FinTech and SME supply chain efficiency: A scoping review

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ABSTRACT

This scoping review examines how financial technology (FinTech) transforms supply chain operations for Small and Medium Enterprises (SMEs). Analyzing 22 peer reviewed articles, the study identifies key FinTech innovations such as blockchain, peer to peer lending, and digital payment systems and their impact. The analysis reveals seven primary themes where FinTech optimizes SMEs supply chains (1) enhanced risk management via real-time monitoring (2) data driven decision making (3) improved financial accessibility through alternative lending (4) predictive analytics for demand forecasting (5) sustainable supply chain financing (6) increased operational efficiency from automation and (7) strengthened customer relationships on digital platforms. Geographically, research is concentrated in developing economies, with a significant focus on China, highlighting FinTech's strategic role in addressing SMEs challenges in emerging markets. The findings demonstrate FinTech's substantial potential to facilitate faster transactions, improve working capital, and foster financial inclusion. However, barriers like cybersecurity risks, regulatory complexities, and limited digital literacy persist. The review concludes that future research should investigate the long term impacts of FinTech adoption, while policymakers must develop supportive regulatory frameworks. Strategic collaboration between financial institutions and SMEs is crucial to fully realize FinTech transformative potential in building resilient and efficient digital supply chains.

1. Introduction

FinTech has emerged at the intersection of finance and technology and has encouraged innovation in the world of business. This includes FinTech solutions, such as blockchain, digital payments, peer to peer lending, and smart contracts, increasing financial access, efficiency, and transparency. These innovations of small and medium enterprises (SMEs) minimize cost, minimize operational ineffectiveness and improve cash flow along with supply chain management (Al-zaqeba et al., 2022). However, SMEs often face challenges, such as limited access to finance and fragmented supply chains. These obstacles are addressed

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largely through FinTech, serving businesses with resilient, sustainable, and inclusive practices (Arner et al., 2019). However, the extent of the effect of FinTech on the general improvement of SMEs supply chain efficiency is still the subject of some debate as existing literature on the subject appears piecemeal and only partially examines the matter.

However, recent literature has mainly focused on FinTech to transformational effect on financial inclusion and improvement to operational efficiency but the systemic understanding of the role of FinTech in the SMEs supply chain transformation is still not formed. Studies identify obstacles in the path, including regulation and lack of technology adoption among SMEs, while highlighting the potential for transparency in blockchain (Huang et al., 2023) and the role of digital payments in liquidity management (Chen & Jiang, 2024) in the path of integration of both technologies (Ullah & Havinga, 2023).

Given the existing gaps in literature, it is necessary to conduct a scoping review to aggregate extant knowledge, assess prominent themes, and highlight unanswered research questions that hinder a nuanced understanding of FinTech potential in this area. By mapping the existing literature, this paper systematizes and unpacks the impact of FinTech on SMEs supply chains particularly in terms of resilience, sustainability, and inclusiveness. The primary objective of this research is to provide a comprehensive mapping of key themes related to FinTech influence on SMEs supply chains, synthesizing existing studies to outline the current state of knowledge and identify critical gaps for future investigation. Ultimately, the findings aim to contribute to the broader literature by analyzing FinTech role in SMEs supply chains and offering a descriptive overview of the field to guide further research. This scoping review is structured as follows, introduction, methodology, results, discussion, future research directions, and conclusions.

2.   Methodology

In this study, a Scoping Review is employed to analyze the literature on the role of FinTech in enhancing supply chain efficiency for SMEs. This method is chosen due to its ability to swiftly identify research trends and the latest findings. Additionally, the Scoping Review allows for a comprehensive exploration of foundational sources and core concepts in the related field by incorporating various types of studies. To ensure methodological rigor, the PRISMA-ScR protocol serves as the primary guideline. Developed by Tricco et al. (2018) as an adaptation of the PRISMA framework for systematic reviews, PRISMA-ScR offers greater flexibility, making it applicable across diverse disciplines beyond just medicine and healthcare. Following the PRISMA-ScR framework, the researchers structured the Scoping Review methodology with three key processes, (1) formulating research questions, (2) designing a literature search strategy, and (3) data extraction and analysis.

2.1 Formulating research questions

To formulate a research question relevant to the study, the researcher utilized the PICo framework developed by (Eriksen & Frandsen, 2018). PICo aims to assist researchers in identifying appropriate keywords and subsequently construct systematic research questions. The framework consists of three key elements: Population (P), Interest (I), and Context (Co). In this study, the researcher selected SMEs (Small and Medium Enterprises) to represent the population, the role of FinTech in enhancing supply chain efficiency as the interest, and supply chain management as the context. Based on these three keywords, the researcher developed the following two research question: What are the main themes and sub themes through which FinTech enhances supply chain efficiency in SMEs? and What the future study in this area?

2.2 Systematic search string

To ensure comprehensive search in this scoping review, the researcher conducted a systematic search based on three main processes, identification, screening, and eligibility. The identification phase involved locating relevant studies through database searches using predefined keywords and subject categories. In the screening stage, the retrieved records were evaluated based on their titles and abstracts to determine their relevance to the research objectives. The eligibility process involved a thorough full text review of the selected studies to confirm their suitability for inclusion in the review. This structured approach ensures methodological rigor, minimizes bias, and allows for a thorough examination of the literature within the defined scope of the study.

2.3 Identification

Identification is a key step aimed at recognizing relevant keywords used in reference materials. These keywords are selected based on the predetermined research questions, where the researcher has established three fundamental keywords, Financial Technology, Supply Chain Efficiency, and SMEs. To ensure more comprehensive literature coverage, the researcher diversified these core keywords by searching for synonyms, related terms, and other variations for each keyword. For this purpose, artificial intelligence (AI) was employed to review and validate the ideas obtained. Additionally, online thesauruses were consulted to ensure the accuracy and breadth of the search scope. Through this effort, the researcher successfully identified several relevant additional keywords, such as Supply Chain Performance, Supply Chain Finance, and Digital Payments. The researchers developed a search string utilizing basic functions such as field codes, phrase searching, wildcards, truncation, and Boolean operators across two databases. During the identification stage of the literature search, the researchers successfully identified 120 potentially relevant articles from Scopus and Web of Science (WoS). These articles were deemed suitable to proceed to the next stage of the systematic review process, which is screening. The use of advanced search techniques ensured a comprehensive and precise retrieval of studies aligned with the research objectives.

Table 1: The search strings

DataBase	Search String
Scopus	TITLE-ABS-KEY (("Financial Technology" OR "FinTech" OR "Digital Payments") AND ("Supply Chain Efficiency" OR "Supply Chain Performance") AND ("SMEs" OR "Small and Medium Enterprises"))
WOS	TS= (("Financial Technology" OR "FinTech OR Digital Payments") AND ("Supply Chain Efficiency" OR "Supply Chain Performance") AND ("SMEs" OR "Small and Medium Enterprises"))

2.4 Screening

The screening and selection of articles followed the Preferred Reporting Items for Systematic Reviews and Meta Analyses extension for Scoping Reviews (PRISMA-ScR) guidelines to ensure methodological rigor and transparency (Table 2). As emphasized by Buchter et al. (2020), clearly defined and consistently applied eligibility criteria are essential for a review to effectively answer its research questions. Accordingly, a multi-stage screening protocol was implemented.

