

The impact of FinTech on banking: a systematic literature review and research agenda including challenges and trends

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Abstract

Purpose – Rapid technological advancement has accelerated the integration of financial technology (FinTech) into traditional banking systems. Banks have adopted digital payments, artificial intelligence, blockchain solutions and open banking frameworks, thereby increasing competition and prompting regulatory adaptation. This study conducts a theory guided systematic literature review and bibliometric analysis of FinTech banking research (2019–2024) to map the intellectual structure, thematic evolution and research gaps.

Design/methodology/approach – The review analyses 224 peer reviewed journal articles indexed in the Web of Science Core Collection. Using BibExcel and VOSviewer, the study employs co-citation analysis, keyword co-occurrence mapping, clustering techniques and temporal overlay analysis. The review protocol follows explicit search strings, inclusion criteria and screening procedures to enhance transparency and replicability.

Findings – Six major thematic domains emerge: competition and risk-taking dynamics, financial inclusion and regulatory boundaries, institutional technology integration, performance and efficiency outcomes, innovation and regulatory economics and digital transformation and adoption behaviour. Temporal analysis reveals a progression from adoption focused inquiry toward governance, competition and systemic stability debates. Despite increasing empirical sophistication, the field remains fragmented across behavioural, institutional and macroprudential levels.

Originality/value – This study embeds bibliometric mapping within a multi-level theoretical framework integrating diffusion, disruptive innovation and ecosystem perspectives. The research provides a critical synthesis of the evolving FinTech banking literature. The findings identify key research gaps, reveal emerging thematic patterns in FinTech banking research and outline directions for future research while offering implications for banking practitioners and regulators.

Keywords FinTech, Banks, Systematic literature review, Cluster analysis, Co citation analysis

Paper type Literature review

1. Introduction

FinTech (Financial Technology) refers to the application of digital technologies to the delivery of financial services, reshaping the competitive, operational, and regulatory landscape of the banking industry (Arner, Barberis, & Buckley, 2016). It encompasses innovations such as digital lending, mobile payments, cryptocurrencies, robo-advisory services, and algorithmic investment platforms. While earlier technological developments, including automated teller machines and online banking, primarily improved efficiency within existing institutional structures, the post 2008 wave of innovation has transformed how financial value is created, delivered, and governed. Advances in platform-based ecosystems, artificial intelligence, distributed ledger technologies, and algorithmic decision-making systems have accelerated broader digital transformation processes across industries (Nazuri, Mohamed, & Daud, 2025). As a result, FinTech has expanded opportunities for innovation while increasing competitive pressure on incumbent banks through the emergence of agile, technology-oriented firms

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(Peón, Antelo, & Sun, 2024). This shift reflects the logic of disruptive innovation, whereby digitally native entrants challenge established business models through scalable and technology driven operating structures (Christensen, 1997; Christensen, Raynor, & McDonald, 2015). Consequently, FinTech represents more than a process of technological modernization; it signals a structural transformation of banking that raises important questions regarding how financial institutions adapt to evolving digital and competitive environments (Goel & Kashiramka, 2025).

Systematic synthesis of FinTech research requires clear theoretical positioning. This research interprets the FinTech banking nexus through a multi-level analytical framework integrating three complementary perspectives. Innovation Diffusion Theory explains variations in FinTech adoption across banks by emphasizing organizational readiness, perceived strategic value, and institutional constraints at the micro level (Rogers, 2003; Tornatzky & Fleischer, 1990). Disruptive Innovation Theory illuminates industry level competitive restructuring, particularly the emergence of technology centric firms whose scalable, asset light models challenge traditional intermediation logics (Christensen, 1997; Christensen *et al.*, 2015). Platform Ecosystem Theory conceptualizes banking evolution as a shift from vertically integrated institutions toward digitally interconnected value networks involving banks, FinTech firms, technology providers, and regulators (Tiwana, 2014; Jacobides, Cennamo, & Gawer, 2018). Together, these perspectives form an integrated interpretive framework that links organizational adoption processes, competitive realignment, and ecosystem governance, enabling a structured analysis of FinTech driven banking transformation.

The period 2019–2024 represents an acceleration phase in FinTech enabled banking transformation, marked by pandemic induced digital adoption, expansion of Open Banking frameworks, regulatory experimentation, and rapid integration of AI driven technologies into banking processes. This period provides an appropriate boundary for examining how technological innovation, regulatory changes, and evolving competitive dynamics have reshaped banking transformation.

Among recent developments, Generative Artificial Intelligence (GAI) has emerged as a major driver of banking transformation, supported by advances in data analytics and the growing availability of financial data (Vučinić & Luburić, 2024; Devabe, 2024). Financial institutions increasingly employ AI driven systems to improve operational efficiency, predictive capabilities, customer service, and cybersecurity (Devabe, 2024; Kshetri, 2024). At the same time, these technologies introduce new risks, including social engineering threats, data disclosure concerns, and governance challenges related to accountability and oversight (Aldasoro *et al.*, 2025). The rapid diffusion of generative AI therefore exemplifies the organizational, competitive, and regulatory transformations reshaping contemporary banking.

Despite the rapid growth of FinTech research, existing review studies remain fragmented in scope and theoretical integration. Several reviews have significantly advanced understanding of digital financial innovation. For example, Liu, Li, and Li (2024) provided a broad systematic mapping of FinTech research across multiple sectors and identified major domains such as FinTech development, adoption, and banking applications. In contrast, Firmansyah *et al.* (2022) focused specifically on FinTech adoption and acceptance, highlighting determinants including trust, financial literacy, perceived usefulness, and technology acceptance. Similarly, Murinde, Rizopoulos, and Zachariadis (2022) examined the implications of the FinTech revolution for the future of banking, while other reviews have focused on specific topics such as digital banking, financial inclusion, lending innovation, competition, and bank performance. Within the banking domain, Pandey, Hassan, Kumari, Zaied, and Rai (2024) identified major intellectual clusters through bibliometric analysis, whereas Elia, Stefanelli, and Ferilli (2023) reviewed the effects of FinTech on customers, banks, regulators, and society.

Although these studies provide valuable insights, they largely examine adoption, competition, regulation, performance, and ecosystem development as separate research streams. Bibliometric reviews successfully map publication trends, citation structures, and thematic clusters, but

generally provide limited explanation of how these themes are theoretically connected or how developments at one level of analysis influence outcomes at other levels. Consequently, existing reviews provide detailed inventories of research topics but offer limited explanation of how technological adoption, organizational transformation, competitive restructuring, regulation, and financial stability interact within banking transformation.

A further limitation concerns the rapidly evolving research landscape. Recent developments including generative AI, Open Banking, RegTech, ESG oriented innovation, cybersecurity, and post pandemic digital transformation are reshaping banking research. However, these developments have not yet been systematically integrated within a comprehensive review framework.

Addressing these limitations, the present study combines systematic literature review procedures, bibliometric analysis, and theory driven thematic synthesis within a multi-level framework integrating Innovation Diffusion Theory, Disruptive Innovation Theory, and Platform Ecosystem Theory. By moving beyond descriptive mapping, the study interprets relationships among research streams and develops a theory informed research agenda.

Existing reviews largely remain either broad FinTech mappings, topic specific systematic reviews, or descriptive bibliometric studies. Consequently, the literature still lacks an integrated review that combines bibliometric evidence with theory-driven synthesis to explain how FinTech induced changes at the technological, organizational, ecosystem, and regulatory levels jointly shape banking transformation and financial system outcomes. Addressing this gap is particularly important given the emergence of AI enabled banking, Open Banking ecosystems, RegTech and SupTech infrastructures, cybersecurity risks, and ESG oriented financial innovation, which increasingly blur traditional boundaries between technological innovation, governance, and financial intermediation.

To address this fragmentation, this study conducts a theory guided systematic literature review (SLR) integrating bibliometric analysis, co-citation analysis, keyword co-occurrence analysis, and theory driven thematic synthesis to examine FinTech research in banking between 2019 and 2024. By combining quantitative intellectual mapping with theoretical interpretation, the study investigates the evolution of research clusters, the relationship between technological and regulatory transformations, and unresolved conceptual and empirical gaps. This approach enables the development of a theory informed research agenda beyond descriptive literature mapping.

First, the study contributes theoretically by integrating Innovation Diffusion Theory, Disruptive Innovation Theory, and Platform Ecosystem Theory into a multi-level framework. By connecting perspectives traditionally examined separately, the framework explains how FinTech adoption, competitive restructuring, and ecosystem transformation interact. Second, it contributes methodologically by combining bibliometric analysis with theory driven thematic synthesis, moving beyond descriptive mapping toward interpretation of the field's intellectual structure. Third, it identifies dominant research clusters and examines their evolution from technology adoption toward AI enabled finance, governance, sustainability, and ecosystem collaboration. Fourth, it develops a theory informed research agenda addressing unresolved questions in adoption, competition, regulation, AI governance, cybersecurity, and financial stability.

The paper is structured as follows: [Section 1](#) presents the introduction; [Section 2](#) provides the background of the study; [Section 3](#) describes the research methodology. [Section 4](#) presents the results and analysis, including the cluster analysis. [Section 5](#) presents the research agenda. Finally, [Section 6](#) concludes the study.

2. Background

2.1 *FinTech and bank profitability*

The relationship between FinTech development and bank profitability remains one of the most debated themes within contemporary banking research. Early studies frequently portrayed

FinTech firms as disruptive competitors capable of reducing traditional banking revenues through digital payments, platform lending, and alternative financial services (Christensen *et al.*, 2015; Vives, 2019; Thakor, 2020). From this perspective, FinTech expansion intensifies competitive pressures, weakens fee-based income streams, and challenges established intermediation models. Empirical evidence supports this concern, as growth in FinTech credit markets has been associated with lower profitability among traditional banking institutions, particularly in highly concentrated banking sectors where alternative lending channels directly compete with incumbent providers (Hodula, 2022; Gopal & Schnabl, 2022). Similarly, studies examining commercial banks suggest that FinTech development may place pressure on profitability by intensifying competition and challenging traditional sources of revenue generation (Phan, Narayan, Rahman, & Hutabarat, 2020; Nguyen, Tran, & Ho, 2022). The divergent findings reflect two opposing mechanisms. FinTech lowers operational costs through digitalization and automation, but it may also erode revenues through competition from digital lenders and payment platforms.

In contrast, a growing body of literature argues that FinTech adoption enhances profitability through operational efficiency, digital service innovation, automation, and improved customer engagement (Wang *et al.*, 2021a, b, c; Zhao *et al.*, 2022). Digital payment systems, e-banking platforms, and data driven decision-making tools reduce transaction costs while enabling banks to expand service accessibility and improve resource allocation. Studies examining technology spillover effects suggest that banks increasingly benefit from FinTech innovation as digital capabilities become integrated into organizational processes and business models (Chen, Wu, & Yang, 2019; Lee, Li, Yu, & Zhao, 2021). Furthermore, the literature increasingly suggests that digitalization and electronic payment infrastructures are among the most frequently identified drivers of improved banking performance (Thakor, 2020; Alaassar, Mention, & Aas, 2023).

These contrasting findings suggest that the relationship between FinTech and profitability is neither uniformly positive nor negative. FinTech rarely produces immediate performance gains. Competitive pressures often challenge incumbent banks initially, while later adaptation and technological integration create new sources of value. Recent research therefore views profitability as contingent on digital capabilities, market structure, regulation, and adaptation capacity rather than FinTech adoption alone (Frost, Gambacorta, & Huang, 2023).

From a Dynamic Capabilities perspective, profitability outcomes depend on banks ability to adapt and integrate FinTech innovations (Teece, 2007). Divergent findings may reflect differences in digital maturity, regulation, and banking structures across banking systems (Phan *et al.*, 2020; Lee *et al.*, 2021; Nguyen *et al.*, 2022).

