

REVIEW

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Financial inclusion and fintech: a state-of-the-art systematic literature review

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Abstract

This study presents an all-inclusive analysis of the literature on the augmentation of financial inclusion through fintech. Ninety-six papers were selected from the 2951 articles in the Web of Science, Scopus, and EBSCO databases. This study uses bibliometric and content analysis techniques to illuminate the underexplored aspects of fintech's impact on financial inclusion. Unlike previous studies, this study consolidates a significant amount of the literature on financial inclusion by systematically contextualizing theories and viewpoints from the fintech sector. The key findings include the identification of three main research clusters: (1) the advent of novel services, (2) the transformation of the market landscape, and (3) the roles of stakeholders in the fintech ecosystem. The analysis reveals gaps in the existing research, such as the need for more studies on the tangible impact of fintech on financial inclusion and regulation. This study concludes by highlighting potential directions for future research and emphasizing the importance of policymakers paying greater attention to fintech's implications for financial inclusion.

Keywords: Fintech, Financial inclusion, Sustainable growth, Systematic literature review, Bibliometric analysis, Content analysis

JEL Classification: G2, O16, O33

Introduction

Financial inclusion is crucial for households, enterprises, and national economic development. Recent studies of financial inclusion have primarily concentrated on three key areas: creating metrics for financial inclusion (Sarma 2016; Mialou et al. 2017), exploring the factors that influence financial inclusion (Zins and Weill 2016; Kumar 2013; Kabakova and Plaksenkov 2018), and examining the impact of financial inclusion (Hannig and Jansen 2010; Adegbite and Machethe 2020; Ghosh and Vinod 2017). However, the importance of financial technology (fintech) in improving financial inclusion is a new but crucial field requiring further research.

Fintech emerged in the mid-2010s and gained attention owing to its rapid growth and diverse impacts on various aspects of life (Lai and Samers 2021). Over the past decade, fintech has undergone three critical waves of development, each contributing to the expansion of financial services and the inclusion of marginalized populations (Palmié et al. 2020). This rapid evolution has made it easier to implement easily accessible

financial services, such as mobile money, particularly in regions where traditional banking is not easily accessible (Pelletier et al. 2020; Senyo et al. 2020). The scope of fintech's impact extends beyond traditional financial services and aligns with sustainable development initiatives. This rapid evolution has made it easier to implement accessible financial services, such as mobile money, which has become increasingly popular worldwide, particularly in places where traditional banking is scarce (Pelletier et al. 2020; Senyo et al. 2020). Fintech has an important impact that extends beyond traditional financial services and has a significant intersection with sustainable development initiatives. Recent research shows that fintech supports eco-innovation and energy efficiency, lowers carbon emissions, and promotes environmental sustainability (Akram et al. 2023; Adebayo et al. 2024). Fintech is essential to achieve global sustainability goals because it increases access to green financing and funding for energy projects, along with financial inclusion.

This study explores how fintech, an emerging force in financial services, integrates and impacts the financial inclusion framework. Our research is driven by the need to understand the operationalization of fintech in enhancing financial access and addressing the challenges it poses to existing financial ecosystems. By conducting a systematic literature review of 96 studies (selected from 2951 papers) across three databases: Web of Science (WoS), Scopus, and EBSCO, we analyze the evolution and impact of fintech on financial inclusion, identify key themes, and propose directions for future research. This enabled us to identify the evolution of this research field and the primary research themes or clusters. We further performed a content analysis of ABS 3, 4, and 4* journal publications through co-citation or clustering analysis to deepen our understanding of the fintech–financial inclusion literature.

The key findings include the identification of three main research clusters: (1) the advent of novel services, (2) the transformation of the market landscape, and (3) the roles of stakeholders in the fintech ecosystem. These themes could help researchers identify and avoid areas of research that are overdeveloped, overcrowded, or no longer developing. Moreover, we propose the following feasible directions for future research on fintech–financial inclusion: (1) the regulation of digital finance, encompassing security aspects and consumer/investor protection; (2) business strategies promoting fintech-led financial inclusion; (3) digital models targeting Sustainable Development Goals (SDGs); and (4) the tangible impact of digital finance on financial inclusion.

This study makes several contributions to the existing literature. First, it offers an exhaustive review of the emerging yet pivotal topics of fintech and financial inclusion. While previous reviews touched on various aspects of financial inclusion (Duvendack and Mader 2020; Ozili 2021), our study focuses specifically on the role of fintech, a relatively new and rapidly developing field.

Second, our empirical analysis is enriched using data from three journal databases: Scopus, WoS, and EBSCO, covering the period up to March 2024. This comprehensive dataset enables us to examine fintech's role as a driving force of financial inclusion, providing valuable insights into the state of financial inclusion worldwide. Notably, previous systematic reviews have often relied on more constrained data regarding observation numbers and the studied timeframe. For instance, Kim et al. (2018), Liu et al. (2020), Ali et al. (2023) focused solely on the WoS or Scopus and examined new products, such as mobile payment, microfinance, and blockchain.

Third, our systematic literature review covers all new fintech services, such as payments, lending, and crowdfunding, as well as all the transformation mechanisms of fintech in increasing productivity and changing stakeholder mindsets in the ecosystem. This comprehensive approach provides insights into the broad range of fintech's impact on financial inclusion.

The paper is structured to first outline the theoretical underpinnings of financial inclusion and fintech in Sect. “[Theoretical review](#)”. Section “[Methods](#)” outlines the methodology and offers a preliminary quantitative analysis of the research using a systematic literature review approach. Section “[Content analysis of the three clusters](#)” explores how fintech affects the current financial inclusion practices. Section “[Discussion, research gaps, and future directions](#)” discusses potential directions for future research. A summary of our findings is provided in Sect. “[Conclusion](#)”.

Theoretical review

Financial inclusion and fintech: definition and measurement

Conceptualizing and assessing financial inclusion

Financial inclusion has recently received significant interest, with an increasing body of research linking it to poverty risk. Initially, before the 2008 financial crisis, “financial inclusion” was often used interchangeably with “microfinance”. However, this economic downturn caused significant shifts in microfinance dynamics. Countries that prioritize microfinance, such as Bolivia, Nicaragua, Morocco, Pakistan, and Bosnia, have experienced increasing bankruptcy rates (Bateman 2014). Simultaneously, some microfinance institutions have begun to emphasize high-profit, high-interest loans for high-risk projects with swift payback periods, excluding disadvantaged individuals (Elliot et al. 2018). Additionally, the financial viability of many microfinance institutions has become questionable as they increasingly rely on public sector support.

In reaction to these developments, the World Bank presented a report, “Finance for All? Policies and Pitfalls in Expanding Access” (Bank 2007), which marked the transition toward a revised financial inclusion model. This report defines financial inclusion as the sustainable delivery of affordable and valuable financial services, particularly for low-income individuals, a definition widely adopted in subsequent studies (Muzigiti and Schmidt 2013; Ahamed and Mallick 2019).