Following the PRISMA-ScR framework, a structured screening process with explicit eligibility criteria was applied to ensure rigor and transparency. Buchter et al. (2020) underscore that clearly defined selection criteria are fundamental for addressing research questions effectively. To align with the study scope on organizational and managerial fintech perspectives, articles focusing solely on consumer fintech were deemed non eligible and excluded. The inclusion criteria were restricted to peer reviewed journal articles in English, published between 2020 and 2024 within the subject areas of Business, Management,

Accounting, Social Sciences, Economics, Econometrics, and Finance, to guarantee both timeliness and thematic relevance. Conversely, systematic reviews, books, conference proceedings, and other non primary sources were excluded to prioritize original research. Furthermore, only articles with fully accessible texts were considered, thereby excluding unavailable sources from the review process. This systematic application of inclusion and exclusion rules resulted in 62 articles advancing to the full-text eligibility stage.

In the systematic screening process, several criteria were used to select relevant articles. Buchter et al., (2020) emphasized the importance of clear selection criteria to help researchers answer the research questions effectively. The strategic search process in systematic reviews involves screening to establish criteria for selecting relevant articles (Table 2). Four main criteria were applied. First, regarding publication year, only articles published within the last five years (2020–2024) were selected to ensure the validity and timeliness of the information. Second, inclusion and exclusion criteria were implemented to refine the literature search, where only journal articles were considered primary sources, while systematic reviews, books, book chapters, book series, and conference proceedings were excluded to prioritize original research. Third, only English language articles were chosen to avoid potential translation errors that could compromise the accuracy of the analysis. Fourth, the focus was placed on articles in specific fields such as Business, Management, Accounting, Social Sciences, Economics, Econometrics, and Finance to ensure relevance to the study scope. This filtering process helped ensure that only the highest-quality and most appropriate academic materials were included in the research. As a result of this process, 62 articles were identified and carried forward to the third stage eligibility.

Table 2: The inclusion and exclusion criteria

Criterion	Eligibility	Exclusion
literature type	research articles	systematic reviews, books, book chapters, book series, and conference proceedings
Language	English	non-English
Timeline	2020-2024	<2019
Subject area	Business, Management & Accounting, Social Sciences, Economics, Econometrics and Finance	Computer Science, Decision Sciences, Engineering, Psychology, Energy, Medicine

2.5   Eligibility

The process refers to the second round of screening conducted to ensure that the selected articles are relevant to the predetermined objectives of the study. At this stage, each article undergoes a thorough evaluation, beginning with an analysis of the title, followed by an in depth review of the abstract and full content. This assessment ensures that the chosen articles align with the research questions and contribute to achieving the study objectives. Through this process, 40 articles were excluded, while the remaining articles were carried forward to the next stage extraction and data analysis.

2.6   Extraction and data analysis

The selected articles were then thoroughly examined to extract data relevant to the study objectives and research questions. For this purpose, a deductive thematic analysis was applied. Deductive thematic analysis refers to identifying themes based on specific sources (Naeem et al., 2023). The first step involved establishing themes derived from previous studies (Onaseso, 2021; Qin, 2023; Girase, 2024). Once the

themes were determined, the researcher selected (Risk Management, Decision Making, Financial Accessibility, Predictive Analytics, Supply Chain Sustainability, Operational Effectiveness and Customer Orientation) key themes. These themes were then validated by experts in the field, who confirmed their alignment with the study objectives and research questions. Following this verification, the researcher extracted relevant data from the selected articles based on the predefined themes.
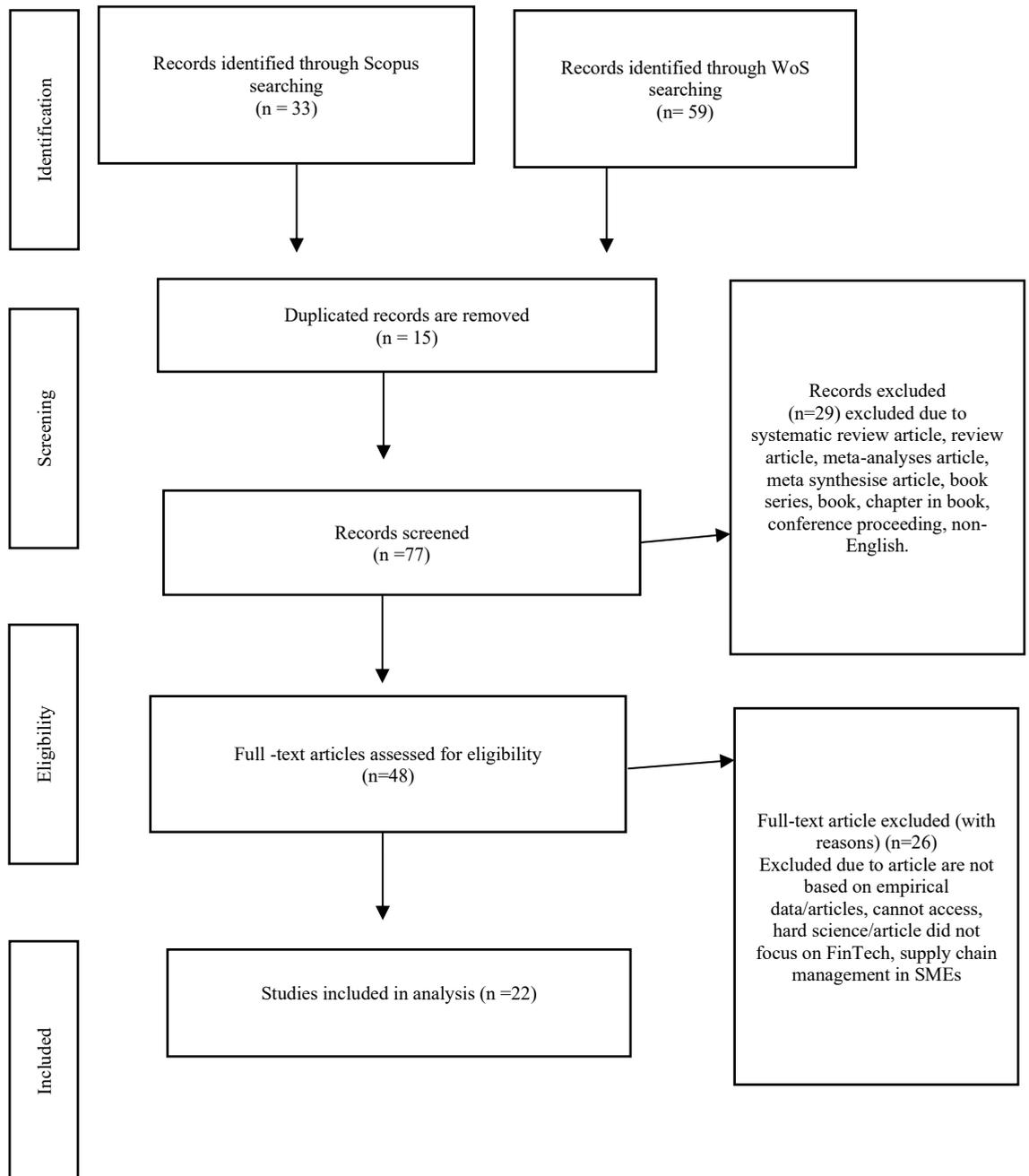