2.2 FinTech and risk taking

The relationship between FinTech innovation and risk taking has emerged as a central debate within banking research. Existing research suggests that digital technologies enhance risk management capabilities by improving information processing, monitoring, and decision-making functions (IMF, 2019; Thakor, 2020). Artificial intelligence, machine learning, and algorithmic credit assessment systems enable banks to analyze large volumes of data, strengthen fraud detection, automate compliance activities, and improve predictive risk modelling (IMF, 2019; Rahman, Ming, Baigh, & Sarker, 2023). Similarly, digital lending platforms and alternative data sources may reduce information asymmetries and improve borrower evaluation, thereby supporting more efficient credit allocation (Berg, Burg, Gombović, & Puri, 2020; Thakor, 2020).

However, recent research challenges the assumption that technological innovation necessarily reduces risk (Cevik, 2024; Saklain, 2024). While advanced analytics improve predictive capabilities, they also introduce new governance and systemic vulnerabilities (Aldaroso *et al.*, 2025; Brown & Piroška, 2022). Studies highlight concerns regarding algorithmic bias, limited model explainability, data privacy risks, and increasing dependence

on complex technological infrastructures (Kshetri, 2024; Vučinić and Luburić, 2024). Similar concerns apply to blockchain technologies, whose adoption remains constrained by governance, cybersecurity, and regulatory challenges (Kowalski, Lee, & Chan, 2021). The emergence of generative AI has further intensified concerns surrounding accountability, supervisory oversight, and operational resilience within increasingly digitalized financial systems (Aldasoro *et al.*, 2025; Kshetri, 2024; Devabe, 2024). These opposing effects suggest that FinTech reshapes risk through a dual mechanism: it improves risk identification and monitoring through advanced analytics, while simultaneously increasing exposure to model risk, cyber risk, and governance fragility arising from algorithmic opacity and technological complexity.

These contrasting findings suggest that FinTech simultaneously mitigates traditional banking risks while creating new technological and governance related vulnerabilities (Thakor, 2020; Cevik, 2024; Saklain, 2024). Rather than simply reducing risk, FinTech shifts attention from traditional credit and operational risks toward cybersecurity, algorithmic governance, and data related vulnerabilities. Consequently, recent research increasingly conceptualizes risk management as a co-evolutionary process in which technological innovation and governance mechanisms must develop in parallel to ensure financial stability and institutional resilience (Brown & Piroška, 2022; Vučinić & Luburić, 2024; Aldasoro *et al.*, 2025).

The divergence in findings may reflect differences in institutional contexts and technological maturity. Studies in mature financial systems often report improved risk monitoring, whereas research on emerging technologies highlights governance and supervisory challenges. From a Dynamic Capabilities perspective, FinTech outcomes depend on firms ability to adapt and reconfigure technological resources (Teece, 2007). Banks possessing stronger digital capabilities may leverage FinTech innovations to enhance risk assessment and monitoring, thereby reducing exposure to traditional financial risks. However, Socio Technical Systems Theory suggests that technological outcomes depend on the alignment between technology, governance, regulation, and human oversight (Baxter & Sommerville, 2011).

2.3 FinTech and financial inclusion

Financial inclusion is one of the most widely examined outcomes of FinTech development in banking. Traditional financial systems have long been constrained by information asymmetries, high transaction costs, and limited physical outreach, restricting access to financial services among small businesses and underserved populations (Bollaret, Silanes and Schwienbacher, 2021). FinTech innovations seek to address these barriers through digital lending platforms, mobile payment systems, algorithmic credit assessment, and alternative data sources that expand access to payments, savings, credit, and insurance services (Kowalewski & Pisany, 2023; Lagna & Ravishankar, 2022).

A substantial body of research suggests that FinTech contributes positively to financial inclusion by reducing transaction costs and extending financial services beyond traditional banking networks. Mobile payments, platform based financing, and digital financial services enable broader participation in formal financial systems while improving the efficiency of service delivery (IMF, 2019). Empirical evidence further indicates that smartphone penetration plays a significant role in facilitating digital financial adoption, highlighting the importance of technological accessibility in expanding inclusion outcomes (Liu, Li, & Wang, 2020; Demirgüç-Kunt, Klapper, Singer, Ansar, & Hess, 2020; Jünger & Mietzner, 2020). From a transaction cost perspective, these innovations improve information transmission and reduce search and verification costs, thereby supporting more efficient financial intermediation (Thakor, 2020).

However, the literature also indicates that the benefits of FinTech are not uniformly distributed. While many studies emphasize its potential to democratize access to financial

services, others demonstrate that inclusion outcomes vary considerably across countries and institutional settings. Differences in digital infrastructure, internet availability, regulatory support, and consumer trust significantly influence adoption patterns and the effectiveness of FinTech initiatives (Kowalewski & Pisany, 2023; Baber, 2020; Senyo & Osabutey, 2020). This suggests that FinTech driven inclusion may be simultaneously expansionary and exclusionary, reinforcing a digital divide paradox in which aggregate access improves while relative exclusion persists for structurally disadvantaged groups.

From a theoretical perspective, the relationship between FinTech and financial inclusion can be understood through Financial Intermediation Theory, which suggests that financial institutions create value by reducing information asymmetries and transaction costs between savers and borrowers (Thakor, 2020). FinTech innovations extend this intermediation function through digital platforms, alternative data sources, and automated processes that broaden access to financial services for previously underserved populations. However, socio technical perspectives emphasize that inclusion outcomes depend not only on technological availability but also on supporting infrastructure, regulatory frameworks, and users ability to adopt and effectively utilize digital financial services (Baxter & Sommerville, 2011). FinTech driven inclusion is shaped by interactions among technology, regulation, infrastructure, and user adoption.

2.4 FinTech collaboration vs competition

The relationship between FinTech firms and incumbent banks represents one of the most contested themes within contemporary banking research. Early discussions frequently portrayed FinTech as a disruptive force capable of challenging traditional banking models through digital lending platforms, mobile payment systems, embedded finance solutions, and data driven service delivery. From a disruptive innovation perspective, FinTech firms benefit from scalable, asset light business models, advanced data analytics, and lower operational costs, enabling them to compete with banks in areas traditionally dominated by financial intermediaries (Thakor, 2020). Digital payment innovations, in particular, have been associated with the erosion of traditional fee-based revenue streams and the transfer of customer interface control from incumbent banks to technology enabled platforms (Kowalewski & Pisany, 2023). These developments have fuelled concerns regarding banking disintermediation and the long-term competitive position of traditional financial institutions.

However, empirical evidence provides only limited support for the view that FinTech will fully replace incumbent banks. A growing body of research suggests that FinTech driven transformation increasingly occurs through collaboration rather than direct substitution. Banks retain important structural advantages, including access to insured deposits, established customer relationships, regulatory protections, and institutional legitimacy, which continue to provide competitive resilience (Boot, Hoffmann, Laeven, & Ratnovski, 2021; Thakor, 2020). Consequently, many financial institutions have responded through strategic partnerships, acquisitions, white label arrangements, and joint platform development initiatives that integrate FinTech capabilities into existing banking operations (Boot *et al.*, 2021). Similar patterns are evident in blockchain adoption, where distributed ledger technologies have largely been incorporated into existing organizational and regulatory structures rather than replacing traditional intermediaries (Bollaret, Silanes and Schwiendbacher, 2021). This coexistence reflects a structural interdependence within platform based financial ecosystems, where FinTech firms compete in customer facing innovation while relying on banks regulatory, balance sheet, and settlement infrastructure, resulting in hybrid competition collaboration dynamics rather than pure substitution. This implies that FinTech competition cannot be analytically separated from collaboration, as ecosystem interdependence transforms rivalry into a co-specialization process rather than a zero-sum competitive dynamic.

These contrasting findings suggest that the competitive implications of FinTech depend on broader ecosystem and institutional dynamics. From a platform ecosystem perspective, financial services increasingly operate through interconnected networks linking banks, FinTech firms, merchants, technology providers, regulators, and consumers (Kowalewski & Pisany, 2023). Competitive advantage therefore derives not only from technological capabilities but also from effective ecosystem coordination and strategic positioning. Rather than producing wholesale displacement, recent evidence increasingly supports a process of hybridization in which competition and collaboration coexist simultaneously. FinTech firms exert competitive pressure on incumbent institutions while also serving as innovation partners that facilitate digital transformation. Consequently, contemporary research increasingly conceptualizes FinTech driven change as a process of co-evolution and ecosystem adaptation rather than a straightforward transition from traditional banking to technological disruption.

2.5 AI enabled banking transformation

Artificial intelligence has become a central force reshaping financial intermediation by transforming credit allocation, risk assessment, and operational decision making in banking systems. A growing body of empirical research demonstrates that machine learning methods significantly improve predictive accuracy in credit risk modelling by incorporating large scale and high dimensional datasets that extend beyond traditional financial variables. For instance, evidence from mortgage and consumer lending markets shows that algorithmic models outperform conventional scoring techniques in predicting default risk, thereby reducing informational asymmetries and improving credit allocation efficiency (Fuster, Plosser, Schnabl, & Vickery, 2019; Berg *et al.*, 2020).

Despite these efficiency gains, the literature presents mixed evidence regarding the broader implications of AI adoption in banking. On one hand, studies suggest that AI driven lending technologies reduce processing costs, improve screening efficiency, and expand access to credit, particularly for previously underserved borrowers (Fuster *et al.*, 2019; Berg *et al.*, 2020). These findings support the view that AI enhances financial intermediation by lowering transaction costs and improving monitoring capabilities.

On the other hand, an emerging stream of research highlights that algorithmic lending systems may introduce new forms of risk, including model instability, opacity in decision making, and potential biases embedded in training data. Such issues raise concerns about fairness, accountability, and regulatory oversight in automated credit systems (Berg *et al.*, 2020). The mixed evidence reflects a fundamental trade-off between predictive efficiency gains and increased model opacity, where improvements in decision accuracy are accompanied by heightened concerns over explainability, fairness, and regulatory compliance. “AI therefore represents a shift from rule based financial intermediation to probabilistic decision-making systems, where performance gains are inseparable from interpretability and governance constraints, making outcomes inherently conditional rather than universally efficiency enhancing.”

A related literature further emphasizes the importance of interpretability in financial machine learning applications. While complex models such as deep learning architectures improve predictive performance, they often lack transparency, creating challenges for regulatory compliance and risk governance. Research on explainable machine learning suggests that interpretable models can improve trust and auditability in financial decision systems, although this may involve trade-offs with predictive accuracy (Rudin, 2019).

Overall, the literature suggests that artificial intelligence does not merely enhance existing banking activities but fundamentally transforms the mechanisms through which financial intermediation is conducted. While numerous studies highlight improvements in credit allocation, screening accuracy, data processing capabilities, and operational efficiency, other research identifies concerns relating to algorithmic bias, model opacity, and governance vulnerabilities (Berg *et al.*, 2020; Rahman *et al.*, 2023). These contrasting findings indicate

that the outcomes of AI adoption are highly contingent upon factors such as data quality, institutional capabilities, regulatory oversight, and the maturity of digital infrastructures. Consequently, recent research increasingly conceptualizes AI adoption as a transformative and context dependent process that reshapes decision making practices, organizational structures, and regulatory requirements within modern banking systems (Murinde *et al.*, 2022; Vučinić & Luburić, 2024).

This can be understood through Dynamic Capabilities Theory (Teece, 2007), which argues that sustainable competitive advantage depends not merely on technology acquisition but on an organizations ability to integrate, adapt, and continuously reconfigure technological resources. In the banking context, the effectiveness of AI therefore depends on how successfully institutions embed these technologies within existing risk management, governance, and decision-making frameworks. Similarly, socio technical perspectives (Baxter & Sommerville, 2011) emphasize that technological outcomes are shaped by the interaction between technical systems and organizational structures. From this perspective, the mixed evidence reported in the literature reflects differences not only in AI capabilities but also in governance arrangements, regulatory environments, and human oversight mechanisms. AI enabled banking transformation should therefore be viewed as a co-evolutionary process in which technological innovation and institutional adaptation develop jointly to support efficiency, fairness, and financial stability.

2.6 Emerging streams in FinTech and banking

Recent FinTech research increasingly extends beyond traditional concerns of profitability, risk taking, financial inclusion, and bank FinTech competition toward broader questions of governance, ecosystem coordination, and institutional resilience. This shift reflects the growing maturity of digital financial systems and the emergence of technologies that reshape interactions among banks, FinTech firms, regulators, and consumers.