Assessing financial inclusion—a multifaceted construct—necessitates a diversified approach depending on the objectives of the research or statistical organization. For example, international organizations, such as the International Monetary Fund (IMF) and the World Bank, have employed different methods for gauging financial inclusion at individual and national levels. Individual-level financial inclusion is typically measured using self-reported responses to standardized questions. However, national-level financial inclusion is assessed via indicators evaluating the financial inclusion status of a population per 100 adults.

The financial inclusion calculation is also guided by the research objectives and data availability. For instance, composite indicators are frequently employed to measure financial inclusion based on relevant indicators that align with research objectives. Two widely referenced databases for financial inclusion research are the Global Findex Database of the World Bank and the IMF's Financial Access Survey by the IMF. For instance,

the World Bank database has undergone numerous updates. The most recent version (2021) comprises nearly 300 indicators spanning various aspects of financial inclusion, including savings, borrowing, payments, risk management, access to and use of formal and informal services, and the financial technology used to conduct financial transactions (Demirgüç-Kunt et al. 2020).

Fintech: conceptualization and measurement

Fintech, an abbreviation for financial technology, first emerged in 2014 in industry reports from global consulting firms (Lai and Samers 2021). Over the years, fintech has drawn substantial interest owing to its rapid evolution and impact on diverse aspects of life. The term fintech is often used interchangeably with “internet finance” and “digital finance”, especially in China, where the term “internet finance” is more prevalent (Hua and Huang 2021). Other studies refer to fintech as information and communication technology, mobile money, mobile payments, and mobile banking (Lagna and Ravishankar 2022). Numerous studies have been conducted on fintech’s impact on financial inclusion, particularly in the context of ICT4D (Information and Communication Technologies for Development).

Fintech typically represents the introduction of innovative technology-based financial services offered by startups, including crowdfunding, peer-to-peer (P2P) lending, and foundational digital technologies such as blockchain and artificial intelligence (Bollinger and Yao 2018). Although fintech covers a broad spectrum of applications and categories (Bollinger and Yao 2018), it can generally be categorized into three primary components: technology, financial services, and the linkage between the two (Lai and Samers 2021). Palmié et al. (2020) outline the evolution of fintech in three distinct waves: (1) electronic payments; (2) blockchain and cryptocurrency; (3) artificial intelligence and its applications in areas such as digital lending, personal finance, online and mobile banking, peer-to-peer lending, investment management, payments, crowdfunding, insurtech, and regtech.

Recently, a new type of crowdfunding—prosocial crowdfunding—has emerged. Micro-finance institutions can raise capital from prosocial lenders through platforms such as Kiva.org, Zidisha.org, and Milaap.org. Jancenelle and Javalgi (2018) suggests that this crowdfunding type could positively influence financial inclusion. Further, mobile money has grown in popularity worldwide, especially in developing countries with underdeveloped banking and capital markets, and low economic inclusion. Researchers (Pelletier et al. 2020; Senyo et al. 2020; Senyo and Osabutey 2020) highlight the importance of mobile money in promoting financial inclusion in these regions. The widespread adoption of mobile money is attributed to factors such as cost reduction, convenience (Dong et al. 2018), and the success of systems such as M-Pesa in Kenya (Duncombe and Boateng 2009; Lashitew et al. 2019; Oborn et al. 2019; Lagna and Ravishankar 2022; Lai and Samers 2021).

Theoretical background: fintech and financial inclusion

The theoretical foundation for understanding fintech’s impact on financial inclusion and development is based on several key theories. The capability approach theory proposed by Sen et al. (1980) emphasizes the importance of normative values in ensuring that

technology is accessible and affordable and fosters freedom and creativity among individuals. Schumacher's appropriate technology theory (Schumacher 1973; Pal et al. 2020) builds on Sen's perspective, highlighting the need for technology that enhances users' existing skills and capabilities and promotes sustainable people-oriented development in ICT4D. In developing countries, mobile phones are often seen as technologies that bolster human freedom and capabilities (Hatakka and De 2011; Ahamed and Mallick 2019).

Economic theories on supply and demand, along with theoretical frameworks for product, technology, and service bundling, emphasize the potential of fintech to complement technological and service innovations in the financial sector (Dong et al. 2018).

From an individual behavior perspective, technology acceptance theories help explain the decision-making process when individuals adopt technology to access financial services. The theory of reasoned action (Fishbein et al. 1980; Bagozzi 1982) suggests that end users rationally evaluate potential consequences before engaging with a new technology. This theory explains why urban residents and individuals with better education, higher financial literacy, and higher income are more likely to access financial services through fintech. The Technology Acceptance Model (Davis 1989), an extension of the theory of reasoned action, considers the functionality and ease of use of technology and has become a prominent theoretical foundation for technology diffusion research (Coffie et al. 2021). The theory of planned behavior (Ajzen 1991) suggests that fintech usage is influenced by an individual's intentions, which are shaped by their attitudes, norms, and perceived behavioral control.

The Unified Theory of Acceptance and Usage of Technology (UTAUT) (Venkatesh et al. 2003) integrates eight theoretical models to explain the adoption and usage of technology. UTAUT identifies four key factors influencing behavior: behavioral intention, effort expectancy, facilitating conditions, and social influence. The expanded UTAUT2 model (Venkatesh et al. 2012) includes additional constructs, such as habits, hedonic motivation, and price value. These models have been widely applied to explain the use of various communication technologies, including mobile banking (Zhou et al. 2010), mobile payments (Yang et al. 2012), e-government (Wang and Shih 2009), mobile phone technologies (Zhou 2011), Internet banking (Riffai et al. 2012), and health information systems (Kijisanayotin et al. 2009).

In financial inclusion and fintech, production theories suggest that technology positively affects economic growth and development. Institutional theories propose that promoting financial inclusion aligns with neo-liberalism, arguing that financial markets evolve through institutional change and the encouragement of market mechanisms. The emergence of fintech is a catalyst for advancing financial markets for the underprivileged in developing countries that have previously faced numerous obstacles (Bernards 2019b). This perspective aligns with the policies and key frameworks of financial inclusion of the World Bank and G20.

While fintech is often considered as a driver of financial inclusion, several scholars offer some critical assessments. Mader (2018) argues that financial inclusion can sometimes prioritize the interests of financial institutions rather than benefiting the poor. Similarly, Loubere (2017) show that in China, digital finance may exacerbate inequalities and reinforce government social control rather than empower disadvantaged groups. Bateman et al. (2019) critique the optimistic views on mobile money, suggesting that

platforms like M-Pesa may increase economic dependency in the Global South. In the U.S. context, Bartlett et al. (2022) reveal how fintech may fail to eliminate lending discrimination against minority groups. These concerns highlight the need for a balanced understanding of fintech's role in fostering inclusion, especially in the Global South, where inequalities can be maintained (Langley and Leyshon 2022; Akolgo 2023).

This perspective suggests that while fintech offers opportunities for expanding financial services, its implementation can also replicate historical patterns of exclusion, particularly in marginalized regions (Campbell-Verduyn and Giumelli 2022). Therefore, a critical examination of fintech's role in advancing genuine financial inclusion, especially for vulnerable populations, is essential for further research and policy development.