Figure 1. Flow diagram of research selection process using Preferred Reporting Items for Systematic Reviews (PRISMA)

3.   Result

Provide a detailed list of all searches in the flow diagram shown in Figure 1. The initial search in Scopus & WoS yielded 350 articles and abstracts of various types. Further electronic searches produced 92 articles and abstracts (Scopus yielded 33 articles & WoS yielded 59 articles). After title and abstract screening, 48 articles were deemed eligible for full-text assessment. Subsequently, 22 articles were included in the analysis. Table 3 presents an overview of the 22 recent publications included in this scoping review.

Table 3. Data charting

Author & Year	Finding	Themes	Sub-Themes
(Park & Li, 2021)	Financial data analysis enables companies to identify potential risks in the supply chain, such as supplier failures or market fluctuations, and FinTech allows them to take proactive measures to ensure the smoothness and efficiency of SMEs supply chain operations		Risk Forecasting
(Liu et al., 2023)	Big data technology enhances credit risk management for SMEs in the supply chain, reduces information asymmetry in supply chain financing, and creates a crucial digital ecosystem for the development of sustainable supply chain financing		Reducing Information Asymmetry
(Zhan et al., 2024)	Blockchain technology not only reduces regulatory compliance costs for financial institutions but also provides SMEs with better credit verification and reduces default tendencies. It additionally offers guarantees from core enterprises, which enhances financial collaboration within the supply chain and helps SMEs improve their stability and brand value	Risk Management	Cooperation and Supply Chain Stability
(Wu et al., 2021)	Big data technology in FinTech helps SMEs manage credit risk more effectively, reduce transaction costs, and minimize information asymmetry in supply chain financing. This technology also builds a crucial digital ecosystem to ensure the sustainability of supply chain financial development		Credit Risk Management
(Xie et al., 2022)	FinTech plays a crucial role in enhancing the quality of information flow within the supply chain. Efficient information exchange enables better coordination among supply chain participants and supports more accurate decision-making, thereby improving overall operational effectiveness, particularly for SMEs		Improve Communication Flow
(Mhlanga, 2023)	FinTech facilitates better data collection and analysis, enabling companies to make informed decisions based on real-time data. This enhances inventory management efficiency and demand forecasting two critical elements in optimizing supply chain operations for SMEs		Improved Data Management
(Chen et al., 2019)	The study found that credit risk factors vary significantly across industries, and industry-specific credit risk assessment improves the predictive accuracy of the model. Emphasizing solvency and profitability is critical in credit risk evaluation to ensure more efficient and secure supply chain financing for SMEs	Decision Making	Credit Scoring Accuracy
(Li et al., 2022)	FinTech equipped with analytical capabilities enables SMEs to make precise data-driven decisions, thereby enhancing inventory planning and control. As demonstrated in studies, this effective logistics management ultimately leads to improved operational efficiency within business supply chains		Data-Driven Decisions
(Lara & Huachez,2024)	FinTech enhances the accuracy of credit risk assessment in supply chain financing. However, traditional indicators remain vital in loan decision-making, demonstrating how		Financing Decision Optimization

(Jamaludin, 2021)	the integration of modern technology and conventional methods collectively improves the efficiency and effectiveness of financing for SMEs within the supply chain FinTech can be integrated with other technologies like blockchain and IoT to enhance supply chain efficiency. Blockchain provides secure and transparent transaction records, while IoT enables real-time goods tracking together creating a more efficient and effective supply ecosystem for SMEs		Integration with Other Technologies
(Pylaeva et al., 2022)	By automating financial processes and reducing the need for manual intervention, FinTech can lower operational costs. These cost savings can then be passed through the entire supply chain, benefiting all involved parties while enhancing the efficiency and competitiveness of SMEs within the supply ecosystem	Operational Effectiveness	Cost Reduction
(Purwaningsih et al., 2024)	Blockchain technology has proven to enhance supply chain efficiency for SMEs and demonstrates a positive correlation with export performance. While its impact on financial performance remains inconclusive, these findings highlight FinTech significant potential in supporting more efficient and globally competitive business operations for SMEs		Implications for Financial Performance
(Rao & Li, 2022)	FinTech innovations streamline and accelerate financing processes, while traditional supply chain management methods often lag in meeting current demands. However, FinTech solutions can adapt in real-time, ensuring seamless connectivity between enterprises and suppliers to enhance operational efficiency for SMEs		Financing Process Transformation
Rodríguez-Espíndola et al., 2022)	FinTech leverages data analytics to provide clear visibility into spending patterns and cash flow management, enabling SMEs to make informed decisions regarding inventory management and supplier selection with greater precision ultimately enhancing overall supply chain operational efficiency		Enhanced Data Analytics
(Khan et al., 2023)	FinTech harnesses big data analytics to provide deep insights into spending patterns and supplier performance, enabling SMEs to optimize their supply chain operations by identifying cost-saving opportunities and improving supplier relationships thereby enhancing overall efficiency and competitiveness	Predictive Analytics	Supplier Performance
(Li et al., 2020)	Logistics Finance (LF) helps SMEs access financing and logistics services. However, the rapid growth of e-commerce has exacerbated capital shortage challenges for SMEs. Blockchain-based platforms are thus proposed to enhance logistics finance efficiency, particularly within e-commerce ecosystems, while strengthening supply chain effectiveness through innovative FinTech solutions		Real-Time Inventory Management
(Zheng et al., 2023)	Blockchain technology can incentivize data sharing through token-based economic models, encouraging supply chain participants to engage in more efficient data exchange practices. This enhances transparency and improves the effectiveness of financial operations for SMEs within the supply ecosystem	Supply Chain Sustainability	Incentivization of Data Sharing

