, M'sik and Casablanca (2020) analyzed the Corpus of COVID-19 and reported a coherence score c_v between 0.40–0.50.

5.3 Cluster analysis

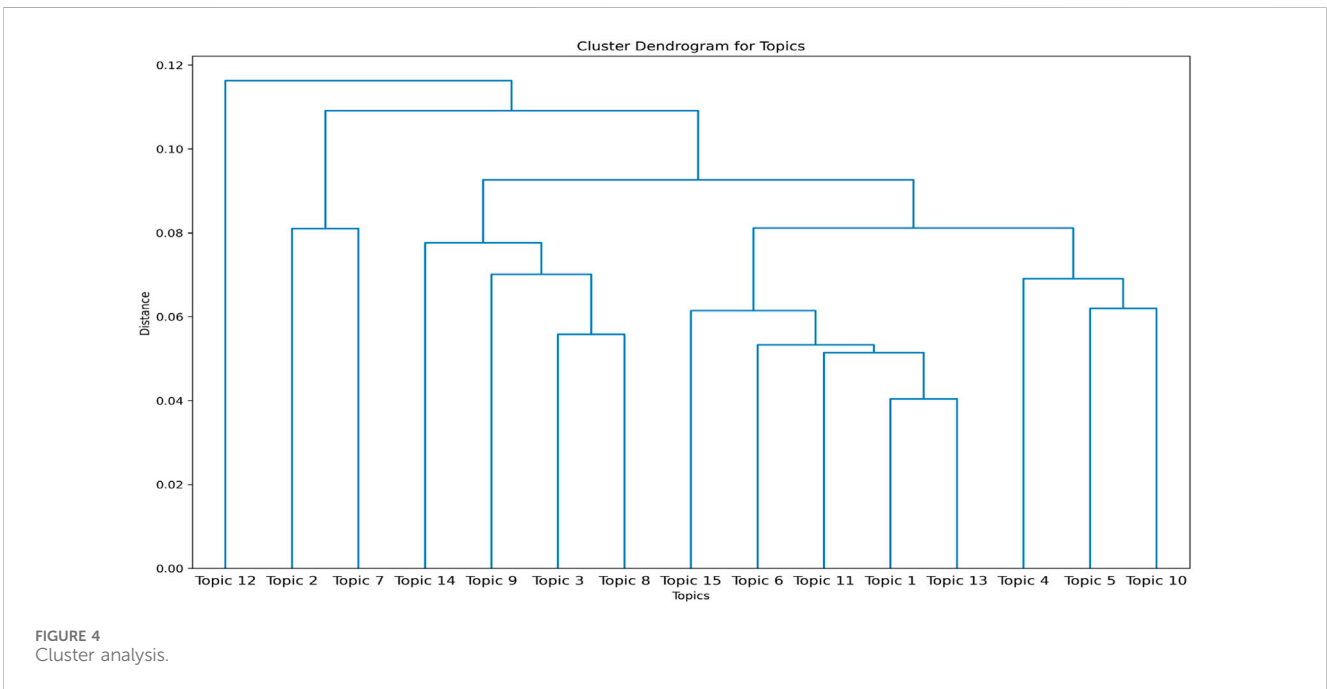
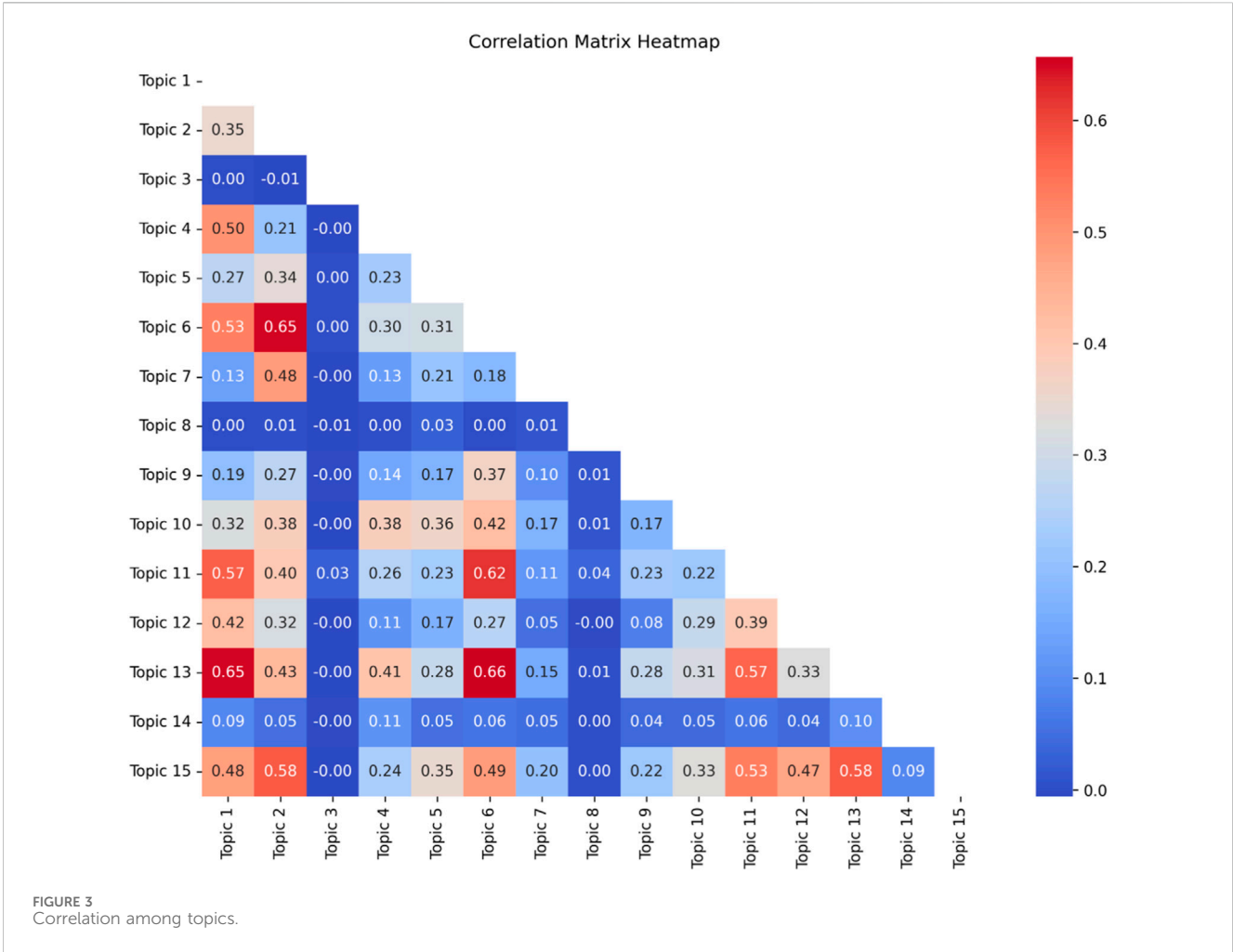
Cluster analysis is a method for grouping topics that often co-occur in the same documents, have similar word distributions, and exhibit correlations in topic proportions. The last method for labelling topics is to observe the correlations between topics (Weston et al., 2023). The correlation among topics is presented in Figure 3. The strongest correlation is between Topic 6 and Topic 13 (0.66), followed by Topic 1 and Topic 13 (0.65), and Topic 2 and Topic 6 (0.65). A high correlation is found between Topic 6 and Topic 11 (0.62), while Topic 15 shows a high correlation with Topic 2 (0.58) and Topic 13 (0.58).