One emerging stream concerns the governance of digital financial ecosystems, particularly through open banking and central bank digital currencies (CBDCs). Open banking initiatives enable third party access to financial data through application programming interfaces (APIs), promoting innovation, competition, and customer centric financial services (Jacobides *et al.*, 2018; Liu *et al.*, 2024). Similarly, CBDCs are expected to enhance payment efficiency and financial accessibility while supporting digital transformation within financial systems. However, recent studies suggest that these developments may also create new governance challenges relating to data ownership, privacy, cybersecurity, and the concentration of market power within platform-based ecosystems (Casolaro, Rauber, & Lima, 2025). From an ecosystem perspective, the benefits of greater connectivity and interoperability must therefore be balanced against risks associated with platform dependence and changing forms of financial intermediation (Jacobides *et al.*, 2018).

A second emerging stream focuses on responsible artificial intelligence and digital governance. While artificial intelligence, generative AI, and machine learning technologies have demonstrated significant potential for improving credit assessment, fraud detection, compliance monitoring, and customer service, growing concerns exist regarding algorithmic opacity, model bias, accountability, and cybersecurity vulnerabilities (Rudin, 2019; Kshetri, 2024). Recent research on generative AI further highlights risks associated with hallucinations, data privacy, and governance oversight in high stakes financial environments (Aldasoro *et al.*, 2025). These concerns have stimulated growing interest in explainable AI, which seeks to improve transparency and auditability while maintaining predictive performance. At the same time, RegTech and SupTech solutions increasingly employ advanced analytics and automation to strengthen compliance and supervisory capabilities. Nevertheless, the literature remains divided regarding whether technological advances can adequately mitigate the governance risks they simultaneously create. From a socio technical perspective, technological outcomes depend not only on algorithmic

sophistication but also on organizational structures and human actors within which technologies are embedded (Baxter & Sommerville, 2011).

A third emerging stream concerns sustainable and transparent digital finance. Evidence suggests that Green FinTech applications can support ESG assessment, climate risk monitoring, and sustainable investment allocation through enhanced data analytics and digital reporting systems (Mirza, Umar, Afzal, & Firdousi, 2023). Similarly, blockchain enabled accounting systems and digital accounting transformation initiatives are expected to improve transparency, auditability, and the real time verification of financial information. However, empirical evidence remains fragmented, and significant concerns persist regarding ESG measurement quality, greenwashing risks, implementation costs, and the long-term effectiveness of digital reporting infrastructures. From a Dynamic Capabilities perspective, the value of these technologies depends on organizations ability to integrate emerging digital tools into broader sustainability and governance strategies (Teece, 2007).

Collectively, these emerging streams converge toward a broader transformation in which financial systems are shifting from institution centred intermediation to digitally governed platform ecosystems. Across open banking, AI governance, CBDCs, RegTech, and sustainable finance, a common tension emerges between innovation and control, where technological advancement simultaneously enhances efficiency and connectivity while increasing systemic complexity, data governance challenges, and regulatory demands.

Collectively, these emerging streams indicate that FinTech research is evolving from a primary focus on efficiency and technological disruption toward broader debates concerning governance, transparency, sustainability, and systemic resilience. Consequently, future research should increasingly examine how technological innovation interacts with institutional adaptation, regulatory oversight, and ecosystem governance in shaping the long-term evolution of banking systems.

2.7 Integrative thematic synthesis

The thematic review reveals that FinTech is not merely a technological innovation but a transformative force reshaping the banking sector across multiple dimensions. The literature consistently demonstrates that FinTech influences bank performance, financial inclusion, risk management, competitive dynamics, and organizational transformation. However, the direction and magnitude of these effects remain contingent upon institutional, technological, and regulatory conditions.

Across the reviewed themes, a common pattern emerges. FinTech technologies improve efficiency, expand financial access, and enhance data driven decision making, thereby creating opportunities for greater profitability and service innovation. At the same time, these technologies introduce new challenges related to cybersecurity, algorithmic governance, regulatory compliance, and operational resilience. Consequently, the impact of FinTech cannot be understood as uniformly positive or negative.

The review further suggests that contradictory findings reported in prior studies are largely explained by differences in digital maturity, regulatory environments, banking structures, and organizational capabilities. Banks with stronger technological capabilities and adaptive strategies are more likely to benefit from FinTech innovation, whereas institutions with limited digital readiness may experience increased competitive pressure and technological risk.

Overall, the literature points toward a co-evolutionary relationship in which FinTech innovation, banking institutions, and regulatory systems develop simultaneously. This perspective provides the foundation for the conceptual framework proposed in the following section.

Figure 1 presents the conceptual framework derived from the thematic synthesis of the reviewed literature. The framework positions digital transformation as the primary driver of FinTech innovation within the banking sector. Advances in artificial intelligence, big data

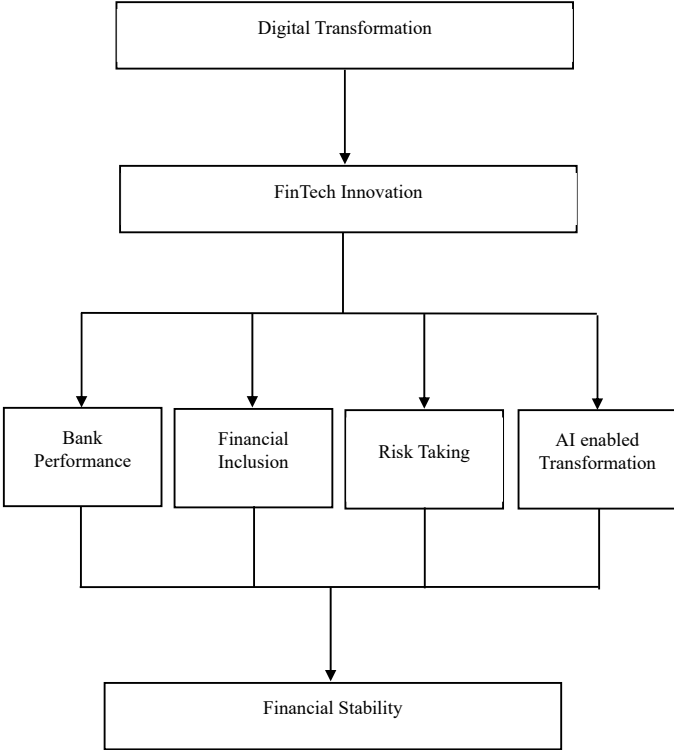


Figure 1. The proposed framework of FinTech and bank determinants in literature

analytics, blockchain, cloud computing, and digital platforms have accelerated the integration of technology into banking operations and business models.

The framework further proposes that FinTech innovation influences three key dimensions of banking outcomes: bank performance, financial inclusion, and risk taking. Existing studies suggest that FinTech can improve operational efficiency, reduce transaction costs, and enhance customer engagement, thereby contributing to improved performance. Simultaneously, digital financial services expand access to financial products and support financial inclusion. However, FinTech may also alter banks risk profiles by introducing new technological, cybersecurity, and governance challenges.

These dimensions collectively influence financial stability. While improvements in performance and inclusion may strengthen the resilience of financial systems, excessive risk taking and inadequate governance mechanisms may generate new vulnerabilities. The framework therefore conceptualizes FinTech as a transformative but contingent force whose outcomes depend on the interaction between technological innovation, organizational capabilities, and regulatory environments.

3. Methodology

This study employs a theory guided systematic literature review (SLR) combined with bibliometric analysis to map and interpret the intellectual structure of FinTech research in banking during the 2019–2024 acceleration phase. The review follows the structured three stage framework proposed by [Tranfield, Denyer, and Smart \(2003\)](#), consisting of planning the

review, conducting the review, and reporting and dissemination (Figure 2). Consistent with established SLR standards in management research, the procedure emphasizes transparency, replicability, and explicit documentation of search strategies, screening procedures, and analytical parameters.

The bibliometric component is embedded within the multi-level theoretical framework developed in the introduction, integrating innovation diffusion theory, disruptive innovation theory, and platform ecosystem theory. This theoretical anchoring guides cluster interpretation, temporal analysis, and research gap identification. The review process was structured in accordance with the PRISMA 2020 reporting framework, including documentation of identification, screening, eligibility, and inclusion stages. This protocol enhances transparency, reproducibility, and consistency with systematic review best practices.

3.1 Planning the review

The planning stage established the conceptual scope, theoretical positioning, database selection, search strategy, and inclusion criteria prior to data collection. The review was designed to address three interrelated research questions: (1) How is FinTech research in banking intellectually and theoretically structured during the 2019–2024 period? (2) How have thematic clusters evolved in response to intensified technological adoption, AI integration, and regulatory transformation? (3) What theory informed conceptual and empirical gaps emerge across clusters, and how can these gaps inform a focused research agenda and actionable implications for banking stakeholders? These questions directly align

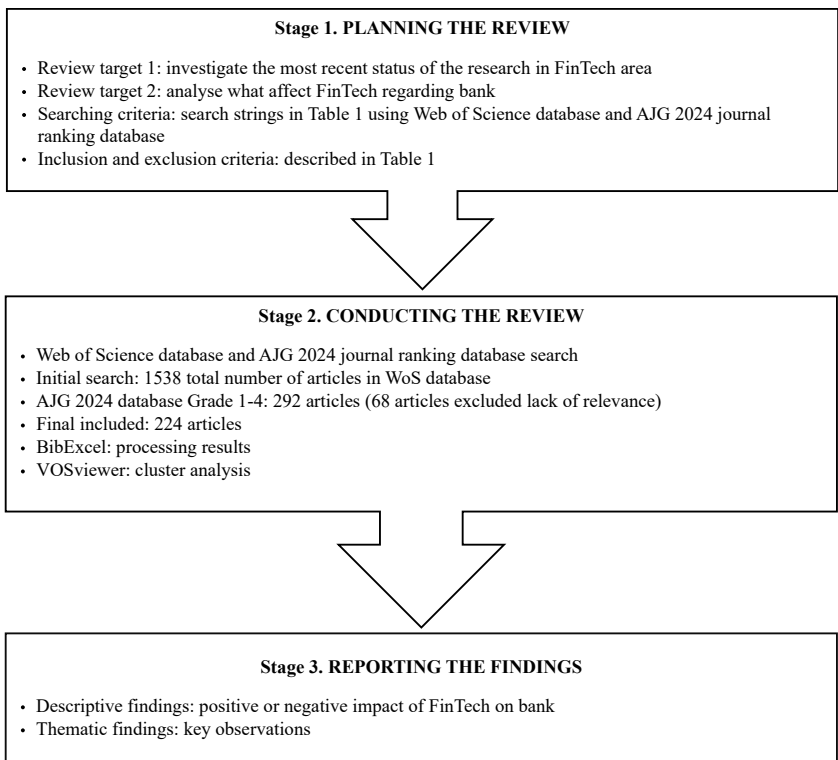


Figure 2. The review process based on [Tranfield et al. \(2003\)](#)

with the multi-level interpretive architecture developed earlier, ensuring coherence between theoretical framing and empirical mapping.

The Web of Science Core Collection was selected as the primary database due to its rigorous indexing standards, structured citation metadata, and compatibility with bibliometric analysis software. Web of Science provides standardized citation linkages that facilitate co-citation analysis and intellectual structure mapping.

To assess potential database related bias, a supplementary search was conducted in Scopus using identical search terms, document type restrictions, language filters, and publication years. Comparison of the resulting records indicated substantial overlap with the Web of Science corpus and no material differences in the dominant thematic clusters, co-citation structures, or temporal patterns. Given this convergence, Web of Science was retained as the primary analytical database while Scopus served as a robustness verification source.

To ensure quality control and academic rigour, retrieved records were cross referenced with the Academic Journal Guide 2024 (AJG 2024). The dataset was restricted to journals listed in the AJG, encompassing outlets rated from one star to four star categories. This approach established a transparent and replicable quality threshold while ensuring inclusion of peer reviewed publications recognized within management, finance, and information systems research. Although ranking based filtering may exclude some emerging journals, it reduces heterogeneity in publication standards and is consistent with established review practices in management research.