Source	Description	Theme	Sub-theme
(Xiaoxu et al., 2019)	The integration of FinTech with Business-to-Business (B2B) platforms enables closer collaboration between banks and agricultural enterprises. This partnership helps streamline both financial and logistical processes, thereby enhancing overall supply chain efficiency for SMEs in the agricultural sector		Enhanced Collaboration
(Kharaishvili & Atanelishvili, 2022)	FinTech also supports sustainability by enabling SMEs to adopt eco-friendly practices, such as facilitating investments in renewable energy and sustainable supply chains. These are crucial for assessing environmental impacts on government procurement, while simultaneously enhancing operational efficiency and fulfilling environmental responsibilities		Sustainable Business Practices
(Yu et al., 2021)	Early payment strategies in FinTech platforms can mitigate credit risk for low-profile customers, while platform service fees influence overall customer costs. This demonstrates how FinTech solutions enhance both efficiency and accessibility of supply chain financing for SMEs	Financial Accessibility	Efficiency and Accessibility of Financing
(Hong & Qin, 2025)	Blockchain technology ensures timely payments from core enterprises, while green ratings incentivize SMEs to secure discounted financing. Additionally, digital platform access enhances operational efficiency and credit rewards collectively strengthening SMEs supply chain effectiveness through FinTech solutions		Enhanced Security
(Mustafi et al., 2024)	FinTech solutions that prioritize user experience with intuitive interfaces and rapid services not only enhance customer satisfaction but also foster greater engagement and loyalty. This ultimately contributes to the overall efficiency of SMEs supply chains through smoother and more user-friendly financial access	Customer Oriented	Enhancing Customer Satisfaction

Through a systematic thematic analysis of 22 scholarly articles, this study identified seven core themes, each elaborated by a set of 22 distinct sub-themes. This structured framework emerged from a rigorous, iterative engagement with the literature, enabling a more nuanced and organized interpretation of the research landscape. The resulting categorization not only delineates key areas of impact but also ensures a comprehensive and layered exploration of SMEs supply chains.

The integration of FinTech into SMEs operations represents a profound structural shift, moving beyond mere digitization to a holistic re-engineering of financial and operational paradigms. The first theme, Risk Management, captures how FinTech fundamentally mitigates systemic vulnerabilities. By deploying alternative credit scoring models that analyse transactional data and cash flow patterns, FinTech platforms reduce the information asymmetry that has traditionally excluded SMEs from formal lending. Digital payment systems and blockchain enabled smart contracts further risk operations by ensuring transactional transparency and immutability, which minimizes fraud and payment delays. This is augmented by artificial intelligence, which proactively forecasts supply chain disruptions, allowing SMEs to adjust procurement and logistics pre-emptively. Collectively, these tools transform risk from an opaque threat into a manageable variable, fostering notable supply chain resilience and generating measurable cost savings through reduced insurance premiums, lower cost of capital, and diminished operational losses.

Building on this secured foundation, the second theme, Decision Making, highlights a critical evolution in SMEs strategic capabilities. FinTech shifts decision making from intuition based to data informed processes. Leveraging advanced analytics and algorithmic tool, SMEs can now optimize financing choices comparing loan products in real time and improve core operational judgments regarding inventory, pricing,

and supplier relationships. Integrated platforms aggregate financial and supply chain data into unified dashboards, while blockchain secures and accelerates information sharing across distributed networks. This capability not only enhances operational agility, allowing for rapid response to market shifts, but also elevates market competitiveness by enabling SMEs to identify and capitalize on efficiencies previously visible only to larger corporations with dedicated analytics teams.

This leads directly to the third, closely linked theme of Financial Accessibility, which addresses the democratization of capital. FinTech dismantles traditional barriers through automated application and underwriting processes, significantly reducing the time and bureaucracy required for financing. Enhanced security protocols build trust in digital transactions, while peer to peer lending and microfinancing models supported by platform economies create more inclusive capital networks. This transparency and inclusivity do more than improve individual supply chain efficiency contribute to a fairer financial ecosystem where entrepreneurs at various growth stages from start-ups to scaling businesses can access tailored funding instruments, thereby levelling the competitive playing field.

The fourth theme, Predictive Analytics, examines how FinTech institutionalizes foresight within SMEs operations. Moving beyond retrospective reporting, real time analytics enable dynamic inventory management, using predictive models to align stock levels with forecasted demand, thus preventing costly overstocking or revenue eroding shortages. Enhanced data tools also facilitate continuous supplier performance monitoring, identifying risks of delay or quality lapse before they cause disruption. When integrated with digital financial platforms, these analytics provide cost effective, scalable solutions that boost overall operational efficiency by turning data into a strategic asset for proactive management.

Underpinning all these functional improvements is the fifth theme, Operational Effectiveness, where FinTech drives tangible, bottom line gains. By accelerating financing processes from invoice factoring to loan disbursements FinTech significantly improves cash flow cycles. Automation reduces administrative overhead and human error in areas like reconciliation and compliance, while the integration of complementary technologies such as AI and the Internet of Things (IoT) creates synergistic efficiencies. For instance, IoT sensors can trigger automated payments upon shipment delivery. These enhancements collectively improve financial performance and enable smoother, more competitive day to day operations, allowing SMEs owners to redirect resources from routine financial administration toward core business growth and innovation.

Looking beyond pure efficiency, the sixth theme, Supply Chain Sustainability, explores how FinTech encourages a transition to responsible business practices. Green financing instruments, such as sustainability linked loans, incentivize SMEs to adopt eco friendly operations by tying interest rates to environmental performance metrics. Blockchain technology facilitates transparent tracking of carbon footprints and ethical sourcing, enabling verifiable green credentials. Furthermore, incentivized data sharing across the supply chain can promote collaboration on circular economy models. For SMEs, this translates into operational models that balance environmental stewardship with long term economic savings, meeting increasing regulatory and consumer demand for accountability while often realizing cost reductions through optimized resource use. Thus, FinTech emerges not only as a tool for financial and operational optimization but also as a critical enabler of sustainable and resilient SMEs growth in a complex global economy.

Together, these themes illustrate a cohesive narrative, FinTech serves as a multifaceted enabler for SMEs, transforming not only financial and operational processes but also supporting strategic, sustainable, and customer centric growth within modern supply chains.