The cluster analysis was executed and presented to find the themes from the dataset using a dendrogram. The dendrogram displays the 'best' division into any number of groups (Jolliffe et al., 1989). It is a tree diagram that represents the topics grouped according to their similarity; the height of the line represents the similarity between topics. We have extracted five themes from the dendrogram analysis of the data, as shown in Figure 4. Theme one (Blockchain, AI and Data Intelligence) from topic 12 is centred around artificial intelligence, machine learning, and blockchain technology with direct financial application. Theme two (Blockchain Technology and Supply Chain Financing), gathered from Topics 2 and 7, focuses on the core blockchain technology in supply chain financing and logistics. Theme 3 (Blockchain for Governance, Identity and Regulation), gathered from Topics 14, 9, 3, and 8, focuses on government usage of blockchain, like digital identity, voting, Hyperledger, and legal framework. Theme 4 (Blockchain Infrastructure, Risk and Smart Systems), gathered from topics 15, 6, 11, 1, and 13, focuses on blockchain as a data-driven ecosystem, linked with IoT, security, and decentralisation. Last theme 5 (Blockchain in Finance and Markets), gathered from topics 4, 5, and 10, focuses on blockchain-enabled finance like lending platforms, decentralised markets, and fintech systems.

6 Discussion and future research direction

This study explored blockchain in the financial domain by analyzing 2,401 scholarly articles using STM. The findings highlight both the technological foundations of blockchain and its expanding applications in finance, while also pointing to challenges that prevent widespread adoption.

The present study focuses on the core technological aspects of blockchain, including decentralisation, smart contracts, security, and data management (Lavanya and Kavitha, 2022; Secinaro et al., 2021; Tseng and Shang, 2021). Topic 6, "Blockchain, Technology, and Security," accounted for nearly 35% of the dataset, reflecting scholarly interest in ensuring that blockchain systems are robust, secure, and capable of maintaining trust in decentralised environments. Other technology-centred topics, such as Hyperledger, IoT, and AI integration, viz. 8, 11, and 12, demonstrate how interdisciplinary approaches are being used to enhance blockchain infrastructures and explore their broader potential (Choi et al., 2020; Rana et al., 2021). These results suggest that while blockchain is often framed as a financial innovation, understanding its technical motives remains critical



to enable reliable and scalable applications (Truby, 2018; Zheng et al., 2018). The analysis section shows that blockchain research is increasingly emphasising financial applications. Topics related to lending platforms, decentralised finance (DeFi), liquidity management, and risk modelling, viz. 4, 5, and 10, reveal that blockchain is being explored not only for payment systems but also as a tool to transform investment, credit, and fintech activities (Kumari and Devi, 2022; Varma, 2019).

Cluster analysis confirms this trend, with Theme 5, which is “Blockchain in Finance and Markets”, grouping topics around financial services, signaling a shift from theoretical explorations to practical use cases. The growing prominence of DeFi, in particular, illustrates blockchain’s potential to enable peer-to-peer lending, automated trading, and transparent financial operations without reliance on traditional intermediaries (Chang et al., 2019; Lavanya and Kavitha, 2022). Blockchain research is extending beyond finance, encompassing areas such as digital identity, voting, legal frameworks, and supply chain finance, as explained in themes 2 and 3 (Feng et al., 2019; Yeoh, 2017). This trend reflects a recognition of blockchain’s utility in governance, regulatory compliance, and cross-sector applications. Additionally, the integration of AI and machine learning as theme 1 indicates an emerging interdisciplinary focus, where blockchain supports advanced analytics and data-driven decision-making in financial and organisational contexts (Li and Wang, 2025; Vella et al., 2025).

The cluster analysis of blockchain research in finance reveals five interrelated themes that provide a comprehensive view of the field. These also present the research gaps that can be undertaken by future researchers to extend the literature:

6.1 Theme one: blockchain, AI and data intelligence

Topic 12 (Data, Financial and AI) drives this theme that connects blockchain, AI and data intelligence. In the present times, there has been unprecedented growth in FinTech due to the development of metaverse along with Generative Artificial Intelligence (Hutson and Banerjee, 2025). These technologies are capable of preventing fraud by improving security of transactions and management of risk to help transform the different operations of the financial sector (Subburayan et al., 2024). The analytics provide deep insights into the origin of the data, predictive planning, uncovering breach of security and fraud and regulatory compliance, using blockchain data and records (Dillenberger et al., 2019). These perspective highlight the synchronization of blockchain with various technologies such as machine learning, artificial intelligences to support automated decision-making and predictive analytics (Li and Wang, 2025; Vella et al., 2025). To explore this perspective further and broaden the knowledge, we propose the following questions:

RQ1: How can blockchain leverage AI to create trust in the financial sector?

RQ2: Can blockchain use big data and data intelligence to provide private and secure financial services?