Quality assurance was achieved through inclusion of peer reviewed journal articles, AJG based journal screening, predefined inclusion and exclusion criteria, and independent verification of screening decisions. Formal study level quality scoring was not conducted because the objective was intellectual structure mapping rather than effect size synthesis.

The search strategy was constructed iteratively to balance comprehensiveness and precision (Table 1). The search was conducted using the Web of Science Core Collection database. The following citation indexes were included: Social Sciences Citation Index (SSCI), Science Citation Index Expanded (SCI EXPANDED), and Emerging Sources Citation Index (ESCI). The search was executed using the Topic field (TS), which includes titles, abstracts, author keywords, and Keywords Plus. The complete search query was defined as: TS = (“FinTech” OR “Financial Technology”) AND (“Bank” OR “Banking” OR “Commercial Bank*”) The wildcard operator (*) was used to capture plural and related word forms. Database filters were applied to restrict results to English language journal articles

Table 1. Search strings, filters, and selection criteria

Search strings	Search filters	Inclusion criteria	Exclusion criteria
• FinTech • Bank	• Web of Science database • Search period: 2019–2024 • Search in: title, abstract, or the keywords list • Document type: international peer-reviewed journal • Journal quality: Academic Journal Guide 2024 • Language: English	• Only grade 1–4 journals (AJG, 2024) • Articles investigating FinTech and bank • Articles investigating how FinTech affects bank performance and bank operations • Articles focused on positive aspects and negative aspects regarding financial technology	• Journal field and discipline: business history, marketing, organization study, psychology, public sector, regional studies, sector studies, social sciences

Source(s): Authors’ own elaboration

published between 2019 and 2024, ensuring temporal consistency and comparability across records. The selected timeframe reflects the acceleration phase of FinTech enabled banking transformation characterized by pandemic induced digital adoption, expansion of open banking regimes, proliferation of regulatory sandboxes, and intensified AI integration into core banking functions.

To assess the robustness of the search strategy, an additional sensitivity search was conducted using an expanded set of keywords frequently associated with FinTech enabled banking research, including “digital banking,” “open banking,” “RegTech,” “AI banking,” “blockchain finance,” “digital finance,” and “neobanks.” These terms were incorporated through Boolean combinations and applied using the same database, language, document type, and period restrictions. Although the expanded search identified a limited number of additional records, comparison of the resulting corpus with the primary dataset revealed substantial overlap in the most influential publications, co-citation structures, and thematic clusters. The substantial overlap between both datasets indicates that the core intellectual structure of FinTech banking research is robust and not materially dependent on specific search terminology. Therefore, the original search strategy was retained as the primary analytical dataset, while the expanded search served as a robustness check.

Inclusion and exclusion criteria (Table 1) were defined ex ante to minimize selection bias. Articles were included if they explicitly examined interactions between FinTech innovations and banking institutions, banking performance, risk management, regulation affecting banks, or ecosystem level coordination involving banks and FinTech firms. Studies focussing exclusively on cryptocurrency price dynamics, purely technical blockchain architecture without banking context, or financial technology applications unrelated to banking institutions were excluded. Conference proceedings and book chapters were excluded to maintain consistent peer review standards. These criteria ensure conceptual relevance while preserving analytical focus on the FinTech banking nexus.

3.2 Conducting the review

The execution stage followed a structured screening process designed to ensure transparency and replicability (Figure 3). The initial Web of Science search yielded 1538 records. After restricting to English language publications, 1512 records remained. Exclusion of non-article document types (149 proceedings papers and 37 book chapters) reduced the dataset to 1326 records. Application of the 2019–2024 time filter further reduced the sample to 395 articles. Cross referencing with the AJG 2024 list resulted in 292 articles. Title and abstract screening based on predefined inclusion and exclusion criteria produced the final sample of 224 articles. This selection process followed a structured PRISMA 2020 flow (identification, screening, eligibility, and inclusion), ensuring transparent tracking of dataset refinement. Articles were assessed for relevance to the FinTech banking nexus, with ambiguous cases re-examined prior to final inclusion decisions. In cases of uncertainty, articles were re-evaluated against the inclusion criteria to ensure consistent application across the dataset.

Bibliometric analysis was conducted using BibExcel and VOSviewer. Co-citation analysis was employed to identify the intellectual foundations of the field by examining how frequently pairs of references are cited together within the dataset. Full counting was applied to ensure equal weight across citations, and minimum citation thresholds were established to exclude marginal references while preserving structural integrity of the network. Thresholds were determined iteratively based on network density and interpretability considerations to ensure meaningful network visualization.

Keyword co-occurrence analysis was performed using VOSviewer to identify thematic clusters and assess their stability. Author keywords and Keywords Plus were included to capture both conceptual framing and database generated indexing terms. Association strength normalization was applied to correct for frequency imbalances and ensure proportional representation of relationships between terms. A minimum occurrence threshold was defined

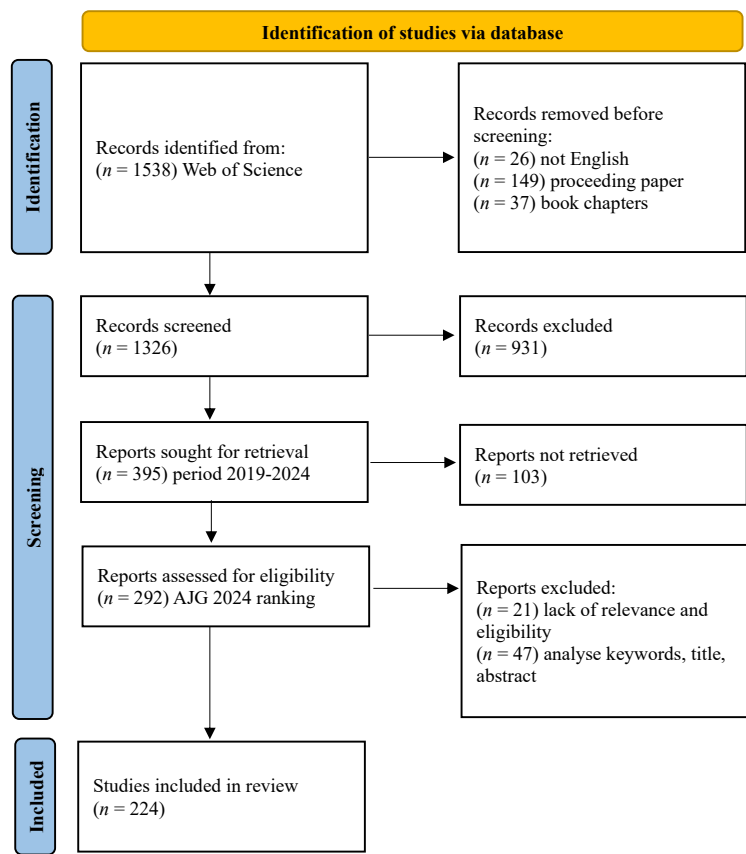


Figure 3. Conducting the review based on PRISMA (Stage 2)

to remove low frequency keywords that do not contribute to stable cluster formation. Sensitivity testing was conducted by adjusting thresholds to confirm stability of cluster structures. Clusters were interpreted through iterative reading of core articles within each grouping to ensure conceptual coherence rather than reliance solely on algorithmic proximity.

Temporal overlay analysis was conducted to examine shifts in keyword prominence across the 2019–2024 period. This enabled identification of emergent themes, particularly AI governance, digital risk modelling, and ecosystem regulation, and allowed examination of how cluster composition evolved during the acceleration phase. By integrating quantitative mapping with theory guided qualitative interpretation, the analysis moves beyond descriptive visualization toward explanatory synthesis. This temporal mapping enables examination of how technological, regulatory, and organizational dynamics co evolve within the FinTech banking research landscape.

To enhance reliability, a subset of screening and classification decisions was independently reviewed by the co-author. Any discrepancies were resolved through discussion and consensus, reducing the likelihood of subjective bias.

Following bibliometric network construction, thematic coding was conducted through an iterative qualitative interpretation process. For each cluster, the most central keywords, strongest link strengths, and highly cited publications were examined together. Cluster labels were derived through close reading of representative articles (titles, abstracts, keywords, and

full texts where necessary), ensuring that themes reflected substantive conceptual content rather than algorithmic proximity.

Cluster interpretation followed a theory-guided procedure. Innovation diffusion theory informed interpretation of adoption-oriented clusters, disruptive innovation theory guided analysis of competition and market restructuring themes, and platform ecosystem theory informed clusters related to governance, collaboration, and interorganizational relationships. Theoretical interpretation was therefore used as an analytical lens through which bibliometric structures were examined rather than allowing cluster meaning to emerge solely from algorithmic grouping.

Reliability was enhanced through transparent documentation, independent verification, and sensitivity testing of bibliometric thresholds. Validity was supported through triangulation across co-citation analysis, keyword co-occurrence analysis, temporal overlay analysis, and theory guided thematic interpretation.

3.3 Reporting the findings

Findings are presented in two complementary stages. First, descriptive bibliometric evidence is reported, including publication trends, journal distribution, geographical patterns, and methodological characteristics of the literature. Second, co-citation, keyword co-occurrence, and temporal overlay analyzes are used to identify the dominant thematic clusters and examine their evolution over time. These findings are then interpreted through the study's theoretical framework to derive research gaps and future research directions. The descriptive analysis outlines the development and composition of FinTech banking research, while bibliometric techniques reveal its intellectual structure, thematic organization, and emerging trajectories.

The thematic findings are organized according to the clusters derived from keyword co-occurrence analysis and supported by co-citation and temporal pattern evidence. Each cluster is examined in terms of its dominant concepts, key contributions, and theoretical implications, enabling integration of bibliometric evidence with theory informed interpretation.

4. Results and analysis

This chapter presents the empirical findings derived from the co-citation and cluster analyzes conducted in the field of financial technology (FinTech) and banking. It first examines the 25 most frequently co-cited publications ([Appendix 1](#)), thereby identifying the foundational works that have shaped the intellectual structure of FinTech banking research. In addition, the analysis highlights the 50 most influential recent contributions published between 2019 and 2024 ([Appendix 2](#)), capturing major developments in the field.

Specifically, it explores patterns of keyword co-occurrence and author keyword co-occurrence, elucidating the thematic configurations and conceptual linkages that characterize the literature. Together, these analyzes identify the principal research streams and their interrelationships within FinTech banking research. Unlike prior bibliometric reviews that treat co-citation and keyword mapping as separate descriptive exercises, this study integrates these analyzes within a multilevel theoretical architecture. This enables identification not only of dominant themes but of structural fragmentation and under theorized intersections.