Comparative analysis with existing literature

To highlight our study's distinctive contributions and positioning relative to the extant body of literature, we compared our study with four recent literature reviews that intersect the domains of financial inclusion and fintech. This comparative matrix outlines each study's focus, methodology, geographic coverage, databases used, and periods covered, thus illustrating our research's unique and comprehensive approach.

Our study focuses on the impact of fintech on financial inclusion and provides a comprehensive analysis of this topic. We cover a broader and more recent time period (up to March 2024) compared with other studies, ensuring that our findings are up-to-date and relevant. Unlike other studies that focus on narrower aspects such as microfinance, SME financing, or specific technologies such as blockchain, our study encompasses a broader spectrum of fintech and its implications for global financial inclusion. Drawing from a wide range of databases (WoS, Scopus, and EBSCO), we ensured a comprehensive coverage of the relevant literature. Additionally, our study maintains a global perspective, while other studies focus on specific regions like sub-Saharan Africa. The following comparative matrix (Table 1) illustrates how our study compares with other significant studies, highlighting our unique contributions and the depth of our analysis.

This comparison underscores the unique contributions and strengths of our study in relation to the existing literature's review on related topics. Our study provides a timely, comprehensive, and globally focused analysis of the impact of fintech on financial inclusion, thus addressing the critical gap in the current understanding of this subject.

Methods

Research agenda

The main objective of this study is to systematically review and synthesize the existing literature on financial inclusion and fintech by employing the rigorous and iterative approach outlined by Tranfield et al. (2003). To achieve this goal, this study employs an integrated methodological approach-systematic literature review, bibliometric analysis, and content analysis-to ensure a comprehensive exploration of the fintech landscape, providing robust findings that guide future research (Kim and So 2022; Jain et al. 2023).

First, to identify the relevant papers, this study employs a systematic literature review methodology guided by the PRISMA framework (Page et al. 2021), ensuring transparency and reproducibility. Using VOSviewer, we conduct a bibliometric

Table 1 Comparison of systematic literature reviews on financial inclusion and fintech

Feature	Our paper	Ribeiro et al. (2022)	Sanga and Aziakpono (2023)	Trivedi et al. (2021)	Nan et al. (2021)	Liu et al. (2020)	Ali et al. (2023)
Title	Financial inclusion and fintech	Does microfinance foster the development of its clients?	FinTech and SMEs financing	Application of blockchain technology in E-Finance	Socioeconomic impacts of mobile money in Sub-Saharan Africa	What have we learned from 10 years of fintech research?	Bibliometric analysis of global research trends on microfinance institutions
Focus	Comprehensive review on financial inclusion through fintech	Microfinance impact on poverty and women empowerment	Trends and challenges in FinTech and SME financing	Blockchain technology in financial and e-finance sectors	Socioeconomic impacts of mobile money	Fintech business models, mobile payment, micro-finance, P2P lending, crowdfunding	Global research trends on microfinance and financial inclusion
Methodology	Systematic literature review, bibliometric overview	systematic literature review, bibliometric overview	Systematic literature review, bibliometric analysis	Systematic literature review	Systematic literature review	Bibliometric analysis	Bibliometric analysis
Geographical coverage	Global	Global	Global	Global	Sub-Saharan Africa	Global	Global
Databases Used	Web of Science, Scopus, EBSCO	Web of Science, ABS	Web of Science, Scopus	ScienceDirect	Multiple including ACM, EBSCO, ScienceDirect	Web of Science	Scopus
Period Covered	Up to March 2024	2012-2021	2008-2022	2017-2021	2008-2019	1995-2017	1989-2019
Main findings	Identification of main research clusters in fintech and financial inclusion	Impact of microfinance on poverty, need for more focus on women	Trends in FinTech impacting SME financing	Usage of blockchain in finance	Impacts of mobile money on socioeconomic factors	Evolution of fintech business models, identifying future trends	Emerging hotspots in microfinance research
Contribution	Depth of content analysis with a focus on under-explored aspects of fintech's impact on financial inclusion	Demand-side focus on microfinance	Specific focus on SMEs and FinTech financing	Focus on blockchain's role in e-finance	Focus on mobile money's socioeconomic impacts	Analyzes the evolution of FinTech research	Bibliometric analysis of microfinance and financial inclusion

analysis that reveals key thematic clusters in the fintech and financial inclusion literature (Tranfield et al. 2003; Xu et al. 2018; Dawood et al. 2022). Based on these findings, a detailed content analysis was conducted to uncover critical insights and research gaps (Kim and So 2022).

The research process followed several key steps that are detailed below.

Defining relevant search terms: We will identify and refine a set of keywords and phrases that effectively capture the key concepts related to financial inclusion and fintech. These search terms will be used to thoroughly search the relevant literature across various databases.

Conducting literature searches: Utilizing the defined search terms, we will perform an extensive literature search across various academic databases, such as WoS, Scopus, and EBSCO. The search will be conducted systematically to identify all relevant studies.

Filtering and selecting relevant studies: Following the PRISMA guidelines (Page et al. 2021), we will apply a series of inclusion and exclusion criteria to screen the identified studies. This process will involve removing duplicates, assessing the relevance of titles and abstracts, and evaluating the full-text articles for eligibility. The PRISMA flow diagram will be used to illustrate the study selection process and ensure transparency and reproducibility.

Descriptive Analysis—Quantitative Exploration: The selected studies will be thoroughly analyzed and synthesized using quantitative techniques. We will employ bibliometric and network analysis methods to identify key studies, authors, and research themes, as well as to identify current research trends (Tranfield et al. 2003; Xu et al. 2018).

Content Analysis—Reporting the results: The selected papers will be analyzed using content analysis, which involves systematically categorizing and interpreting the qualitative data within the studies. The papers will be grouped into different clusters based on their themes, research focus, and key findings. This clustering process will provide an overview of the main research areas in the fintech and financial inclusion literature. By employing content analysis, we aim to uncover the nuanced aspects of the field that may not be readily apparent through other analysis techniques. The synthesized results will be discussed in the context of the research objectives, highlighting the key insights, gaps, and potential future research directions. This in-depth analysis will contribute to a more comprehensive understanding of the current state of research on fintech and financial inclusion and identify areas requiring further investigation.

By following this research agenda, we aim to provide a comprehensive and rigorous review of the literature on financial inclusion and fintech. Integrating these multiple methods—systematic literature review, bibliometric analysis, and content analysis—provides a robust and reliable framework for exploring the role of fintech in advancing financial inclusion. Using the PRISMA framework ensures a systematic and methodologically sound selection process, whereas bibliometric and content analyses offer a broad overview and deeper insights into the literature. This

systematic approach will contribute to a deeper understanding of the field, identify current trends and inform future research and policy decisions.

Identification of search terms

As fintech and financial inclusion are the two main focuses of this study, we selected two sets of search terms to cover these two topics (Table 2). The keywords were chosen based on previous literature reviews of similar themes, the authors’ research experience, and insights from established academics in the field.