6.2 Theme two: blockchain technology and supply chain financing

This theme evolved by integrating Topic 2 (Blockchain, Technology, Chain) and Topic 7 (Chain, Supply, Supply Chain Finance (SCF)). It captures research on core blockchain infrastructure applied to supply chain financing and logistics. Topics in this cluster, which exhibit moderate correlations (e.g., Topic 15 and Topic 2), reflect an emphasis on traceability, transparency, and efficiency across financial and operational networks (Kumari and Devi, 2022; Zheng et al., 2018). Zhang et al. (2025) proposed a solution, which is based on a Convolutional Neural Network-Particle Swarm Optimization, capable of building a warning system for security risk. It is important to note that the role of SCF is crucial for small and medium-sized enterprises for providing financing (Fang et al., 2025). Using the insight from the extant literature, the following Research questions are proposed for future researchers:

RQ1: How can blockchain technology lead to the development of supply chain financing

RQ2: Can the supply chain financing running on blockchain have a different financing rate?

6.3 Theme three: blockchain for governance, identity and regulation

This theme is much broader and includes Topic 14 (Electricity, Service, Attacks), Topic 9 (Voting, Blockchain, Listed), Topic 3 (Peer, Identity, Buyer) and Topic 8 (Hyperledger, Fabric, Law). The major dimensions are digital voting, Hyperledger frameworks and the legal system. This collection highlights the pivotal role of blockchain for identity management, regulatory compliance, and governance, bridging technological potential with institutional and policy needs (Feng et al., 2019; Yeoh, 2017). Leadership, social norms and community engagement, traits of human behaviour, are instrumental in the governance of an organization; however, using blockchain algorithms, the organization can improve transparency and decentralization (Vella et al., 2025). The capability of blockchain also extends to improve efficiency, security, and transparency, along with enabling users to trust governance structures. All these positive actions led to the reduction of cost and better decision-making (Polcumpally et al., 2024). Many organizations do not possess unified governance, which acts as a threat to blockchain technology adoption (Banerjee and Chandani, 2025). We propose the following research questions:

RQ1: Is blockchain technology capable of handling electricity threats and attacks?

RQ2: How can blockchain provide consensus among the participants and adhere to the regulations and protocols?

6.4 Theme four: blockchain infrastructure, risk and smart systems

Topic 15 (Financial, System, Risk), Topic 6 (Blockchain, Technology, Security), Topic 11 (Data, System, IoT), Topic 1

(Data, Decentralized, Reserved), and Topic 13 (Blockchain, Smart, Data) constitute theme 4. It represents the most technologically interconnected cluster, with strong correlations between Topic 6 and Topic 13 (0.66) and between Topic 1 and Topic 13 (0.65). Research here focuses on building resilient, secure, and scalable blockchain ecosystems linked to IoT, risk governance, and smart financial systems, emphasizing both technical robustness and practical reliability (Tseng and Shang, 2021; Zheng et al., 2018). The technological infrastructure and regulatory frameworks should be properly aligned for the successful implementation of blockchain technology in financial services aimed at improving efficiency and security (Izzatillayev et al., 2025). Another research performed by Singh and Verma (2025) reported that the use of IoT devices is widespread among household infrastructure, and blockchain technology can lead to greater adoption of IoT. We propose the following research questions to cover the topics within this theme and increase the body of knowledge:

RQ1: How can blockchain infrastructure support a secure system and ensure access and rights are given to the legitimate entities?

RQ2: How does blockchain propose a system for DeFi, ensuring a smart security system?

6.5 Theme five: blockchain in finance and markets

The last theme comprises Topic 4 (Defi, Decentralized, Rights), Topic 5 (Lending, Digital, Loan) and Topic 10 (Financial, Research, Study). It centers on the practical financial applications of blockchain, including decentralised finance (DeFi), lending platforms, and investment markets. This cluster demonstrates how blockchain is reshaping real-world financial operations by enhancing transparency, efficiency, and accessibility, reflecting a shift in research from foundational technology toward applied financial innovation (Chang et al., 2019; Lavanya and Kavitha, 2022). Collectively, these clusters reveal that blockchain research in finance is both deepening its technological foundations and expanding into applications across financial markets, governance, and cross-sector domains, while also highlighting interconnections between technology, regulation, and financial practice. Prices in the decentralised markets are usually efficient, while there could be a few frictions related to gas fees and Ether volatility. The prices in the decentralised exchanges are closely linked with the currency markets due to arbitrage and informed trading (Ranaldo et al., 2024). The announcement of blockchain by the firm led to positive market reactions by the small firms in the United States (Ali et al., 2023), highlighting the importance of blockchain in business processes. To extend the literature, we propose the following research questions for future researchers:

RQ1: How can DeFi help and support the liquidity and trading system in the financial markets?