4.1 Co citation analysis

To uncover the intellectual foundations of FinTech research in banking, a co-citation analysis was conducted using BibExcel on a corpus of 224 Web of Science indexed articles published between 2019 and 2024. To focus on structurally central contributions, a threshold was applied at the inflection point of the citation frequency distribution. This yielded the 25 most frequently co-cited publications presented in [Table 2](#). Association strength normalization was employed to reduce size bias, and the resulting network was cross validated in VOSviewer to confirm cluster stability and relational coherence. The co-citation patterns are interpreted

Table 2. The most frequently cited publications in FinTech and bank

Rank	Publication	Source	Total citation
1	Buchak et al. (2018)	<i>Journal of Financial Economics</i>	68
2	Fuster et al. (2019)	<i>Review of Financial Studies</i>	58
3	Cheng and Qu (2020)	<i>Pacific-Basin Finance Journal</i>	37
4	Zhao et al. (2022)	<i>Journal of International Money and Finance</i>	37
5	Hornuf et al. (2021)	<i>Small Business Economics</i>	36
6	Wang et al. (2021a, b, c)	<i>Research in International Business and Finance</i>	34
7	Phan et al. (2020)	<i>Pacific-Basin Finance Journal</i>	33
8	Wang et al. (2021a, b, c)	<i>European Journal of Finance</i>	30
9	Chen et al. (2019)	<i>Review of Financial Studies</i>	29
10	Lee and Shin (2018)	<i>Business Horizons</i>	29
11	Jagtiani and Lemieux (2018)	<i>Journal of Economics and Business</i>	28
12	Berg et al. (2020)	<i>Review of Financial Studies</i>	27
13	Haddad and Hornuf (2019)	<i>Small Business Economics</i>	22
14	Sheng (2021)	<i>Finance Research Letters</i>	20
15	Li, Spigt, and Swinkels (2017)	<i>Financial Innovation</i>	20
16	Laeven and Levine (2009)	<i>Journal of Financial Economics</i>	19
17	Murinde et al. (2022)	<i>International Review of Financial Analysis</i>	17
18	Vallee and Zeng (2019)	<i>Review of Financial Studies</i>	16
19	Drasch et al. (2018)	<i>Journal of Economics and Business</i>	16
20	Iyer, Khwaja, Luttmer, and Shue (2016)	<i>Management Science</i>	15
21	Demirgüç-Kunt and Huizinga (2010)	<i>Journal of Financial Economics</i>	15
22	Auer and Stijn Claessens (2018)	<i>BIS Quarterly Review</i>	15
23	Degryse and Ongena (2005)	<i>Journal of Finance</i>	14
24	Beck et al. (2013)	<i>Journal of Financial Intermediation</i>	14
25	Banna et al. (2021)	<i>Journal of International Financial Markets, Institutions and Money</i>	14

Source(s): Authors' compilation based on literature analysis

through financial intermediation, platform ecosystem, and institutional adaptation perspectives to identify the theoretical foundations shaping contemporary FinTech banking research.

The co-citation structure reveals three interconnected yet analytically distinct intellectual streams. The first and most central stream is anchored in research examining the structural transformation of financial intermediation. Highly co-cited studies such as [Buchak, Matvos, Piskorski, and Seru \(2018\)](#) and [Fuster et al. \(2019\)](#) occupy pivotal positions in the network, reflecting their foundational role in conceptualizing FinTech as a force reshaping traditional banking boundaries through marketplace lending, shadow banking mechanisms, and platform-based credit allocation. This stream draws primarily on financial intermediation theory and platform ecosystem logic, framing FinTech either as a substitute for traditional banks under a disintermediation hypothesis or as a technological complement that reconfigures cost structures and expands market reach. The density of co-citations surrounding these works indicates that early research area predominantly framed FinTech as competitive reconfiguration rather than institutional co-evolution, a framing that continues to anchor subsequent debates.

A second concentration of highly co-cited contributions focuses on bank performance, operational efficiency, and evolving risk exposures. Frequently co-cited studies such as [Cheng and Qu \(2020\)](#), [Wang et al. \(2021a, b, c\)](#), and [Zhao et al. \(2022\)](#) share an analytical orientation toward measuring profitability dynamics, cost efficiency gains, credit risk modelling improvements, and financial stability implications in digitally transforming banks. This

stream engages more directly with efficiency stability trade off frameworks and risk-shifting theories, reflecting a sustained scholarly debate regarding whether FinTech enhances systemic resilience through improved analytics and cost reduction or introduces new vulnerabilities through cyber risk, algorithmic opacity, and liquidity fragmentation. Unlike the transformation focused literature, this body of work operationalizes FinTech's impact through empirical performance metrics, positioning innovation as a measurable intervention in bank level outcomes and systemic stability.

A third intellectual concentration centres on regulatory frameworks, financial inclusion, and institutional co-evolution. Frequently co-cited works such as [Hornuf, Klus, Lohwasser, and Schwienbacher \(2021\)](#) and [Erel and Liebersohn \(2022\)](#) conceptualize FinTech within post crisis regulatory reforms, capital requirements, and supervisory innovation mechanisms. This stream reflects institutional theory and regulatory innovation perspectives, emphasizing that technological change is embedded within evolving governance ecosystems rather than operating as an exogenous market disruption. The centrality of these studies demonstrates that oversight structures, compliance architectures, and inclusion dynamics are integral to the intellectual development of the field.

Beyond thematic identification, the co-citation network reveals a broader structural characteristic: the field exhibits intellectual expansion without full theoretical integration. Although transformation, performance, and regulatory perspectives are connected through shared references, they remain segmented in their core assumptions, methodological designs, and outcome variables. Structural transformation studies rarely incorporate formal financial stability modelling; performance-oriented research often abstracts from platform ecosystem dynamics; and regulatory analyzes tend to prioritize institutional design while under examining operational bank level consequences. This limited bridging across streams suggests that FinTech banking research is developing along parallel theoretical trajectories rather than converging toward an integrated explanatory framework. Such segmentation helps explain the persistent divergence in conclusions regarding FinTech net effects on competition, stability, and institutional adaptation.

The co-citation structure further suggests an underlying causal logic linking the three dominant intellectual streams. Rather than representing isolated research domains, the clusters can be interpreted as successive stages in the evolution of FinTech banking relationships. Foundational studies examining marketplace lending, digital platforms, and alternative credit allocation mechanisms, such as [Buchak et al. \(2018\)](#), [Fuster et al. \(2019\)](#), and [Jagtiani and Lemieux \(2018\)](#), focus on how technological innovation reshapes traditional financial intermediation structures. These structural transformations subsequently influence bank level outcomes, including operational efficiency, profitability, credit allocation, and financial stability, which are central concerns of studies such as [Cheng and Qu \(2020\)](#), [Wang et al. \(2021a, b, c\)](#), and [Zhao et al. \(2022\)](#). As new opportunities and vulnerabilities emerge, regulatory institutions respond through supervisory adaptation, compliance innovation, and governance reforms, reflected in the growing influence of [Hornuf et al. \(2021\)](#), [Haddad and Hornuf \(2019\)](#), and related contributions. Viewed collectively, the literature reflects a dynamic cycle in which technological disruption reshapes market structures, generates performance consequences, and ultimately necessitates institutional and regulatory responses. This interpretation provides a more integrated understanding of how FinTech developments influence banking systems over time.

The persistent divergence in empirical findings identified across the co-citation network can be partially explained by contextual and methodological heterogeneity. Studies using Chinese banking datasets frequently report positive effects of FinTech adoption on efficiency, financial inclusion, and competitiveness ([Phan et al., 2020](#); [Zhao et al., 2022](#)), whereas research conducted in more mature banking environments often reports mixed outcomes, emphasizing operational complexity, cybersecurity risk, market concentration, and regulatory uncertainty ([Berg et al., 2020](#); [Murinde et al., 2022](#)). Differences in institutional settings, regulatory frameworks, technological maturity, and measurement approaches further

contribute to these inconsistencies. Consequently, many apparent contradictions in the literature may reflect contextual variation rather than fundamentally competing theoretical explanations. This observation highlights the need for comparative and cross-country research designs capable of identifying the institutional conditions under which FinTech creates value while minimizing emerging risks.

Building upon the observed fragmentation of the literature, several integrative propositions emerge from the co-citation structure. First, the impact of FinTech on banking performance appears contingent upon the interaction between technological capabilities and institutional governance mechanisms rather than technological innovation alone. Second, efficiency gains derived from digital transformation are more likely to enhance financial inclusion and long-term competitiveness when accompanied by effective risk management, cybersecurity safeguards, and regulatory oversight. Third, collaborative platform ecosystems involving partnerships between incumbent banks and FinTech firms appear more likely to generate sustainable innovation outcomes than purely substitution-based models of competition. These propositions provide a conceptual bridge between transformation, performance, and governance perspectives and offer a foundation for future theory development within FinTech banking research. From a managerial perspective, the findings suggest that successful digital transformation requires balancing innovation objectives with governance capabilities, risk controls, and regulatory compliance structures.

Recent influential studies increasingly examine AI enabled financial services, Open Banking ecosystems, sustainability oriented digital finance, and cybersecurity resilience. These themes suggest a shift from disruption centred narratives toward broader concerns with governance, sustainability, and responsible innovation.

4.2 Cluster analysis

Network analysis and cluster analysis were conducted to support the investigation. These analyzes were performed on the full sample of 224 articles using VOSviewer. Two bibliometric indicators were calculated: (1) the co-occurrence of all keywords, and (2) the co-occurrence of authors keywords. [Figure 4](#) presents the cluster structure derived from the co-occurrence analysis of all keywords, illustrating the thematic groupings identified within the dataset.

4.2.1 Cluster based on most frequent all keyword co-occurrences. The keyword co-occurrence analysis ([Figure 4](#)) identifies six distinct thematic clusters via VOSviewer, reflecting the breadth and diversity of research topics situated at the intersection of financial technology (FinTech) and the banking sector. These clusters collectively illustrate the principal intellectual structures and research streams that characterize scholarly discourse within this rapidly evolving field.

These clusters represent distinct but related debates on how financial technology reshapes intermediation structures, organizational governance, adoption processes, and systemic stability. Collectively, they indicate a shift from traditional relationship-based banking toward data driven, platform oriented financial ecosystems.

Competition, risk taking, big data, governance, liquidity, and financial stability constitute the dominant themes of the first cluster. Evidence (e.g. [Cheng & Qu, 2020](#); [Wang et al., 2021a; b, c](#); [Banna, Hassan, & Rashid, 2021](#)) suggests that FinTech improves credit screening through data analytics and reduces information asymmetry, supporting efficiency and diversification. However, related studies also report increased liquidity risk and systemic fragility under intensified competition, consistent with earlier evidence on competition stability trade-offs ([Demirgüç-Kunt & Huizinga, 2010](#)). This indicates that FinTech produces simultaneous efficiency and stability effects depending on market structure.

A second cluster highlights the relationship between financial inclusion, shadow banking, blockchain, regulation, and post crisis credit intermediation. The literature shows that FinTech platforms can both complement and substitute traditional banking functions, particularly in

Figure 4. The 74 most frequent all keyword co-occurrences

SME and consumer credit markets (Lee & Shin, 2018; Jagtiani & Lemieux, 2018; Hornuf *et al.*, 2021; Murinde *et al.*, 2022). At the same time, the expansion of platform-based credit raises concerns about shadow banking and institutional boundary shifts (Beck, De Jonghe, & Schepens, 2013; Vallee & Zeng, 2019). Regulation is often treated as external to technological change rather than co-evolving with it, highlighting a persistent gap in explaining how supervisory frameworks adapt to platform based financial systems.

Adoption, trust, digital transformation, and the acceleration of digital banking during COVID 19 emerge as the central concerns of the third cluster. Grounded in Technology Acceptance and diffusion perspectives, it shows that perceived usefulness, ease of use, and trust shape FinTech uptake (e.g. [Drasch, Schweizer, & Urbach, 2018](#)). The COVID 19 shock accelerated digital banking adoption, particularly in retail and corporate segments. However, the evidence remains largely micro level and survey based, with limited connection to institutional or systemic outcomes, suggesting a narrow behavioural focus within this stream.

Another important stream of research examines FinTech credit, SME financing, supply chain finance, and AI driven lending. Studies indicate that alternative data and algorithmic credit scoring reduce informational frictions and improve access to finance, especially for SMEs (Chen *et al.*, 2019; Zhao *et al.*, 2022). However, emerging risks related to algorithmic opacity, bias, and procyclicality remain underexplored, particularly regarding borrower resilience and credit cycles. As a result, the broader macroeconomic implications of automated lending systems remain insufficiently developed.

Questions of bank performance, corporate governance, efficiency, and institutional heterogeneity dominate the fifth cluster. Evidence suggests that FinTech adoption improves operational efficiency but yields mixed profitability effects across banks, particularly among smaller or less digitally advanced institutions (Phan *et al.*, 2020; Zhao *et al.*, 2022).

Governance quality (Laeven & Levine, 2009) appears to moderate these outcomes, indicating that technological impact is conditioned by institutional capacity rather than technology alone. Overall, FinTech is increasingly interpreted as a capability building process rather than an exogenous performance driver.

The final cluster connects financial innovation with corporate social responsibility and broader financial inclusion objectives. It highlights the role of FinTech in expanding access to underserved populations and supporting inclusive finance objectives (Lee *et al.*, 2021). However, empirical evidence remains fragmented, and standardized measures of social and sustainability outcomes are still limited.