The fintech-related keywords include terms such as “financial technology”, “FinTech”, “e-finance”, “P2P lending platform”, “Crowdfunding”, “Blockchain”, “Smart contract”, “Digital currency”, “Mobile payment”, “Robo-advisors”, “E-banking”, and “InsurTech”.

The keywords associated with financial inclusion comprise phrases like “Financial inclusion”, “financial access”, “inclusive finance”, “Access to banking services”, “Access to credit”, “Money advice”, and “microfinance”.

Data collection and analysis

We employed a four-stage strategy following the PRISMA guidelines (Page et al. 2021) to identify relevant studies for our final review. The first stage involved collecting journal articles from three comprehensive databases–WoS (n = 993), Scopus (n = 1920), and EBSCO (n = 835)–using predetermined search terms. We selected an unrestricted time-frame until March 2024 to include as many pertinent publications as possible. The initial search resulted in 3748 articles, which were stored in CSV format and completed with key information, such as paper title, authors’ names and affiliations, abstracts, keywords, and references. We removed 797 duplicate records, leaving 2951 unique papers.

In the second stage, we excluded records that were not in the ABS 3, 4, 4* categories (n = 2538) based on the Academic Journal Guide from the Association of Business Schools

Table 2 Search strings and keywords

Search strings and keywords:
(“financial technology” OR “finance technology” OR “FinTech” OR “Fin-tech” OR “e-finance” OR “P2P lending platform” OR “Peer to peer” OR “Online lending” OR “Crowdfunding” OR “Crowdfund investing” OR “Transaction terminals” OR “Cashless payments” OR “Paypal” OR “Alipay” OR “Personal finance management” OR “Blockchain” OR “Smart contract” OR “Digital currency” OR “Bitcoin” OR “Mobile payment” OR “Mobile money” OR “Robo-advisors” OR “Automated portfolio management” OR “E-banking” OR “online bank” OR “mobile bank” OR “InsurTech” OR “algorithmic trading”) AND (“Financial inclusion” OR “financial inclusive” OR “financial exclusion” OR “financial access” OR “access to finance” OR “financial service” OR “inclusive finance” OR “Access to banking services” OR “Access to credit” OR “Access to insurance” OR “Savings and assets” OR “Money advice” OR “financial advice” OR “microfinance”)
This table contains a compilation of search strings and keywords, bifurcated into fintech keywords and financial inclusion keywords. These search strings and keywords have been utilized to conduct a comprehensive literature review on fintech’s influence on financial inclusion

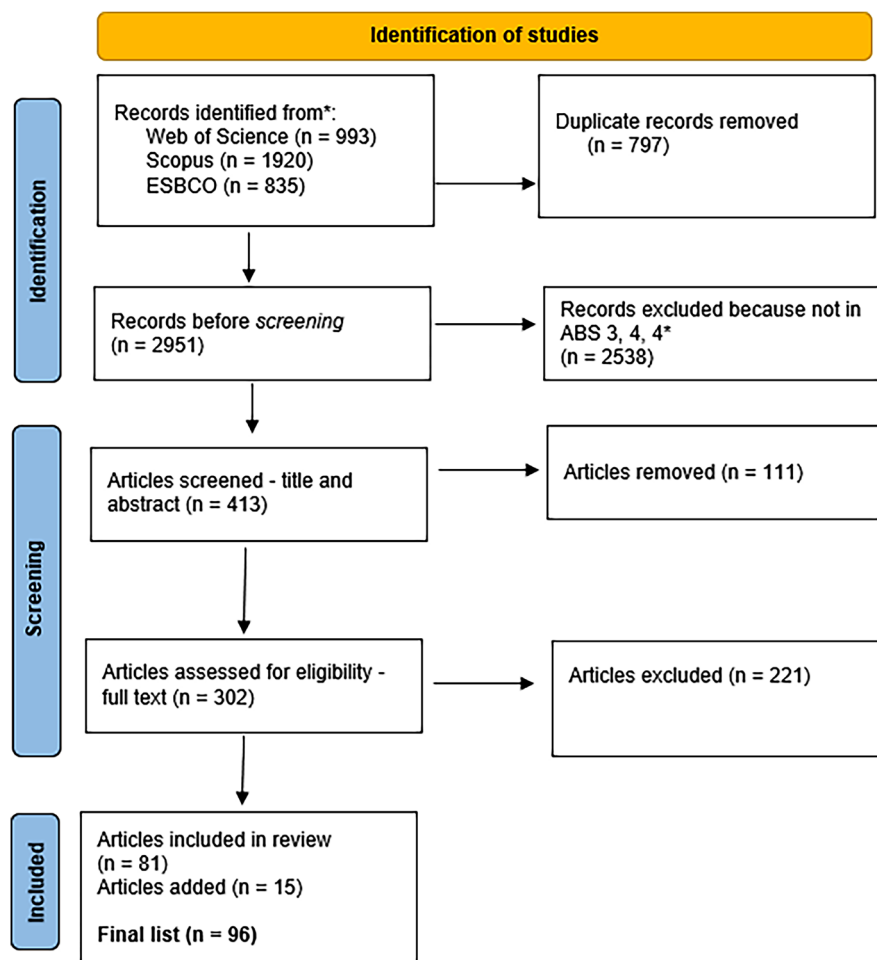


Fig. 1 The PRISMA flow diagram for the systematic review process to identify the papers for final review. *Note* This PRISMA diagram illustrates the flow of information through the different phases of the systematic review. The process involved identifying records from Web of Science, Scopus, and EBSCO databases, removing duplicates, screening records based on ABS category, and assessing full-text articles for eligibility. Additional studies were identified from other sources and added to the final list. The diagram maps out the number of records identified, included, and excluded at each stage, along with the reasons for exclusions. The final selection involved the application of inclusion and exclusion criteria, leading to the identification of 96 journal articles for the bibliometric and content analysis

(ABS/AJG 2021). This ensured scientific relevance and international recognition of the selected articles. Finally, 413 papers were retained for title and abstract screening.

In the third stage, we screened the titles and abstracts of 413 papers and removed 111 irrelevant papers.

Finally, we conducted a full-text assessment of the remaining 302 papers for eligibility. We excluded 221 articles that did not meet the inclusion criteria, leaving 81 studies for review. We included 15 additional studies identified from other sources and added them to our final list. The final list comprised 96 studies for analysis, including 81 studies from the systematic search and 15 studies from other sources.

The PRISMA diagram (Fig. 1) illustrates the flow of information through the different phases of the systematic review, mapping out the number of records identified, included, and excluded, and the reasons for exclusion.

Descriptive analysis: quantitative exploration

Within the scope of our study, we analyzed 96 articles, a fraction of the 2951 papers initially sourced, published between 2005 and 03/2024. The data in Fig. 2 illustrate a noticeable increase in the number of publications over time. This pattern indicates growing attention being paid to the area being explored, implying that research in this field has become notably active and dynamic in recent years.