In Figure 2, the locations of the studies of the role fintech in supply chain efficiency in context SMEs are shown to indicate their geographical context. The analysis shows that the studies were conducted in 8 countries conducting research in this domain and most the study are conducting in China with 13 study. Some studies were conducted in multiple countries. In terms of publication trends, Figure 3 displays the number of articles indexed in Web of Science (WoS) and Scopus from 2020 to 2024. The data reveals that

publication output peaked in 2022, followed by a slight decline in 2023. However, 2024 increasing in publication numbers. Based on this analysis, subsequent years are expected to witness more significant growth in publications, particularly regarding FinTech role in enhancing supply chain efficiency, especially among SMEs. This anticipated growth is driven by rapid advancements in financial technology innovations such as blockchain, digital payments, and alternative financing, which are becoming increasingly accessible to SMEs for managing cash flow, logistics, and operational financing. Additionally, government support through digitalization incentives and FinTech friendly regulatory frameworks, like Open Banking, is accelerating the adoption of these technologies. SMEs are also becoming more aware of FinTech benefits, including faster financing, more efficient transactions, and improved supply chain transparency. These advantages are stimulating increased research and publications examining FinTech impact on business competitiveness.
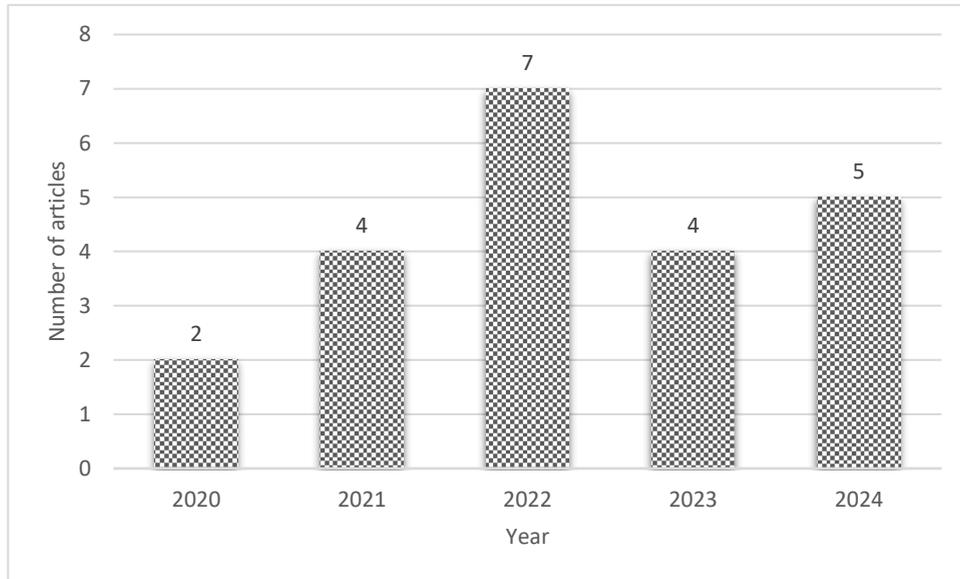

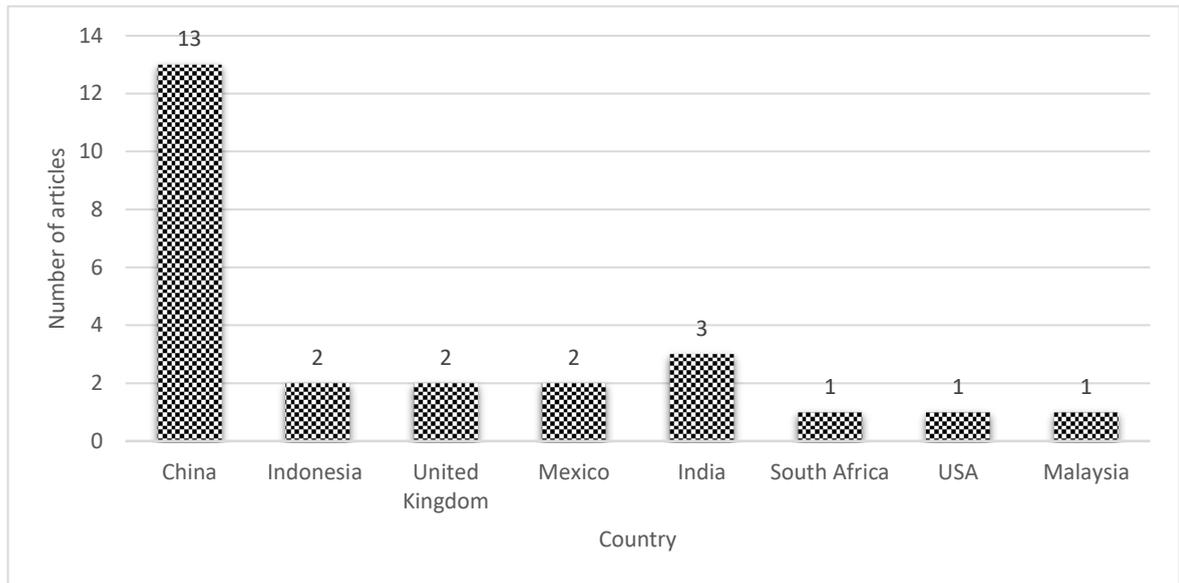Figure. 2. Number of articles published in Web of Science (WoS) and Scopus

Figure. 3. Location of study

4. Discussion

In this section, we will explore the key themes and sub-themes emerging from the findings, focusing on the research question regarding fintech impact on improving supply chain efficiency in SMEs. Through a detailed review process, 22 articles were selected for analysis, leading to the identification of 22 relevant sub-themes.

4.1 Risk management

FinTech applications and potential benefits for SMEs supply chains, a critical and explanatory examination reveals a more nuanced relationship between technological potential and practical adoption, deeply influenced by theoretical frameworks and SMEs specific constraints. From a supply chain theory perspective, the purported reduction in information asymmetry through big data (Wu et al., 2021) aligns with the principles of Agency Theory, which highlights the costs and risks arising from misaligned information between parties. FinTech theoretically mitigates these agency problems by providing transparent, real time data on transactions and counterparty reliability. However, this theoretical benefit is contingent on SMEs having the digital infrastructure and literacy to integrate these platforms, a constraint often overlooked. The discussion of blockchain enhancing cooperation and stability (Su et al., 2022) connects to Network Theory, which emphasizes the value derived from interconnected relationships. While blockchain can create immutable records and smart contracts that theoretically strengthen network trust, its implementation requires significant collaboration and standardization across the supply chain a formidable challenge for SMEs who typically lack the bargaining power to dictate such systemic changes to larger partners or financial institutions.

Furthermore, the adoption of these advanced tools is not automatic and must be examined through technology adoption models. Models like TOE (Technology-Organization-Environment) framework clarify that SMEs FinTech integration is hindered not by a lack of available solutions but by critical organizational and environmental constraints. Organizationally, SMEs often face resource limitations financial, human, and technological that restrict their ability to invest in and deploy sophisticated risk forecasting or blockchain systems. Environmentally, the regulatory landscape for FinTech, particularly

concerning data privacy and cross-border transactions, adds complexity and cost. Therefore, the critical insight is that the descriptive benefits of improved credit risk management (Nahar et al., 2024) and operational smoothness (Tsapa, 2024) are not guaranteed outcomes but are conditional upon overcoming these adoption barriers. The promise of a sustainable digital ecosystem exists in tension with the reality that the costs and complexities of adoption may inadvertently exclude the very SMEs FinTech aims to empower, potentially reinforcing existing inequalities within supply chains rather than alleviating them. Ultimately, a shift from a descriptive to a critical analysis underscores that the transformative impact of FinTech on SMEs supply chains is less about the technology itself and more about the alignment of innovative solutions with the structural realities, strategic capacities, and collaborative ecosystems in which SMEs operate.