Taken together, the six clusters indicate that FinTech functions as a connecting mechanism linking financial intermediation, governance, adoption, and performance. The coexistence of positive and negative outcomes across clusters helps explain divergent findings in the literature. While studies focused on efficiency, innovation, and inclusion generally report beneficial effects, research examining competition and stability highlights risks related to market concentration, liquidity stress, and systemic fragility. These differences appear to reflect variations in institutional context and level of analysis rather than direct theoretical contradictions. Collectively, the findings suggest that FinTech outcomes depend not only on technological innovation but also on governance quality, regulatory effectiveness, and ecosystem collaboration, reinforcing the view that digital transformation is fundamentally an institutional as well as a technological process.

Several targeted research opportunities emerge from the cluster structure. Future studies should examine how regulatory frameworks co-evolve with platform-based financial ecosystems, investigate the long term effects of AI driven lending on credit cycles and financial stability, and develop multilevel models linking consumer adoption, organizational transformation, and systemic banking outcomes. Comparative cross country analyses would be particularly valuable for identifying the institutional conditions under which FinTech generates sustainable performance and inclusion benefits. From a managerial perspective, the findings suggest that banks should complement technology investments with governance capabilities, cybersecurity safeguards, and risk-management systems. FinTech firms may achieve more sustainable outcomes through partnership based ecosystem strategies rather than purely disruptive business models. For regulators, the results highlight the importance of adaptive supervisory frameworks capable of supporting innovation while maintaining financial stability.

4.2.2 Cluster based on most frequent authors keyword co-occurrences. The analysis of author defined keywords (Figure 5) reveals six distinct clusters that broadly align with the patterns identified in the previous section, while providing a clearer indication of the main research themes and disciplinary orientations.

The author keyword co-occurrence analysis identifies six interrelated domains in FinTech banking research. Rather than treating these clusters as parallel themes, this section interprets them as analytically distinct perspectives that together explain how digital finance reshapes banking systems across different levels of analysis.

The first cluster focuses on bank competition, risk-taking, blockchain, and financial stability, and is interpreted here as a structural tension perspective on FinTech development. This stream is grounded in charter value and risk-shifting theories, which suggest that intensified competition can reduce bank franchise value and increase incentives for risk taking. Empirical studies such as Cheng and Qu (2020) and Wang *et al.* (2020) indicate that FinTech improves credit screening and reduces information asymmetry through data driven lending models. However, these efficiency gains coexist with evidence of higher liquidity risk and potential systemic fragility under competitive pressure, consistent with Demirgüç-Kunt and Huizinga (2010).

Overall, this cluster highlights a persistent tension in the literature between efficiency improvements and financial stability concerns, showing that FinTech does not have uniform

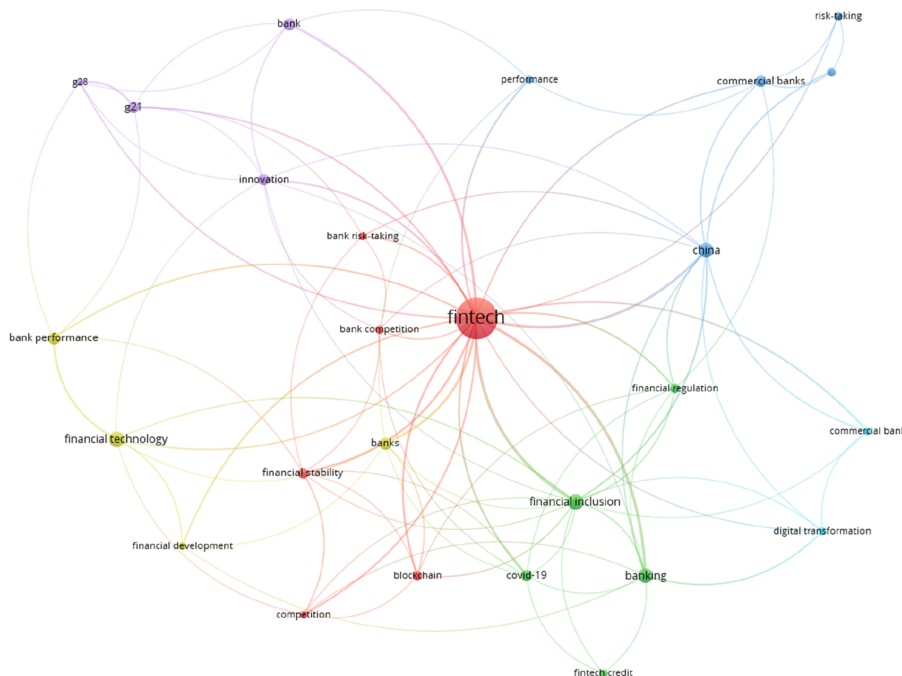


Figure 5. The 26 most frequent authors keyword co-occurrences

effects on banking systems. Unlike the other clusters, this stream is primarily concerned with system wide trade offs rather than institutional or behavioural mechanisms.

Building on the system level tensions identified above, the second cluster shifts attention to institutional boundaries and regulatory adaptation in digital finance. It includes financial inclusion, FinTech credit, blockchain, regulation, and COVID 19 effects. Studies such as [Banna et al. \(2021\)](#) and [Demirgüç-Kunt et al. \(2020\)](#) show that FinTech expands access to financial services, particularly in underserved markets, by lowering transaction costs and improving credit availability. At the same time, platforms increasingly blur the boundary between traditional banking and shadow banking activities ([Murinde et al., 2022](#)).

This cluster therefore reflects a dual dynamic: expansion of inclusion on one side, and regulatory uncertainty on the other. Rather than treating regulation as external, the evidence suggests it is increasingly embedded within the evolution of digital financial ecosystems. In contrast to the first cluster, the emphasis here is not on stability outcomes but on how institutional and regulatory frameworks adapt to technological change.

Moving from institutions to individuals, the third cluster focuses on adoption, trust, digital transformation, and COVID 19 driven behavioural change, and is interpreted as a micro level mechanism perspective. Rooted in Technology Acceptance and diffusion theories (e.g. [Drasch et al., 2018](#)), this literature explains FinTech usage through perceived usefulness, ease of use, and trust. The COVID 19 period accelerated digital banking adoption, particularly in retail and SME segments.

However, most evidence remains survey based and concentrated at the user level, with limited connection to organizational change or systemic banking outcomes. As a result, digital transformation is often conceptualized as an adoption decision rather than a structural transformation of banking institutions. Compared to the institutional focus of Cluster 2, this stream operates at the individual behavioural level and does not directly address system level

implications. Extending beyond adoption, the fourth cluster examines FinTech credit, SME financing, and AI-based lending, and is interpreted as an innovation mechanism perspective on credit allocation.

Studies such as [Chen et al. \(2019\)](#) and [Zhao et al. \(2022\)](#) show that alternative data and algorithmic credit scoring improve access to finance, particularly for SMEs, by reducing informational frictions. These innovations enhance efficiency in credit markets and expand lending capacity.

At the same time, emerging issues such as algorithmic opacity, bias, and procyclical lending are increasingly noted but remain less developed in empirical research. This suggests that while credit innovation is well documented, its systemic risk implications are still evolving. Unlike the behavioural focus of Cluster 3, this stream focuses on how digital technologies transform core banking functions, particularly lending mechanisms.

The fifth cluster focuses on bank performance, governance, and efficiency, and is interpreted as an organizational capability perspective. Evidence ([Phan et al., 2020](#); [Zhao et al., 2022](#)) shows that FinTech adoption generally improves operational efficiency, but profitability effects vary significantly across institutions. The impact depends on governance quality, managerial capability, and institutional readiness ([Laeven & Levine, 2009](#)).

This suggests that FinTech should not be viewed as an external shock, but rather as a capability that interacts with internal organizational structures. Differences in outcomes across banks therefore reflect variation in absorptive capacity and strategic adaptation. Compared to Cluster 4, which focuses on technological innovation in lending, this cluster emphasizes internal organizational conditions that determine whether such innovations translate into performance gains.

The final cluster examines FinTech, financial inclusion, CSR, and sustainable finance, and is interpreted as a societal impact perspective on digital finance. Studies such as [Lee et al. \(2021\)](#) highlight the role of FinTech in expanding access to underserved populations and supporting broader inclusion objectives. This includes both financial inclusion and emerging sustainability related goals. However, the empirical measurement of social and ESG outcomes remains fragmented, limiting comparability across studies and weakening causal inference about long-term societal impacts. Unlike the previous clusters, which focus on markets, institutions, or organizations, this stream evaluates FinTech through its broader social and developmental implications.

Taken together, the clusters reveal a structured progression from system-level tensions (competition and stability), to institutional adaptation (regulation and inclusion), to micro level behaviour (adoption), technological innovation (AI lending), organizational capability (performance), and finally societal outcomes (inclusion and sustainability). This progression highlights that FinTech research is not unified around a single explanatory model but instead operates across multiple analytical levels that remain only partially integrated.

4.2.3 Temporal trend off the more frequent index keyword co-occurrences. Furthermore, [Figure 6](#) illustrates the principal themes emerging from clusters of documents, identified through the temporal evolution of the most frequently co-occurring index keywords.

The temporal evolution of the 74 most frequent index keyword co-occurrences reveals a structured shift in FinTech banking research between 2022 and 2023. Rather than reflecting random variation, the observed patterns indicate a clear intellectual progression from adoption centred studies toward governance, performance, and systemic risk perspectives. This shift reflects both post pandemic digital acceleration and the maturation of FinTech research from exploratory behavioural models to more structurally oriented analyses of banking systems.

In early 2022, the dominant keyword configuration included “technology acceptance model,” “acceptance,” “adoption,” “user acceptance,” “internet banking,” “digital transformation,” “financial inclusion,” and “shadow banking.” This pattern indicates that the literature was primarily focused on behavioural adoption and diffusion processes, largely grounded in Technology Acceptance and diffusion theories (e.g. [Drasch et al., 2018](#); [Jünger & Mietzner, 2020](#)). At the same time, the co-occurrence of “financial inclusion,” “shadow

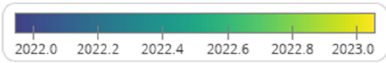


Figure 6. Temporal trend of the 74 more frequent index keyword cooccurrences

banking,” and “financial regulation” suggests an emerging awareness that rapid digitalization had broader macroprudential implications.

Empirical studies during this period (e.g. [Rahman et al., 2023](#); [Yoon & Lim, 2020](#); [Banna et al., 2021](#); [Hodula, 2022](#)) primarily examined determinants of FinTech adoption and its role in expanding financial access. However, these contributions remained largely micro level in nature, with limited integration into systemic or regulatory frameworks. Overall, early 2022 can be characterized as a consolidation phase in which adoption, inclusion, and early regulatory concerns were examined within a post COVID digital acceleration context.

By mid to late 2022, the thematic structure shifted toward technological infrastructure and performance-oriented analysis. Keywords such as “big data,” “blockchain,” “innovation,” “risk,” “profitability,” “market power,” and “credit” became more prominent, indicating a move from behavioural explanations toward structural and organizational transformation. This transition reflects growing interest in how digital technologies reshape banking competition, data governance, and intermediation structures (Stulz, 2022).

During this phase, empirical research increasingly focused on bank level outcomes, including profitability, risk taking, and efficiency (e.g. [Cheng & Qu, 2020](#); [Zhao *et al.*, 2022](#)). The emergence of terms such as “panel data,” “productivity,” “diversification,” and “bank performance” also signals methodological maturation, with greater reliance on econometric

modelling and large scale banking datasets (Wang *et al.*, 2021a, b, c). As a result, FinTech began to be treated less as a technological innovation and more as a measurable determinant of financial performance and competitive positioning.

In 2023, the keyword structure further evolved toward governance, competition, and sustainability dimensions. Frequently co-occurring terms included “corporate governance,” “bank competition,” “market power,” “liquidity,” “efficiency,” and “corporate social responsibility.” This indicates a broadening of the research agenda beyond performance effects toward institutional oversight, ethical considerations, and long-term stability.