RQ2: Can blockchain provide support in the lending process, especially to the SMEs and Fintech?

7 Implications, limitations and future research

The results of this research are very important for researchers, practitioners and regulators and provide a data-centric basis for strategic decisions.

7.1 Theoretical implications

This research has made two theoretical contributions. First, it broadens the perspective of blockchain as only a technical or finance-related phenomenon. We offer an integrative framework through five interrelated clusters, depicting blockchain in finance as a complex socio-technical system of co-evolving technology, market applications and governance (Beck et al., 2018). This framework could be used to expand theory-building to include interdependence and for scholars to create models referring to interconnections. Second, the importance of themes, such as “Blockchain for AI and Data Intelligence” and “Blockchain for Governance, Identity and Regulation”, reflects the need for new theoretical lenses that combine principles of computer science with theories from institutional economics, corporate governance and regulation (Davidson et al., 2018).

7.2 Practical implications

Our cluster analysis presents an avenue for financial institutions and FinTech companies to expand into blockchain. The investment into foundational infrastructure for the system’s security, data integrity and resilient systems will remain a must-have condition for any applications to be trusted, as theme 4 signifies foundational applications are reaching saturation. Likewise, there exists a stage of maturity presented by the applications within theme 5 for practitioners to take advantage of market opportunities with products that could range from productizing user-friendly DeFi interfaces (Schär, 2021), to building tokenisation platforms for real-world assets, to deploying automated lending protocols (Gudgeon et al., 2020). As the next revolutionary frontier for firms and a prospective competitive differential in the U.S. and Europe, the outputs of theme 1 are advancing firms to stake their claim on being early adopters in integrating AI with blockchain for prediction analytics, advanced fraud detection and algorithm-based automated asset management.

7.3 Policy and regulatory implications

Our research indicates a significant gap between technological innovation and regulatory oversight, which will require a substantial change in public policy thought and action. Regulators need to transition their position from reactive to proactive and consider implementing regulatory sandboxes for testing new products (Zetzsche et al., 2018), as well as partnering to develop standards in areas such as smart contract auditing and digital identification. Additionally, regulators will need to adopt ‘Suptech’ (Supervisory Technology), utilising the grounds for transparency provided by

blockchain and creating tools for the real-time, in-the-galley monitoring of systemic risk and nefarious information (Arner et al., 2016), thus taking regulators out of the existing self-reported audit framework. Lastly, because public blockchains are borderless, this new regulatory approach requires unprecedented coordination on a global level to develop harmonized frameworks that reduce the ability to create jurisdictional arbitrage and establish a consistent, stable playing field for the future of finance.

7.4 Limitations and future research

While this study provides an in-depth outline of the study of blockchain in the finance context, it is accompanied by some limitations that can also be made into future research opportunities. First, reliance on the Scopus database and focus on abstracts, keywords and introductions was limiting; while this is a favourable approach, analyzing other databases, or the full text of the repeated articles would provide an even wider range of literature and further thematic detail. Second, STM itself was limiting the 15 topics structure required a level of researcher judgement, which could provide an alternative aggregate understanding if a different number of topics were chosen, and the method is less suited to very fractured and fledgling sub-fields of research (Roberts et al., 2019), where there are limited publications. Finally, although the identification processes of topic labels and the clustering process were supplemented by the STM, and these processes are subjective, and so whilst our five-cluster framework is compelling, it is not the only theme framework that could organise the research landscape.

Building directly from our findings, we present multiple targeted proposals for future research. First, a move to applied solutions (rather than solely conceptual exploration) is required, highly relevant for the intersection of Blockchain, AI, and IoT in adopting agile risk management in Decentralized Finance (DeFi) and architecture for scalable trade finance. Second, the DeFi phenomenon requires interdisciplinary research into practical governance and regulatory solutions, including “Regulatory Tech” in addition to legal personhood for Decentralized Autonomous Organizations (DAOs) (Hassan Collado and De Filippi, 2021). Also, a comparative or empirical approach highlighting requests to continue to explore and understand scalability would have to explicitly track real-world financial ecosystem Layer-2 solutions and implementation (Gans and Halaburda, 2015), beyond discussions of theory. Third, we recommend using qualitative approaches, like case studies, alongside quantitative methods to clarify the organizational and operational realities of blockchain adoption, to the data generated by topic modelling in our review.