4.2   Decision making

A critical examination of FinTech's role in communication flow and data management for SMEs must move beyond description to interrogate how these technologies interact with established supply chain theories and the concrete limitations facing small firms. The enhancement of information exchange and real time data analysis (Kao et al., 2022; Tang, 2024) is fundamentally an application of Information Processing Theory, which posits that organizations adopt mechanisms to reduce uncertainty and improve coordination. FinTech acts as a powerful technical mechanism to close the information processing gap between the data needed for optimal decisions and the data traditionally available to SMEs. However, this theoretical benefit is constrained by SMEs specific realities, the cost of implementing integrated data platforms, the technical expertise required for analysis, and the challenge of achieving data standardization across often fragmented SMEs supply chains. The resulting insight is that while FinTech provides the capacity for superior coordination, its actualization is uneven, potentially creating a digital divide where only resource-rich SMEs can fully leverage these tools, thereby exacerbating competitive disparities rather than levelling the playing field.

Similarly, the revolution in credit assessment (Liu et al., 2022) and the noted persistence of traditional benchmark (Branzoli & Supino, 2020) can be explained through the lens of FinTech adoption model and institutional theory. Models like the Technology-Organization-Environment (TOE) framework highlight that adoption is not merely about technological superiority. The continued relevance of traditional metrics indicates that the environmental context specifically, the risk-averse norms of financial institutions and existing regulatory frameworks create inertia. For risk averse lenders serving SMEs, integrating novel, data driven FinTech assessments with conventional financial ratios represent a pragmatic, incremental adoption path that mitigates perceived risk. This hybrid approach is less a seamless integration and more a negotiated compromise, reflecting the institutional pressures and legitimacy concerns within the financial ecosystem. Therefore, the evolution towards a more integrated, efficient, and responsive supply chain ecosystem is not a linear, technologically deterministic process. It is a complex, contested transition shaped by SMEs resource constraints, the need for legitimacy in financial market, and the gradual, often reluctant, adaptation of existing institutions to new informational paradigms.

4.3   Financial accessibility

While the description of FinTech potential benefits for SMEs supply chain finance is accurate, a critical analysis must examine how these technologies intersect with established theories and confront the harsh realities of SMEs adoption. The promise of early payment solutions and optimized fees (Kouvelis et al., 2020) directly addresses a core tenet of Financial Supply Chain Management, which seeks to align physical, informational, and financial flows to optimize working capital. However, the theoretical reduction of credit risk for low-profile SMEs often clashes with the adoption constraints dictated by the Technology-Organization-Environment (TOE) model. Organizationally, many SMEs lack the digital maturity, systems integration capability, and negotiating power to seamlessly onboard these platforms, potentially excluding the very firms most in need. Environmentally, the proliferation of platforms can lead to fragmentation,

locking SMEs into specific ecosystems and creating new forms of dependency on core enterprises or financial institutions, thereby replicating traditional power imbalances in a digital guise.

Furthermore, the integration of blockchain for timely payments (Xie, 2022) and sustainability-linked incentives (Shen et al., 2024) can be critically assessed through the lens of Network Theory and institutional pressures. Blockchain value in enhancing trust and transparency is theoretically sound, but its implementation requires unprecedented collaboration and standardization across an entire supply chain network a formidable collective action problem where SMEs are typically price takers, not system architects. Similarly, green financing incentives are less pure market optimization and more a reflection of institutional isomorphism, where SMEs adopt sustainable practices primarily to gain legitimacy and access to capital in an environment increasingly shaped by regulatory and investor pressures, rather than from an intrinsic operational shift. Therefore, the stronger foundation FinTech builds is not neutral or universally accessible it is a structured environment where efficiency gains for some may come at the cost of increased systemic complexity, new compliance burdens, and altered power dynamics. The critical insight is that FinTech's transformation of SMEs supply chain finance is as much about reconfiguring institutional relationships and exposing adoption inequalities as it is about streamlining transactions and improving liquidity.

4.4 Predictive analytics

FinTech role in revolutionizing SMEs supply chains requires moving beyond the descriptive benefits of data analytics and blockchain to interrogate how these tools align or clash with established supply chain theories and the material limitations of SMEs. From a theoretical standpoint, enhanced data analytics for supplier performance and inventory management align closely with the Resource-Based View (RBV), which posits that competitive advantage stems from unique, valuable resources. FinTech platforms can, in theory, transform data into such a strategic resource. However, this theoretical promise is heavily mediated by SMEs constraints related to financial capital, technical expertise, and organizational scale. The sophisticated integration required for holistic supplier assessment (Shi & Zhang, 2023) or real time blockchain platforms (Li et al., 2020) often demands investments and skills beyond the reach of typical SMEs, risking the creation of a digital divide within supply chains where only larger or better resourced SMEs can harness these advantages. Consequently, the potential for FinTech to reinforce existing inequalities is as significant as its potential to level the playing field.

Furthermore, the adoption and impact of these technologies can be critically analyzed through the Technology-Organization-Environment (TOE) framework. The environmental context, especially pressure from larger supply chain partner or competitive market, may push SMEs toward adoption, but organizational constraints like legacy systems and risk aversion and technological complexities such as interoperability issues between different platforms actively hinder it. For instance, blockchain promise for transparent inventory financing is theoretically sound but prescribes a level of data standardization and trust in shared infrastructure that is difficult to achieve across fragmented SMEs networks. Therefore, the transformation of SMEs supply chains into more efficient, responsive, and competitive systems is not an automatic outcome of FinTech availability. It is a contested process shaped by the tension between the theory of information enabled supply chain integration and the practical realities of SMEs resource scarcity and ecosystem power dynamics. The critical insight is that FinTech value is contingent not on its features alone, but on its implementation within an ecosystem that addresses these adoption barriers, lest it become another tool that highlight, rather than bridges, the capability gap between large and small enterprises.

4.5 Supply chain sustainability

A critical examination of FinTech three pronged role in SMEs supply chains reveals a complex interplay between theoretical potential and practical constraints, challenging the narrative of seamless digital transformation. The proposed data sharing incentives via blockchain token economies (Wang et al., 2021)

can be analyzed through the lens of Agency Theory, which addresses conflicts arising from misaligned interests and information asymmetry. While token models theoretically align incentives by rewarding data transparency, they assume a level of technological sophistication and trust in the token value that may not exist for many SMEs. This confronts the core SMEs constraint of scarce resources not only financial but also cognitive required to understand and participate in such cryptographic economies. The result is a potential paradox a tool designed to foster inclusivity may inadvertently create a new barrier, segmenting supply chains into those with the capability to engage in tokenized systems and those without.