The increasing presence of governance and CSR-related keywords suggests that scholars are now examining how FinTech adoption interacts with organizational control systems and sustainability objectives (e.g. Lee *et al.*, 2021; Zhao *et al.*, 2023; Hao, Peng, & He, 2023). At the same time, renewed attention to “market power” and “competition” reflects concerns that digital finance may reshape industry structure, potentially increasing concentration in certain market segments. The inclusion of regulatory classification codes (G21, G28) further indicates that FinTech research is becoming more integrated into mainstream banking and finance literature rather than remaining a specialized subfield.

Beyond these temporal phases, the overall evolution reveals a broader intellectual trajectory. The literature initially focused on whether users would adopt FinTech services, then shifted toward evaluating the economic consequences of adoption, and more recently expanded to governance, sustainability, and systemic risk considerations. This progression reflects a shift from technology centred inquiry toward ecosystem level analysis of banking transformation.

Importantly, the temporal structure suggests a sequential logic in which technological adoption enables organizational change, which then produces new competitive dynamics and ultimately generates regulatory and stability challenges. However, this causal chain remains only partially theorized in the literature, as most studies focus on isolated stages rather than integrated multi-level processes linking adoption, performance, and systemic outcomes.

The temporal evolution of author keywords also highlights the emergence of new but still fragmented research frontiers. Recent studies increasingly address AI governance, particularly issues of transparency, fairness, and accountability in automated financial decision-making. Open Banking is gaining attention as a framework for data sharing ecosystems and platform-based competition between banks and FinTech firms. At the same time, ESG and Green FinTech research is expanding in response to growing interest in sustainable finance and climate related financial risks. Regulatory technology (RegTech) is increasingly studied as a tool for enhancing compliance and supervisory efficiency, while cybersecurity and digital resilience have become central concerns due to the growing dependence on interconnected financial infrastructures.

Taken together, these emerging themes suggest a clear shift in the research agenda from adoption and diffusion toward governance, sustainability, and resilience. However, these areas remain only partially integrated into the dominant intellectual structure of the field.

Overall, the temporal keyword evolution demonstrates that FinTech banking research has matured significantly over the past two years. The field has moved from exploratory adoption studies toward more complex analyses of performance, governance, competition, and systemic stability. Despite this progress, the literature remains fragmented across behavioural, organizational, and macroprudential levels. Future research should therefore prioritize multi-level frameworks that integrate consumer adoption, firm-level transformation, and system wide regulatory dynamics. Such integration is necessary to reconcile fragmented findings and develop a more coherent explanation of how FinTech reshapes modern banking systems.

4.2.4 Temporal trend of the most frequent authors keyword co-occurrences. Moreover, Figure 7 presents the prominent themes linked to clusters of documents, identified on the basis of the temporal dynamics of the most frequently co-occurring authors’ keywords.

The temporal evolution of the 74 most frequent index keyword co-occurrences shows a clear shift in FinTech banking research between 2022 and 2023, moving from adoption centred

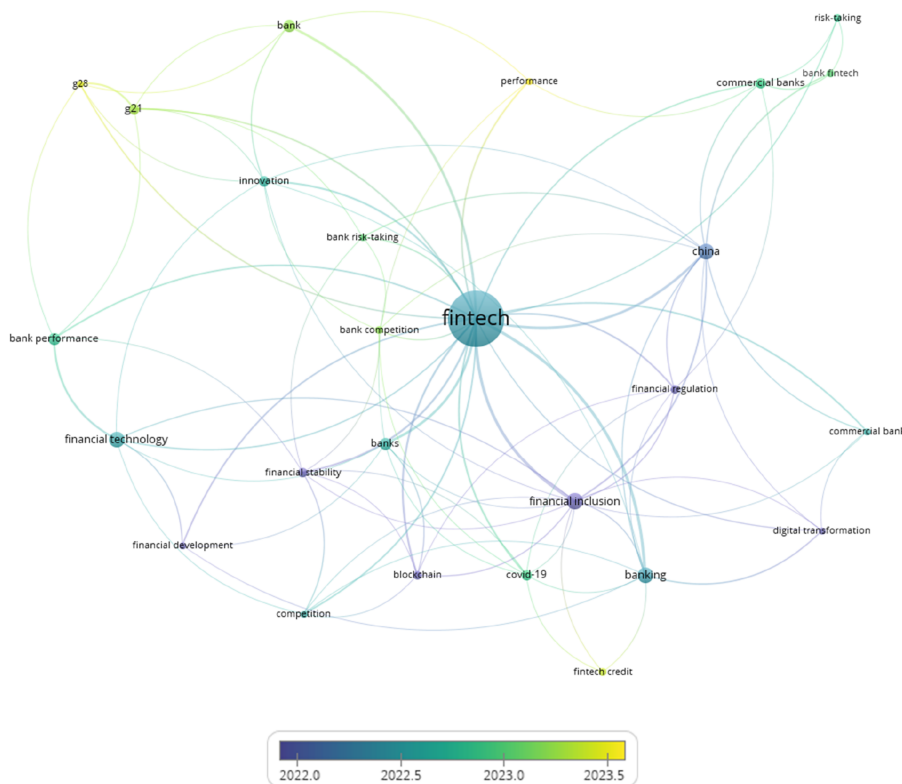


Figure 7. Temporal trend of the 26 most frequent authors keyword co-occurrence

inquiry toward governance, performance, and systemic stability concerns. Rather than representing random variation, this pattern reflects post-pandemic digital acceleration and the gradual maturation of FinTech research from exploratory studies to more structurally and theoretically informed analyses.

In early 2022, dominant keywords such as “technology acceptance model,” “user acceptance,” “adoption,” “digital transformation,” “financial inclusion,” and “shadow banking” indicate a strong behavioural and diffusion-oriented focus. Research during this stage primarily examined determinants of FinTech adoption and trust, largely grounded in Technology Acceptance and diffusion theories (Rahman *et al.*, 2023; Jünger & Mietzner, 2020). At the same time, inclusion and regulatory concerns began to appear alongside stability related terms such as “financial stability” and “monetary policy,” reflecting early awareness that rapid digitalization had macroprudential implications (Banna *et al.*, 2021; Hodula, 2022). This phase can therefore be interpreted as exploratory, with emphasis on understanding digital diffusion and its immediate financial system effects.

By late 2022, attention shifted toward structural and performance-related themes, including “big data,” “blockchain,” “profitability,” “credit,” and “risk.” This transition reflects a move away from behavioural explanations toward firm level and system-level evaluation of FinTech’s economic consequences. Studies increasingly adopted econometric approaches to assess bank performance, productivity, and risk-taking (Wang *et al.*, 2021a, b, c; Zhao *et al.*, 2022), signalling methodological consolidation and stronger emphasis on measurable outcomes rather than adoption drivers.

In 2023, governance and strategic concerns became more prominent, with keywords such as “corporate governance,” “bank competition,” “liquidity,” “efficiency,” and “corporate social responsibility.” This indicates that FinTech is increasingly analyzed in relation to institutional oversight, market structure, and sustainability rather than purely efficiency gains. The growing presence of regulatory classifications (G21, G28) further suggests integration of FinTech research into mainstream banking and regulatory economics frameworks.

Overall, the temporal pattern reflects a developmental sequence in which FinTech research evolves from adoption and diffusion issues toward performance evaluation and ultimately governance and systemic implications. This progression suggests a causal logic whereby technological adoption first enables inclusion and efficiency gains, but subsequently generates competitive pressure, regulatory challenges, and stability concerns that require institutional adaptation. Importantly, this evolution also explains mixed empirical findings: efficiency and inclusion effects coexist with risks related to competition intensity, liquidity stress, and governance complexity.

Despite this maturation, the literature remains fragmented across behavioural, institutional, and macroprudential perspectives, with limited integration across levels of analysis. Future research therefore requires multi-level frameworks that connect adoption dynamics, bank level outcomes, and system wide stability within a unified analytical structure.

5. Research agenda

The bibliometric findings reveal a rapidly expanding yet theoretically fragmented FinTech banking literature. The co-citation analysis identifies three dominant intellectual foundations financial intermediation transformation, bank performance and risk dynamics, and regulatory institutional adaptation while the keyword co-occurrence analysis reveals six interconnected thematic domains encompassing competition and financial stability, financial inclusion and regulation, digital adoption and trust, FinTech credit and SME financing, bank performance and governance, and sustainable financial innovation. Temporal trends further indicate a shift from adoption-oriented research toward governance, performance, sustainability, and regulatory concerns. Although these developments demonstrate the growing maturity of the field, the findings also reveal persistent fragmentation across micro level behavioural studies, meso level organizational analyses, and macro level investigations of financial stability and regulatory change. Similar concerns regarding conceptual fragmentation have been identified in broader assessments of FinTech research (Thakor, 2020; Frost *et al.*, 2023; Claessens, Frost, Turner, & Zhu, 2023).

Rather than treating these themes as independent streams, future research should move toward integrated multilevel theoretical frameworks linking technological innovation, organizational adaptation, regulatory evolution, and systemic outcomes. The co-citation structure suggests that existing studies remain anchored within separate theoretical traditions, including diffusion of innovation theory, financial intermediation theory, institutional theory, platform ecosystem theory, resource-based perspectives, and financial stability frameworks. A central challenge for future scholarship is therefore theory integration. Building on the bibliometric findings, seven interrelated research priorities are proposed.

The strongest theoretical gap identified in the bibliometric analysis concerns the limited integration between research on technology adoption and studies examining competition, risk taking, and financial stability. Existing studies largely explain adoption through diffusion and technology acceptance perspectives, while systemic outcomes are typically examined through financial intermediation and financial stability frameworks. Consequently, the literature provides only a partial explanation of how digital transformation at the organizational level influences broader financial resilience and systemic stability (Thakor, 2020; Claessens *et al.*, 2023). Future research should integrate diffusion of innovation theory, platform ecosystem theory, and macroprudential stability perspectives to explain how FinTech adoption reshapes financial intermediation across multiple levels of analysis.

The regulation-oriented clusters demonstrate the growing importance of governance and institutional adaptation in FinTech ecosystems. However, regulation is frequently conceptualized as an external constraint rather than an adaptive component of technological change. Drawing upon institutional theory and socio technical systems perspectives, future research should conceptualize regulation as an endogenous process that co-evolves with innovation (Baxter & Sommerville, 2011; Brown & Piroška, 2022). Particular attention should be directed toward Regulatory Technology (RegTech) and Supervisory Technology (SupTech), which increasingly enable real-time compliance monitoring, automated reporting, and data driven supervision. Comparative analyses of regulatory regimes may advance understanding of how supervisory architectures shape FinTech ecosystem development (Arner *et al.*, 2016).

The FinTech credit and SME financing clusters highlight the increasing use of artificial intelligence and big-data analytics within lending markets. However, existing research remains primarily focused on efficiency gains and financial inclusion outcomes while providing limited attention to governance implications. Building on this stream, future research should integrate financial intermediation theory, machine learning governance frameworks, and financial stability perspectives to investigate explainability, transparency, accountability, algorithmic bias, and model risk within AI driven lending systems (Berg *et al.*, 2020; Rudin, 2019; Kshetri, 2024). Such research would strengthen understanding of how algorithmic decision-making affects both borrower outcomes and systemic resilience. Future studies should further examine how AI enabled auditing tools, continuous auditing systems, and automated assurance processes affect audit quality, governance effectiveness, and regulatory compliance in digital banking ecosystems. Integrating AI governance frameworks with institutional and regulatory perspectives may provide deeper insights into explainability, accountability, and assurance challenges associated with algorithmic financial systems.

The findings highlight the growing importance of bank FinTech collaboration and ecosystem transformation. Building on platform ecosystem theory, future research should examine how Open Banking architectures, data sharing arrangements, and API based financial infrastructures reshape competition, value creation, and governance within financial ecosystems (Jacobides *et al.*, 2018). Although Open Banking has not yet emerged as a dominant stream within the bibliometric structure, recent evidence suggests that it represents an increasingly important extension of digital transformation research (Liu *et al.*, 2024; Casolaro *et al.*, 2025). Future studies should investigate how ecosystem governance influences innovation, customer relationships, financial inclusion, and institutional resilience across different regulatory environments.