The 96 identified articles were distributed across 62 journals. This spread is presented in Table 3, which lists the journals that published these studies. 'Technological Forecasting and Social Change' leads with 13 articles, which may indicate the journal's specific interest in the implications of technology on society, including how fintech might shape future financial services and inclusion. The presence of the 'Journal of Business Research' and 'World Development' among the top three indicates the cross-sectoral impact of fintech-spanning business research perspectives and developmental economics. Their significant contribution highlights fintech's relevance in technology circles and in broader business and socioeconomic development contexts.

The spread of articles across 62 journals, with only the top journals accounting for a notable proportion (13 of 96), reinforces the idea that the field is not dominated by a single concept or viewpoint. The variety of journals from different academic domains reveals that research on fintech and financial inclusion intersects numerous disciplines, reflecting its broad impact on both theoretical and practical levels. This distribution also suggests that significant insights into fintech's role in financial inclusion come from a wide array of scholarly contributions, indicating the topic's relevance to diverse global audiences and representing a broad range of journals.

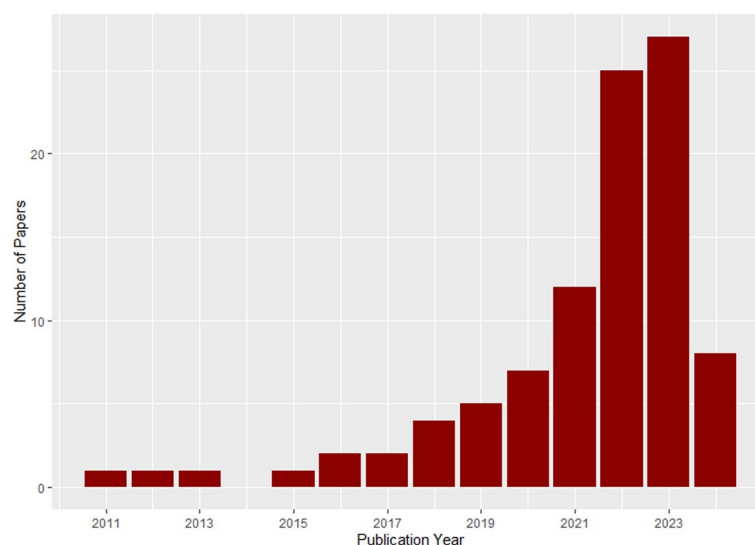


Fig. 2 Publication Trend by Year. *Note* This figure depicts the annual distribution of the 96 articles, out of a pool of 2951.

Table 3 Top 20 journals by number of papers from a total of 62 journals

Rank	Journal	Count
1	Technological Forecasting and Social Change	13
2	Journal of Business Research	5
3	World Development	4
4	European Journal of Finance	3
5	Information Technology and People	3
6	International Review of Financial Analysis	3
7	Journal of Development Studies	3
8	Management Science	3
9	Small Business Economics	3
10	Environment and Planning A-Economy and Space	2
11	European Journal of Information Systems	2
12	Information Systems Frontiers	2
13	Journal of Banking and Finance	2
14	Manufacturing and Service Operations Management	2
15	New Political Economy	2
16	Review of Financial Studies	2
17	Review of International Political Economy	2
18	World Bank Economic Review	2
19	Academy of Management Journal	1
20	Annual Review Of Financial Economics	1

The table lists the top 20 journals with the highest number of selected papers. The count reflects the quantity of papers included from each journal within the scope of 62 journals assessed in this review

The comprehensive list of the 96 articles is accessible in the Appendix B Table 6. This list offers detailed information about the articles, including title, authors, and publication year, facilitating deeper analysis and research.

For this exploratory analysis, we employed network analysis and co-occurrence mapping to examine the existing body of research on fintech and financial inclusion. We used the VOSviewer software to perform co-occurrence analysis and organize the literature based on subject content. Co-occurrence analysis involves generating a network of nodes, where each node represents a keyword and connections indicate the co-occurrence of these keywords in scientific studies. Two keywords were considered co-occurrences if they appeared together in a paper's abstract or keyword list. This method of analysis reveals the relationships and associations between concepts and ideas in a field. Detailed information about the methodology is provided in Appendix A. Figures 3, 4, and 5 illustrate the most commonly occurring keywords, the principal clusters identified through the analysis, and the evolution of these clusters over the years, respectively.

The keyword density shown in Fig. 3 highlights the most frequently occurring keywords in the selected literature, offering an overview of the central concepts of the research. The visualization in Fig. 3 with keyword density reveals the prevalence of 'mobile money', 'financial inclusion', and 'fintech' as key topics. Beyond their frequency, these terms are central nodes that connect with specialized areas such as 'digital payments', 'poverty', and 'gender'. The prominence of 'mobile money' suggests a strong emphasis on the practical tools driving financial inclusion, while its connection to 'poverty' and 'gender' underscores the sectors where the impact is most investigated.

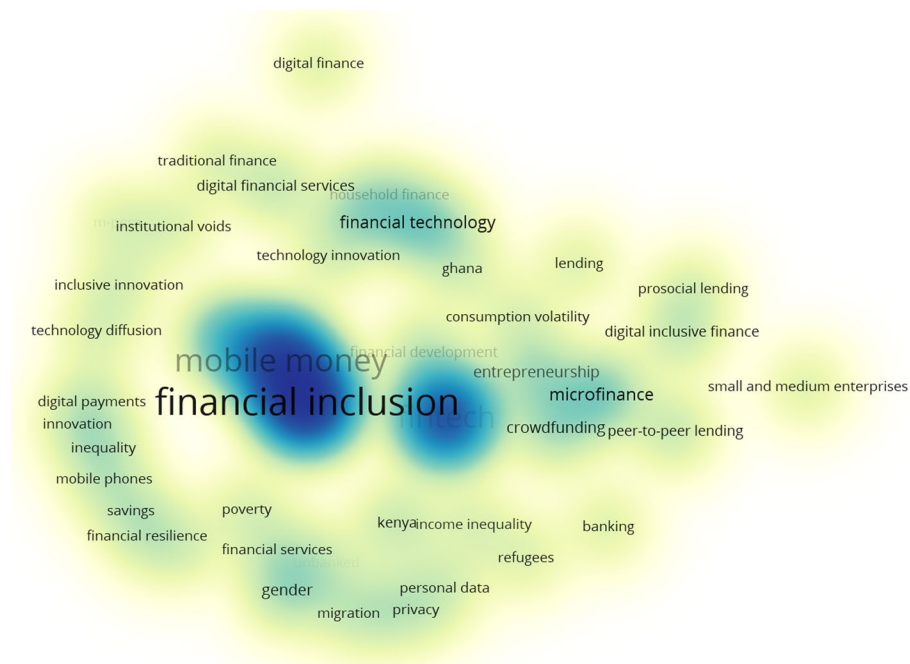


Fig. 3 Keyword Density across Selected Literature. *Note* This figure displays keyword density from 96 selected articles, with node size indicating keyword frequency. Central terms such as ‘mobile money’, ‘financial inclusion’, and ‘fintech’ signal core research foci, while connections to terms like ‘gender’ and ‘poverty’ etc. suggest intersections with broader subjects such as socioeconomic issues. Source: The authors’ analysis via the VOSviewer tool