Furthermore, the enhanced collaboration through B2B platform integration (Mwemezi et al., 2022) and the push for sustainability via green FinTech (Jaiwant & Kureethara, 2023) must be contextualized within FinTech adoption models and institutional theory. The Technology-Organization-Environment (TOE) framework clarifies that successful integration is not guaranteed. Organizationally, SMEs often lack the bargaining power to shape these integrated platforms, risking their transformation into passive price takers within ecosystems dictated by larger financial institutions or core enterprises. Environmentally, the drive for green financing is heavily influenced by institutional isomorphism SMEs may adopt these practices less from an intrinsic operational shift and more from coercive pressure to meet government procurement criteria or secure financing, a reactive rather than strategic move. Thus, FinTech role as a holistic platform is critically interrogated, it does not merely enable collaboration and sustainability but can also function as a mechanism for enforcing new standards and dependencies. The transition towards a competitive and sustainable supply chain is therefore not a neutral technical upgrade but a process mediated by power dynamics, where FinTech can both empower SMEs and subject them to new forms of external control and complexity, testing their resilience as much as enhancing it.

4.6 Customer oriented

A critical analysis of FinTech role in enhancing customer satisfaction within SMEs supply chains must move beyond the description of user centric interfaces to interrogate how this focus aligns with theoretical imperatives and confronts practical adoption barriers. From a supply chain theory perspective, the emphasis on end user experience aligns with the Service-Dominant Logic, which posits that value is co created through interactions between actors in a network. FinTech platforms, by design, can facilitate this co creation by streamlining transactions and improving transparency (Madhani, 2020). However, this theoretical benefit is critically mediated by SMEs constraints. The assumption that intuitive design alone guarantees engagement overlooks the digital literacy gaps, integration costs, and legacy system incompatibilities that many SMEs face. The purported positive feedback loop of loyalty (Li & Li, 2021) may only materialize for SMEs that have already overcome these initial hurdles, potentially exacerbating a divide between digitally mature and nascent firms.

Furthermore, examining this through the lens of FinTech adoption models, such as the Technology-Organization-Environment (TOE) framework, reveals deeper tensions. While the environmental pressure to digitize is strong, organizational readiness within SMEs comprising financial resources, technical expertise, and strategic prioritization is often the limiting factor. The shift towards a customer centric ecosystem is not merely a technological upgrade but a strategic reorientation that demands significant change management, a resource intensive process for SMEs. Therefore, the claim that FinTech fosters a more responsive, customer centric ecosystem must be critically qualified, it does so conditionally, creating a new landscape where competitive advantage is increasingly tied to the capacity for digital adoption. The drive for holistic customer satisfaction thus becomes a double edged sword, acting as a catalyst for system productivity only for those SMEs capable of navigating the substantial organizational and financial constraints of the very technologies designed to empower them.

4.7   Operational effectiveness

A critical analysis of FinTech four proposed dimensions of transformation must interrogate their alignment with supply chain theory and their friction against the realities of SMEs constraints. From a theoretical standpoint, the integration with IoT and AI for transparency (Sah & Shaikh, 2024) aligns with Network Theory, which emphasizes the competitive value derived from interconnected, information rich ecosystems. However, this theoretical ideal presupposes a level of digital maturity and systems interoperability that is often beyond the reach of typical SMEs, whose constraints include limited IT budgets, fragmented technological infrastructure, and a lack of in house expertise to manage complex integrations. The promise of seamless automation thus confronts the practical challenge of integration debt, where the cost and complexity of connecting new FinTech tools with legacy systems can paradoxically increase short term operational burden.

Similarly, the implications for financial performance and financing process transformation (Li et al., 2024; Elsayed, 2024) can be critically examined through the Technology-Organization-Environment (TOE) adoption model. While alternative financing platforms theoretically reduce information asymmetry a core issue in Financial Supply Chain Management their adoption is heavily influenced by the environmental context of trust and regulation, and the organizational context of SMEs credibility. For instance, peer to peer lending algorithms may still penalize SMEs with thin digital credit files, replicating traditional exclusion in a new form. Therefore, the disruption of traditional models is not an absolute gain but a shift in the gatekeeping criteria, potentially creating new digital divides. The critical insight is that FinTech role in driving efficiency and resilience is not automatic it is contingent upon navigating a landscape where technological potential is filtered through significant organizational limitations and evolving environmental pressures, meaning its benefits are likely to be accrued unevenly across the SMEs sector.

Building upon the critical examination presented, the findings across all domains of FinTech application in SMEs supply chains can be systematically mapped to a core set of theoretical frameworks and conceptual model, revealing a consistent narrative of constrained potential. The overarching theoretical alignment is with Information Processing Theory, which posits that organizations invest in mechanisms to reduce environmental uncertainty. FinTech platforms, through big data analytics, blockchain transparency, and real time data exchange, are presented as powerful technical mechanisms designed to close the information processing gap for SMEs. However, the persistent gap between this theoretical capability and practical adoption is best explained by the Technology-Organization-Environment (TOE) framework. This model clarifies that adoption is not a function of technological availability alone but is critically hindered by organizational constraints specifically, the endemic resource limitations financial, human, technological of SMEs and by a complex environmental context of regulatory uncertainty, platform fragmentation, and the need for cross chain standardization.

The analysis further reveals how FinTech interventions interact with fundamental theories of firm relationships and strategy. The promised reduction of information asymmetry through transactional transparency directly engages Agency Theory, offering tools to mitigate costs arising from principal agent conflicts. Concurrently, the emphasis on blockchain enabled collaboration and platform integration resonates with Network Theory, highlighting the value of strengthened, trust based interconnectedness. Yet, both theoretical benefits are contingent on overcoming collective action problems and power asymmetries that SMEs, as typically weaker network actors, cannot dictate. From a strategic perspective, the potential for data analytics to become a unique capability aligns with the Resource-Based View (RBV), suggesting FinTech could help transform information into a source of competitive advantage. However, this prospect is critically mediated by the very organizational constraints highlighted by the TOE framework, risking a scenario where FinTech exacerbates inequalities, granting advantages only to those SMEs already possessing superior resources and digital maturity.