The governance and performance clusters suggest that FinTech adoption should be conceptualized as a long-term capability building process rather than a discrete technological investment. Existing studies frequently treat FinTech investment as an exogenous determinant of performance, profitability, or risk outcomes. Future research should integrate resource based and dynamic capability perspectives to examine how banks develop technological competencies, governance mechanisms, organizational learning processes, and board level digital expertise over time (Teecce, 2007). Such approaches may provide deeper insights into how institutions successfully embed digital transformation within long-term strategic decision making. Future research should investigate how FinTech enabled digital accounting systems, real time financial reporting, and automated reporting infrastructures reshape transparency, internal controls, and managerial decision making within banking institutions. Drawing upon digital governance and institutional perspectives, such studies may examine how emerging reporting architectures influence accountability, information quality, and organizational resilience in increasingly data driven banking environments.

While trust and risk feature prominently in adoption-oriented research, cybersecurity remains underrepresented as a systemic dimension of digital financial intermediation. The increasing reliance on cloud computing, artificial intelligence, APIs, and interconnected digital infrastructures introduces new vulnerabilities related to cyberattacks, operational

disruption, fraud propagation, and network contagion. Although cybersecurity did not emerge as a distinct bibliometric cluster, its growing relevance represents an important extension of the broader digital transformation and risk management literature. Future research should integrate cyber risk frameworks with platform ecosystem and financial stability perspectives to explain how digital interdependencies affect systemic resilience (Stewart & Jürjens, 2018; Uddin, Mollah, & Ali, 2020; Aldasoro *et al.*, 2025; Vučinić & Luburić, 2024).

The sustainability and financial inclusion clusters represent one of the fastest growing areas within the FinTech banking literature. However, substantial fragmentation remains regarding the conceptualization and measurement of ESG outcomes, inclusion metrics, and sustainability performance. Future research should integrate stakeholder theory, sustainable finance frameworks, and digital governance perspectives to develop harmonized measurement systems linking ESG reporting, financial inclusion, sustainability outcomes, and financial resilience (Lagna & Ravishankar, 2022; Mirza *et al.*, 2023). Particular attention should be devoted to Green FinTech applications, climate risk analytics, sustainable lending technologies, ESG data infrastructures, and digital mechanisms that support inclusive economic development.

Taken together, these seven priorities move beyond the identification of emerging topics and instead address fundamental theoretical limitations revealed by the bibliometric analyses. Collectively, they highlight unresolved tensions among diffusion of innovation theory, institutional theory, platform ecosystem theory, dynamic capability perspectives, AI governance frameworks, and financial stability research. Future studies that integrate these currently fragmented perspectives will be better positioned to explain not only variations in banking performance and competitive dynamics but also the broader implications of digital financial innovation for financial resilience, regulatory adaptation, sustainability, and the future architecture of financial intermediation (Thakor, 2020; Vives, 2019; Frost *et al.*, 2023). Future research should address key FinTech banking developments (Table 3).

6. Conclusion

This study presents a systematic and bibliometric examination of FinTech developments in the banking sector between 2019 and 2024. The analysis is based on 224 representative articles indexed in the Web of Science database. This period is characterized by rapid technological advancement, particularly the growing integration of artificial intelligence, generative AI, and blockchain based infrastructures in financial services. These innovations have expanded the scope of the field beyond digital payment systems toward more complex applications in risk modelling, regulatory technology, and platform based financial ecosystems. Bibliometric mapping reveals that the literature increasingly examines how such innovations reshape competitive dynamics, operational structures, and governance mechanisms within the banking industry. Through clustering and co-occurrence analysis, the study identifies six major thematic domains that structure current research on FinTech in banking.

6.1 Theoretical implications

The study interprets the intellectual structure of the field using keyword co-occurrence, co-citation, clustering, and temporal overlay techniques. These findings are embedded within a multi-level theoretical framework integrating diffusion, disruption, and ecosystem perspectives. The study demonstrate that FinTech banking research has evolved from early adoption and inclusion-oriented inquiry toward more structurally grounded debates concerning competition, governance, performance, and financial stability.

The cluster analysis reveals six interconnected thematic domains: (1) competition and risk-taking dynamics, (2) financial inclusion and regulatory boundaries, (3) institutional technology integration, (4) performance and efficiency outcomes, (5) innovation and regulatory economics, and (6) digital transformation and adoption behaviour. When

Table 3. Structured future research agenda for FinTech banking research

Priority	Research theme	Bibliometric gap identified	Key theoretical perspectives	Future research directions	Suggested methods
1	FinTech adoption, organizational transformation, and financial stability	Weak integration between adoption studies and systemic stability research	Diffusion of Innovation Theory; Platform Ecosystem Theory; Financial Stability Frameworks	Examine how digital transformation influences financial resilience and systemic risk	Longitudinal panel data, SEM, multilevel modelling
2	Regulatory adaptation, RegTech, and supervisory governance	Regulation often treated as exogenous rather than adaptive	Institutional Theory; Socio technical Systems Theory	Investigate regulatory co-evolution, RegTech adoption, and supervisory innovation	Comparative studies, mixed methods, policy analysis
3	AI enabled credit intermediation and algorithmic governance	Limited attention to governance implications of AI lending	Financial Intermediation Theory; AI Governance Frameworks	Study explainability, transparency, accountability, bias, and model risk	Lending datasets, stress testing, longitudinal analysis
4	Open Banking and ecosystem governance	Limited understanding of platform based financial ecosystems	Platform Ecosystem Theory; Network Theory	Explore API-based banking, ecosystem governance, collaboration, and competition	Network analysis, comparative case studies
5	Digital governance capabilities and strategic transformation	Limited understanding of capability development processes	Resource Based View; Dynamic Capability Theory	Examine digital competencies, organizational learning, and board-level technology expertise	Case studies, governance indices, capability maturity models
6	Cyber-risk management and digital resilience	Cybersecurity weakly integrated into FinTech and stability research	Cyber Risk Frameworks; Financial Stability Theory	Investigate systemic cyber risk, operational resilience, and digital vulnerabilities	Network analysis, cyber stress testing, resilience modelling
7	ESG-oriented, inclusive, and sustainable financial innovation	Fragmented measurement of ESG and inclusion outcomes	Stakeholder Theory; Sustainable Finance Theory	Develop ESG, inclusion, and sustainability metrics for digital finance	Cross-country datasets, sustainability indicators, panel analysis

Source(s): Authors' own elaboration

interpreted through financial intermediation theory, risk shifting models, technology acceptance frameworks, and governance perspectives, these clusters offer a broader understanding of FinTech. The literature increasingly treats FinTech not merely as a technological innovation but as a structural force reshaping banking market equilibria, risk allocation, and supervisory architecture.

Temporal analysis further indicates the maturation of the research field. Early studies primarily examined adoption mechanisms, digital transformation, and the expansion of

financial inclusion. Subsequent research shifted toward empirical analyses of bank level performance, competition intensity, and credit dynamics. More recently, scholarly attention has increasingly focused on governance structures, regulatory classifications (e.g. G21, G28), corporate social responsibility, and systemic stability. The convergence between index keywords and author keywords further reinforces this evolutionary interpretation.

The study contributes to the literature in three ways. First, it consolidates previously fragmented research streams into a coherent multi-level framework that integrates behavioural, institutional, and macroprudential perspectives. Second, it highlights persistent disconnects across these levels by revealing the lack of integrative models linking adoption, governance, and systemic risk. Third, it proposes a focused research agenda emphasizing dynamic stability modelling, regulatory technological co-evolution, algorithmic credit risk assessment, digital governance capabilities, and standardized impact measurement for inclusive finance.

6.2 Practical implications

The findings suggest that FinTech adoption should be viewed as a strategic transformation process rather than a standalone technology investment. The bibliometric evidence indicates that successful digital transformation increasingly depends on organizational capabilities, governance quality, and the integration of digital technologies into core banking processes. Bank managers should therefore prioritize long term capability development, including investments in data analytics, artificial intelligence, cybersecurity infrastructure, and digital governance frameworks. The growing importance of Open Banking and platform ecosystems further suggests that collaborative partnerships between banks and FinTech firms may generate greater value than purely competitive approaches. Additionally, the increasing prominence of governance and sustainability themes highlights the need for senior management and boards of directors to incorporate ESG objectives, ethical AI practices, and cyber-risk oversight into digital transformation strategies.

The evolution of FinTech banking research demonstrates that regulatory frameworks must increasingly balance innovation promotion with financial stability objectives. Regulators should strengthen oversight mechanisms addressing algorithmic decision-making, AI governance, digital lending transparency, and cybersecurity resilience. The emergence of RegTech solutions suggests opportunities for technology enabled supervision capable of improving compliance monitoring and risk detection in real time. Furthermore, the growth of Open Banking ecosystems requires robust data governance standards, interoperability requirements, and consumer protection mechanisms. Regulatory authorities should also develop frameworks addressing operational resilience, third party technology dependencies, and systemic risks arising from interconnected digital financial infrastructures.

For policymakers and central banks, the findings highlight the importance of developing balanced digital finance strategies that simultaneously promote innovation, financial inclusion, and systemic stability. Policies supporting digital infrastructure development, digital identity systems, and financial literacy initiatives may enhance the inclusive benefits of FinTech adoption. At the same time, central banks should monitor the implications of digital finance for monetary policy transmission, market concentration, and financial stability. Particular attention should be given to cross border regulatory coordination, digital operational resilience, and the growing role of non-bank technology platforms within financial intermediation processes.

The bibliometric analyses reveal that FinTech banking research has progressed from adoption focused inquiry toward broader concerns involving performance, governance, sustainability, and systemic resilience. However, the literature remains fragmented across behavioural, organizational, and macro-financial perspectives. Future scholarship should therefore prioritize multi-level theoretical frameworks capable of integrating consumer adoption, organizational transformation, regulatory adaptation, and financial stability

outcomes. Greater use of comparative international research designs is also needed to address concerns regarding the overrepresentation of Chinese banking contexts and to improve the generalizability of findings across diverse institutional environments.

The increasing adoption of artificial intelligence, blockchain technologies, digital platforms, and automated reporting systems has significant implications for accounting professionals and auditors operating within digitally transformed banking environments. For accounting professionals, the growing use of digital accounting systems, real-time transaction processing, and automated financial reporting requires enhanced competencies in data analytics, digital reporting, information governance, and technology enabled internal controls. As banking institutions increasingly rely on integrated digital infrastructures, accountants will play a critical role in ensuring data quality, transparency, and reporting reliability.

For auditors, the expansion of AI driven decision-making and algorithmic financial services creates new assurance challenges related to model validation, explainability, algorithmic accountability, cybersecurity controls, and continuous auditing. Furthermore, the increasing integration of ESG objectives within digital banking strategies is likely to expand demand for assurance services related to sustainability reporting, ESG data quality, and non-financial disclosures. These developments suggest that both accounting and audit professions must increasingly combine traditional financial expertise with digital, technological, and governance capabilities.

6.3 Limitations and future work

This study is subject to several limitations. First, the analysis relies exclusively on publications indexed in the Web of Science and filtered using AJG ranked journals, which may exclude relevant studies indexed in Scopus or emerging contributions published outside established ranking systems. Second, bibliometric techniques identify structural relationships such as citation patterns and keyword co-occurrence but cannot fully capture the conceptual nuances or causal arguments developed within individual studies. Third, the temporal scope (2019–2024) focuses on the recent acceleration phase of FinTech development and therefore excludes earlier foundational research on digital banking and financial innovation. Future research could address these limitations by incorporating multi database datasets, extending the longitudinal scope, and complementing bibliometric mapping with qualitative meta synthesis or theory building approaches.

Despite these limitations, the study demonstrates that FinTech banking research is transitioning from exploratory disruption narratives toward more analytically rigorous evaluations of competition, governance, and systemic outcomes. Advancing the field now requires multi-level, longitudinal, and cross-country research capable of explaining, rather than merely documenting, structural transformation in banking in the digital era.

Supplementary material

The supplementary material for this article can be found online.

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