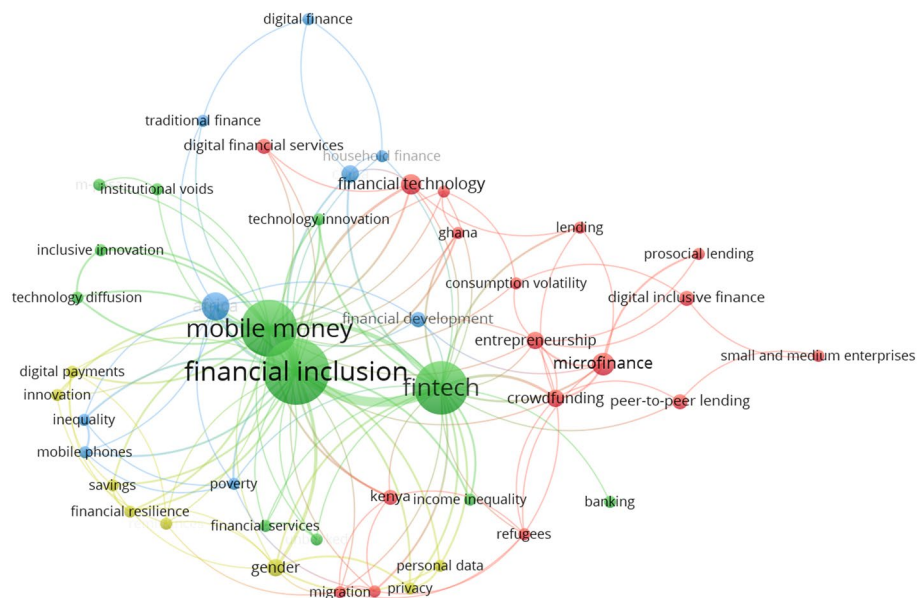


Fig. 4 Thematic Clusters in the Literature. *Note* This figure presents the thematic clusters in the literature on fintech and financial inclusion, generated using VOSviewer. Each color represents a separate cluster based on the co-occurrence of keywords within the analyzed articles. These clusters provide preliminary insights that help define distinct research domains, which are further explored and detailed in Sect. “Content analysis of the three clusters” of the text. Source: The authors’ analysis via the VOSviewer tool

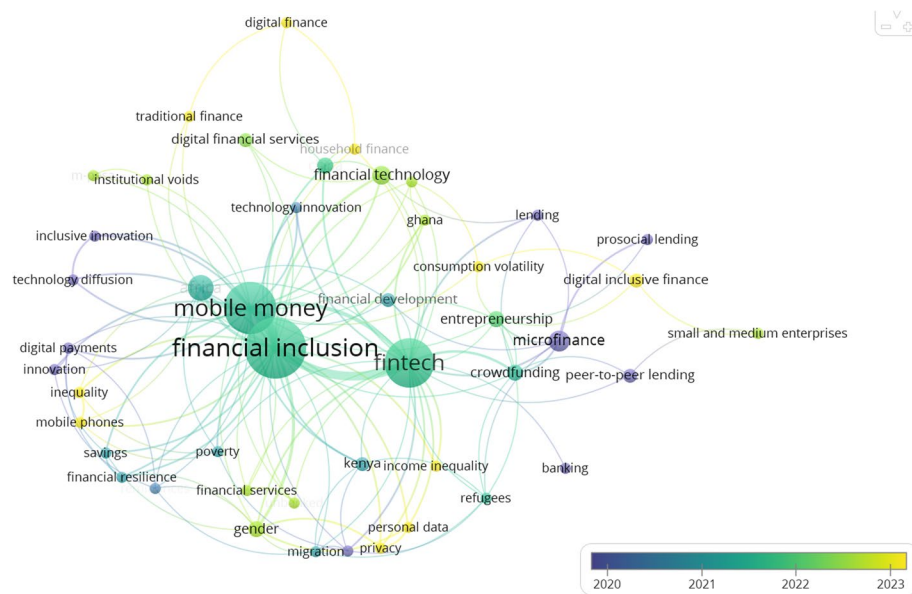


Fig. 5 Evolution of Research Themes Over Time. *Note* This temporal visualization traces the progression of research themes (before 2020, 2020, 2021, 2022, 2023 and after 2023), revealing shifts in focus and the emergence of new topics. The evolving color gradient pinpoints changes in thematic prevalence over time, underscoring how recent years have seen increasing attention to ‘privacy’, ‘inequality’, and ‘personal data’ concerns in fintech. Source: The authors’ analysis via VOSviewer tool

Figure 4 reveals a complex network in which interlinkages between ‘fintech’ and other financial sectors, such as ‘microfinance’ and ‘crowdfunding’, are evident. This network shows a collective increase in fintech research and highlights fintech’s role as a bridge between traditional financial systems and innovative financial solutions addressing inclusion. The thematic clusters revealed in Fig. 4 provide an understanding of the primary thematic groups or research strands within this field. Notably, this study’s evolution, as shown in Fig. 5, emphasizes the shifts in focus and emerging themes over time.

In Fig. 5, the temporal aspect of research themes overtime is highlighted, revealing a growing focus on “privacy”, “inequality”, and “personal data”. This evolution indicates the expanding horizon of fintech research, which increasingly considers the social implications of technology, such as data security and privacy concerns, in the context of financial services. More recent emphasis on these topics indicates a response to the public’s rising concerns over data handling in fintech. The progression of keywords over time demonstrates a shift from a focus on technology and services to an increased awareness of the broader social implications and regulatory environment of fintech. This suggests that the field is moving toward a more mature phase, where the implications of fintech are being evaluated in a broader socioeconomic context, guiding us toward future research pathways that consider the interplay between technology, societal impact, and regulatory frameworks.

This exploratory analysis provides a comprehensive overview of current fintech and financial inclusion research. It identified key themes and their connections. This supports the content analysis in the next section, where we go deeper into the

content of the selected articles to understand the research landscape, helping to identify potential gaps in the literature and directions for future research.

Content analysis of the three clusters

In the previous section, the exploratory analysis of 96 selected papers provided initial insights into the distinct research clusters within the literature on fintech and financial inclusion. To delve deeper into the content of these clusters, we undertook a content analysis of the articles, grouping them into three overarching thematic categories: “The Advent of Novel Services” (indicated by the green and red clusters in Fig. 4), “Transformation of the Market Landscape” (as represented by the blue cluster in Fig. 4), and “the Roles of Stakeholders in the fintech Ecosystem” (symbolized by the yellow cluster in Fig. 4). These were further classified into nine subcategories. Table 4 shows the main categories and their corresponding subgroups as determined from the content analysis.

Cluster 1: the advent of novel services

This cluster examines the emergence of innovative fintech solutions such as mobile payments, peer-to-peer lending, and crowdfunding platforms. These innovations have transformed the accessibility and delivery of financial services, particularly in regions lacking traditional banking infrastructure. For example, the spread of mobile money services has significantly enhanced financial transactions in sub-Saharan Africa by providing financial access to previously unbanked populations (Lashitew et al. 2019; Koomson et al. 2021).