8 Conclusion

In this study, we analysed 2,401 scholarly articles using STM to examine and synthesize the existing research, systematically and scientifically, on blockchain in the finance sector. The objective of

the study was to explore the focus areas and topics and to uncover the emerging trends in blockchain in finance. Fifteen key topics are derived from the study, which were categorized into five thematic clusters and display the technological base of blockchain and its application in the financial sector.

There are two major directions identified for the study of blockchain. Firstly, it is identified that technological aspects are highly emphasized, which include Data security, Data handling, decentralization, and digital contracts. These aspects are crucial for building trust and maintaining sustainable technology. Another one is that the focus of research is diverting to technological aspects in the financial sector, such as Fintech Lending, Decentralised Finance (DeFi), liquidity, and risk management. The findings indicate that the application of blockchain in finance is not restricted to Payment. However, its application is widening into other financial sectors. Along with finance, the blockchain is applied in IoT, AI integration, and digital identity, which indicates cross-sectoral application of the same. There are a few challenges to technology, such as adaptability, suitability, uncertain regulations, and security that hinder the deployment of Blockchain in the financial sector (Feng et al., 2019; Shin, 2019; Yeoh, 2017; Zheng et al., 2018). Though there are technological solutions like digital contracts and Distributed Ledger systems, the application is restricted by legal, governance, and operational challenges. The findings of the study highlighted that though blockchain technology has the potential to transform the financial sector, its application is still restrained in the sector.

The results of this study align with previous research that utilized topic modelling methods, like Structural Topic Modelling (STM), to examine key themes (Mimno et al., 2011). Weerawarna et al. (2023) have used PRISM for content analysis of 50 articles, Norbu et al. (2024) also analysed 48 articles using SLR and PRISMA model, and Alshdaifat et al. (2025) have applied Bibliometric Analysis of 1,102 articles using VosViewer, and these studies are different from our study. Consistent with earlier findings, our study reaffirms the interdisciplinary nature of blockchain research and the shifting thematic focus over time. However, this research differs from past studies by using STM, which integrates document-level metadata of 2,401 research papers between 2016–2026 into topic prevalence and content. This approach provides a more detailed understanding of how blockchain-related topics differ across contexts and change over time. Our findings of theme support from the previous studies focus work Blockchain, AI and Data Intelligence has been supported by Bühlmann et al. (2025); Li and Wang (2025); Saleh (2024); Vella et al. (2025). Blockchain Technology and Supply Chain Financing has been supported by Cao et al. (2021); Ioannou and Demirel (2022). Blockchain for Governance, Identity and Regulation is an important theme to work on, and it is supported by Banerjee and Chandani (2025). Blockchain Infrastructure, Risk and Smart Systems is an important theme to work on, as supported by Tseng and Shang (2021); Zheng et al. (2018). Lastly, Blockchain in Finance and Markets work has been supported by Chang et al. (2019); Lavanya and Kavitha (2022); Rinaldo et al. (2024). Quantitative research design has been applied by Saxena (2024) in blockchain technology, and this study and its findings are different from our study.

Lastly, the research underscores various research gaps in the study of said domain. Literature is dominated by technology-based studies; however, these studies have a limited focus on the

integration of blockchain into the financial sector, policy, and governance. There is scope for future research in various emerging themes such as DeFi, AI-driven technology, IoT IoT-enabled blockchain (Pečiulis et al., 2024; Song et al., 2025). The association studies between the thematic clusters identify that blockchain's applicability and potential can be understood through multidisciplinary methods. However, studies blending financial, technological, and regulatory aspects are limited. The research pertaining to blockchain and its application in the financial sector is at the beginning stage but is gaining rapid attention from researchers.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Author contributions

MS: Writing – original draft, Writing – review and editing, Software, Visualization. PU: Formal Analysis, Validation, Writing – original draft, Writing – review and editing. AC: Methodology, Supervision, Writing – original draft, Writing – review and editing. MP: Formal Analysis, Resources, Writing – original draft, Writing – review and editing. SW: Conceptualization, Project administration, Writing – original draft, Writing – review and editing. SB: Data curation, Writing – original draft, Writing – review and editing. RA: Software, Writing – original draft, Writing – review and editing.

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