The drive towards sustainable and customer centric operations introduces the lens of institutional theory. The push for green FinTech and adherence to new digital platforms often reflects institutional isomorphism

where SMEs adopt practices coercively to gain legitimacy, secure financing, or meet supply chain partner mandates rather than from intrinsic strategic shift. Similarly, the focus on customer centricity aligns with Service Dominant Logic, emphasizing value co creation. In all cases, however, the realization of theoretical benefits is filtered through the prism of SMEs constraints. Ultimately, the integration demonstrates that FinTech transformative impact is less a story of technological determinism and more a complex, contested process shaped by the alignment or misalignment of innovative solutions with the structural realities, strategic capacities, and collaborative ecosystems in which resource constrained SMEs operate. Figure 4 provides an overview of the themes described above.
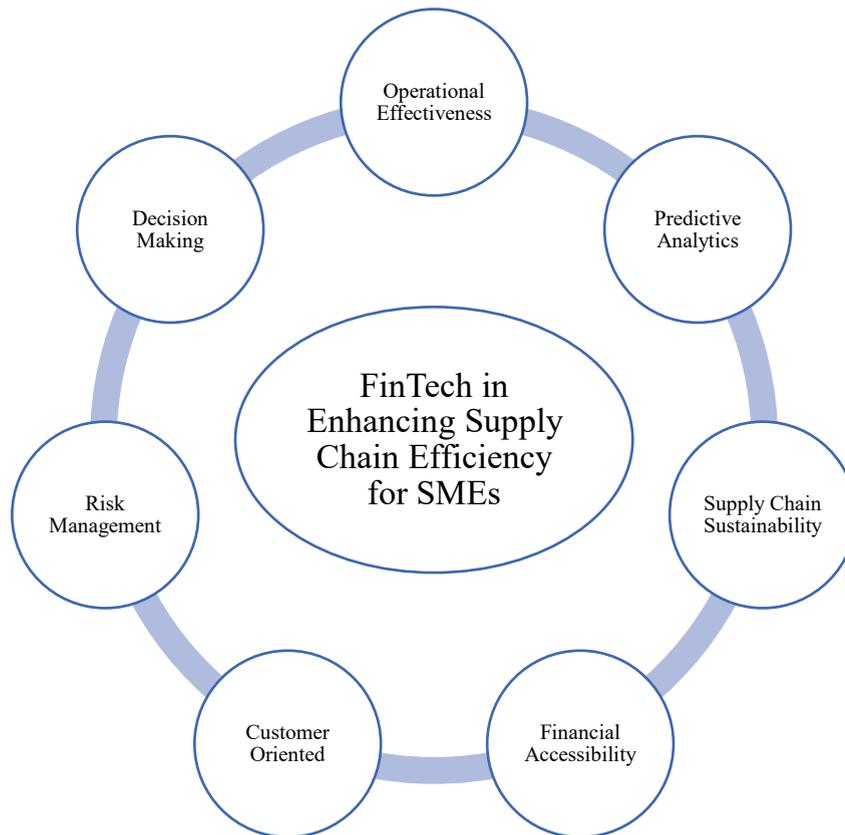

Figure. 4. Framework for fintech in enhancing supply chain efficiency for SMES

5.   Research gaps and future directions

Building upon the promising directions identified in recent literature, the advancement of FinTech for SME supply chains is contingent on addressing three pivotal limitations that currently constrain the rigor, applicability, and scalability of research finding. Firstly, there is a pronounced need for large scale empirical investigations focused on specific FinTech tools and their direct operational impacts. While theoretical frameworks and case studies suggest benefits, the field lacks comprehensive, quantitative evidence linking solutions such as blockchain enabled traceability, AI driven predictive analytics for demand forecasting, or integrated DeFi payment platforms to concrete supply chain key performance indicators (KPIs). Future studies must move beyond conceptual model to rigorously measure the causal effect of these tools on reducing lead times, lowering transaction and administrative costs, improving cash to cash cycles, and enhancing on time in full (OTIF) delivery rates. Without this empirical validation, it remains challenging

for SMEs leaders to justify investments and for policymakers to design targeted support programs. Secondly, the existing body of knowledge suffers from a significant geographical bias, with minimal coverage of SMEs in emerging markets. Much of the discourse is shaped by contexts with advanced digital infrastructure and mature regulatory environments. This overlook the vast potential and unique challenges of SMEs in regions like Southeast Asia, Africa, and Latin America, where FinTech could leapfrog traditional financial bottlenecks. Research must explore how FinTech solutions function amidst constraints such as intermittent connectivity, cash based economies, and less formalized supply chains. Understanding adoption barriers, contextual adaptations, and the differential impact on supply chain efficiency in these settings is critical for developing inclusive, globally relevant FinTech ecosystems.

Thirdly, the comparability and synthesis of research findings are hampered by measurement inconsistency and a lack of standardized metrics. The construction of supply chain efficiency in FinTech studies is often defined using disparate, non validated indicators, making meta analysis and cross industry validation difficult. Future research should work towards developing and adopting a standardized set of financial and operational metrics, for instance, aligning with the Supply Chain Operations Reference (SCOR) model dimensions of reliability, responsiveness, agility, costs, and asset management tailored to the FinTech context. Establishing these benchmarks will allow for consistent measurement across different industries manufacturing vs. agriculture and FinTech applications, enabling clearer benchmarking, more robust validation of tools, and clearer insights into which solutions deliver universal value versus those that are industry specific. By systematically addressing these limitations through targeted empirical validation, broadening geographical scope, and standardizing measurement frameworks future research can transition from highlighting potential to providing definitive, actionable guidance. This will empower SMEs worldwide to harness FinTech full potential, ultimately enhancing their supply chain resilience, liquidity, and competitiveness in an increasingly digital global economy.

6.   Conclusion and recommendations

This study provides a comprehensive overview of how Fintech enhances operational efficiency for SMEs, identifying seven key themes Risk Management, Decision Making, Financial Accessibility, Predictive Analytics, Supply Chain Sustainability, Operational Effectiveness, and Customer Orientation that significantly benefit to SMEs. The findings underscore Fintech transformative impact across multiple facets of SMEs operations, enabling these businesses to overcome traditional barriers and improve performance. By leveraging digital financial solutions, SMEs can optimize processes, mitigate risks, and enhance competitiveness in an increasingly digital economy. However, the study has notable limitations. The research relies on two databases, Scopus and Web of Science, which, while reputable, may have excluded relevant studies due to restricted institutional access. Expanding the search to include additional databases such as Wiley, ScienceDirect, and ProQuest in future research could yield a more comprehensive understanding of Fintech role in SMEs efficiency. From this study, demonstrates a strong geographical bias toward developing nations, with China is most conducting study is 13 out of the 22 analyzed studies. This trend suggests that developing countries are more likely to view FinTech as a strategic tool for enhancing operational efficiency, particularly among SMEs. The emphasis on these regions may reflect the greater need for financial innovation to address gaps in traditional banking services, as well as the potential for FinTech to drive economic growth and inclusion in emerging markets. Further research in more diverse contexts would provide a more comprehensive understanding of FinTech global impact. To advance this field, future research should prioritize the challenges SMEs face in adopting Fintech.

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Author contributions

The research and subsequent article were carried out by Muhammad Hamdi Che Hassan. His contributions encompassed the entire research process, beginning with the conceptualization of the core research idea and the establishment of the underlying theoretical framework. He was also solely responsible for designing the research plan and executing the study. Prof. Madya Dr. Lokhman Hakim Bin Osman. A rigorous process of referral to and discussion with the first author ensured the validity of the emergent themes and sub-themes. Subsequently, the final manuscript was approved for submission.