The advent of novel fintech services has enhanced access to financial services, enabling individuals who lack traditional banking facilities to participate in the financial system (Senyo and Osabutey 2020; Abbasi et al. 2021). Increased accessibility is crucial to enhance financial inclusion and promote economic growth by integrating underserved populations into financial ecosystems (Pelletier et al. 2020). By offering financial tools designed to meet the needs of disadvantaged groups, fintech innovations empower individuals and support efforts to alleviate poverty (Jancenelle and Javalgi 2018). Moreover, the widespread adoption of these services highlights the need to improve digital literacy

Table 4 Three pre-defined overall topic categories in fintech financial inclusion

Cluster	Description
Cluster 1: The Advent of Novel Services	Fintech: Electronic payment Fintech: Crowdfunding/lending aspects
Cluster 2: Transformation of the Market Landscape	Enhancing Efficiency and Reducing Costs through Fintech Promoting Sustainable Growth through Fintech
Cluster 3: The Roles of Stakeholders in the Fintech Ecosystem	Building up the ecosystem Developing financial platform and infrastructure Adopting regulation and enhancing institution quality Broadening the digital skill Financial markets and the role of FinTech

This table categorizes the fintech ecosystem into three thematic clusters: the advent of novel services, the transformation of the market landscape, and the roles of stakeholders. These categories help structure the discussion on fintech's impact on financial inclusion

and provide training (Johnen et al. 2023), as discussed more in Cluster 3. Ensuring that customers can engage effectively with fintech technologies is vital for maximizing their potential benefits and fostering an inclusive digital economy (Asongu et al. 2021).

Fintech: electronic payment

The crucial role of mobile phones in promoting financial inclusion has been explored extensively. Many studies emphasize the significant impact of fintech in accelerating financial inclusion (Bernards 2019a; Demir et al. 2022; Lagna and Ravishankar 2022). A strong correlation has been observed between mobile phone penetration and economic inclusion at both the national and international levels (Demirgüç-Kunt et al. 2020; Pal et al. 2021; Demir et al. 2022). Mobile phone ownership and Internet access can play a significant role in decreasing the number of adults without banking facilities and in promoting financial services among account holders (Tyce 2020; Demirgüç-Kunt et al. 2020; Pal et al. 2021).

Even basic mobile phones can provide access to mobile money accounts and other financial services (Dodgson et al. 2015). Coupled with Internet access, the possibilities for financial inclusion have broadened (Gabor and Brooks 2017). These technologies could help tackle unbanked adults' barriers to accessing financial services. The convenience of mobile phones eliminates the need to travel long distances for financial services (Demirgüç-Kunt et al. 2020; Economides and Jeziorski 2017). They also provide an avenue for digital currency, allowing participation in the formal economy (Dodgson et al. 2015). Studies further indicate that mobile money has a more significant spillover effect on the economy than does traditional banking (Pelletier et al. 2020).

Mobile money, a popular fintech innovation for transactions, enables financial transactions through mobile devices (Senyo and Osabutey 2020; Koomson et al. 2021; Asongu and Le Roux 2023a; Mohamed 2023). It offers convenience, low transaction costs, and broad accessibility because transactions can be performed instantly from any location, at any time, for a small fee (Dong et al. 2018; Lashitew et al. 2019; Senyo and Osabutey 2020; Senyo et al. 2020; David-West et al. 2022; Hamdan et al. 2022; Avom et al. 2023; Shaikh et al. 2023). This is particularly beneficial for individuals in developing countries where traditional banking and capital markets are underdeveloped and financial inclusion is low (Pelletier et al. 2020; Hua and Huang 2021; Lorenz and Pommet 2021).

Mobile money agents play a crucial role in the adoption and use of such services (Johnen et al. 2023). Agent characteristics, such as offering account-opening services, receiving formal training, and proximity to users, significantly affect mobile money adoption rates (Johnen et al. 2023; Lashitew et al. 2019). However, only approximately half of the agents offer account-opening services or are formally trained, indicating room for improvement for further financial inclusion (Johnen et al. 2023).

Mobile money has improved household financial resilience, especially in female-headed and rural households (Sakyi-Nyarko et al. 2022). This facilitates the sending and receiving of financial support during unexpected financial challenges (Koomson et al. 2021). Mobile money adoption is also linked to increased economic activity, consumption smoothing, and business growth, particularly benefiting small and medium enterprises (Fabregas and Yokossi 2022; Mohamed 2023; Song et al. 2024).

However, the rapid expansion of fintech is not without risks and challenges. These issues include regulatory uncertainties, illegal transactions, data abuse, and contributions to inflation in regions with limited market integration (Hua and Huang 2021; Asongu et al. 2021; Qiu 2022). Addressing these issues through appropriate regulations and policies is key to realizing the full potential of mobile money for financial inclusion and economic development (Asongu et al. 2021; Lagna and Ravishankar 2022). These topics are discussed in more detail in the subsequent sections.

Fintech: crowdfunding/lending aspects

Fintech, including P2P lending, can enhance financial inclusion by breaking down banking services, directing capital to core functions, and delivering services digitally. This ensures greater access to funds for the wider population (Galak et al. 2011; Suri et al. 2021; Zhang and Liu 2012; Chu and Wei 2023). The microfinance sector can provide smaller loans to economically disadvantaged individuals and those residing in rural areas who may find traditional banking inaccessible because of a lack of formal identification (Zhang and Liu 2012; Dodgson et al. 2015). P2P lending is a feasible solution to provide low-interest loans to individuals with low credit scores and those seeking small loans in areas with limited banking facilities (Michels 2012; Maskara et al. 2021). P2P lending platforms can enhance financial inclusion by offering an alternative to traditional financial institutions, particularly in rural communities with fewer bank branches and urban areas with limited access to fringe banking services (Maskara et al. 2021).

Growth in P2P lending has been driven, in part, by distrust in traditional banks. Evidence suggests that individuals in U.S. states with greater distrust in banks are more likely to fund P2P loans and lend higher amounts, especially small loans or borrowers with less banking access (Saiedi et al. 2022). The rise in cryptocurrency markets has also influenced the composition and activity of borrowers and investors in P2P lending markets, with increased loan requests and significant loan amounts from borrowers with good credit ratings, technical knowledge of cryptocurrencies, and the intention to borrow for investment purposes (Chung et al. 2023).

Entrepreneurs in developing countries often struggle to secure internal funding for their businesses, which leads them to seek external financing sources (Jancenelle and Javalgi 2018; Abbasi et al. 2021). P2P lending provides a channel for SMEs to fulfill their financial needs (Abbasi et al. 2021). Institutional quality positively moderates the association between P2P lending fintech companies and SMEs' access to financing, suggesting that a supportive institutional environment can enhance the benefits of P2P lending for SMEs (Abbasi et al. 2021).

Crowdfunding, another fintech application, has become an important source of funding for microfinance (Bollinger and Yao 2018; Gama et al. 2023). Initially conceived as a financial instrument to support vulnerable populations excluded from formal financial systems, crowdfunding has evolved into a multi-billion dollar industry. Thus, it has transformed into prosocial crowdfunding, powered by prosocial lenders on prosocial crowdfunding platforms (Jancenelle and Javalgi 2018). This has opened opportunities for unbanked populations (Figueroa-Armijos and Berns 2021) and SMEs (Jancenelle and Javalgi 2018).

Crowdfunding can be particularly beneficial for underrepresented entrepreneurs such as refugees. When refugee loan campaigns are affiliated with MFIs that feature lower default rates, high profitability, an entrepreneurial support orientation, transnational operations, and a digital focus, they achieve better crowdfunding performance outcomes than those affiliated with MFIs that lack these features (Gama et al. 2023). These reputational signals from MFIs can increase entrepreneurial financing and democratize resource acquisition among financially excluded refugee entrepreneurs (Gama et al. 2023).

Moreover, crowdfunding enables altruistic individuals to assist the unbanked population directly, bypassing traditional profit-focused intermediaries such as banks and venture capitalists, who often lack a social or ethical perspective (Figueroa-Armijos and Berns 2021).

Cluster 2: transformation of the market landscape

This cluster explores how fintech innovations are reshaping the traditional financial services landscape. Fintech solutions introduce new efficiency and cost-saving measures to foster competition and innovation across sectors (Gomber et al. 2018). Integrating digital technologies with conventional financial services offers opportunities for improved service delivery, enhanced customer experiences, and extended financial reach for underserved populations (Senyo and Osabutey 2020).

Fintech solutions provide cost-effective alternatives to traditional financial services, facilitating scalability and broader service reach (Economides and Jeziorski 2017). Cost efficiency is essential for extending financial services to underserved markets and fostering economic growth (Lashitew et al. 2022). Further, fintech's alignment with development goals contributes to economic resilience and environmental sustainability, thus supporting global initiatives for sustainable growth (Demir et al. 2022). However, the rapid evolution of fintech presents regulatory challenges requiring adaptive frameworks to manage potential risks and ensure consumer protection (Asongu et al. 2021). Policy-makers must manage these challenges by balancing innovation promotion and implementing regulations that safeguard consumer interests and maintain market integrity (Chu and Wei 2023).

Enhancing efficiency and reducing costs through fintech

Advancements in technology, particularly in mobile transactions, have been recognized for their potential to significantly decrease the associated costs (Bernards 2019a; Demir et al. 2022; Pham and Luu 2023). One specific example is mobile money. This innovative technology allows users to deposit money onto their mobile devices, transfer funds electronically via text messages, and withdraw cash from numerous sources nationwide. This technology reduces the cost of financial transactions, eliminates the need for physical infrastructure, such as bank branches, and provides an easy-to-use interface for users (Dong et al. 2018; Choi and Loh 2023; Konte and Tetteh 2023). Mobile money offers several benefits: convenience, swift transaction processing, increased accessibility, and lower transaction costs (Senyo and Osabutey 2020; Senyo et al. 2021; Mohamed 2023).

Mobile money networks offer an appealing alternative to suppliers because of their lower capital and operational expenses, and fewer institutional restrictions (Economides and Jeziorski 2017). Unlike traditional banks, these networks do not require expensive physical branches; a mobile phone is all one needs to operate as an agent (Lorenz and Pommet 2021). Further, using information and communication technology can reduce the cost of implementing boundary-spanning business models, which can enhance social value creation (Lashitew et al. 2019, 2020). However, it is crucial to recognize that these self-governing social value creation techniques can lead to uneven distributional consequences.

Mobile money can also positively contribute to development through remittances, with the amount of money sent and transfer costs playing a role (Lee et al. 2022; Balasubramanian et al. 2023). Billions of individuals living in poverty worldwide engage in numerous small transactions, creating a consistent income stream through fees generated from these transactions.

The emergence of mobile technology has eliminated the need for long-distance travel to financial institutions. Digital technology can enhance the accessibility of financial services by minimizing the travel costs associated with their delivery (Demirgüç-Kunt et al. 2020). Based on conventional standards, P2P platforms that use nontraditional data can allow subprime customers to secure loans at a reduced cost (Maskara et al. 2021; Abbasi et al. 2021; Erel and Liebersohn 2022). Additionally, robo-advisers offering automated investment services have emerged as cost-effective, flexible, and continuously available online alternatives to traditional wealth management services (Berg et al. 2022). Using robo-advisory systems, customers can customize their investment portfolios to match their risk profiles and objectives (Palmié et al. 2020).

Fintech lending can increase the supply of financial services to small businesses underserved by traditional banks (Erel and Liebersohn 2022). Fintech lending can help ease the financing constraints faced by SMEs (Bu et al. 2024). P2P lending fintech, in particular, can increase access to finance for SMEs (Abbasi et al. 2021). Fintech lending can also reduce disparities in access to financing, as evidenced during the COVID-19 pandemic (Erel and Liebersohn 2022).

Fintech and financial inclusion are synergistic and contribute to anti-money laundering and counterterrorism funding by increasing transparency (De Koker and Jentzsch 2013). This assumption is based on the assumption that increased utilization of formal financial services leads to decreased usage of informal services. Mobile money access can significantly enhance household well-being as measured by real per capita consumption (Munyegera and Matsumoto 2016). This benefit comes from the convenience of remittances; households using these services are likely to receive remittances more frequently and in larger amounts than those that do not (Lashitew et al. 2020).

An increase in fintech lending has consequences for credit market competition and social welfare. Fintech lending could negatively affect high-quality borrowers' access to credit when the fintech lender's screening accuracy is superior to that of banks (Chu and Wei 2023). However, fintech lending primarily reduces borrowers' expected interest rates (Chu and Wei 2023). Technology-based mortgage lending by fintech firms can lead to faster processing times without increasing default rates, and enable a more elastic adjustment of credit supply in response to demand shocks (Fuster et al. 2019). In

corporate bond trading, the introduction of fintech combined with state interventions and post-crisis regulations, has created a competitive market landscape (Macartney et al. 2022).

The fintech revolution includes the forces of innovation, disruption, and transformation in financial services (Gomber et al. 2018). Fintech innovations leveraging technology to improve payment, lending, investments, and risk management (Gomber et al. 2018). Decentralized finance, which uses smart contracts in decentralized ledgers, has the potential to reduce costs and improve financial inclusion, although challenges related to collateral volatility and oracles' reliability remain (Chiu et al. 2022).

Promoting sustainable growth through fintech

The United Nations' 17 SDGs target social, environmental, and economic sustainability. A growing agreement acknowledges the necessity of broader access to financial services to achieve these goals (Bernards 2019a; Demir et al. 2022; Avom et al. 2023; Kanga et al. 2022). Fintech has been recognized as a potential mechanism for the impoverished population access to financial services, thereby aiding their escape from poverty (Bernards 2019b; Lagna and Ravishankar 2022; Agarwal and Assenova 2023; Gabor and Brooks 2017; Lagna and Ravishankar 2022). The UN 2030 Agenda for Sustainable Development and the G20 High-Level Principles for Digital Financial Inclusion highlight the positive influence of fintech in this context (Demir et al. 2022; Avom et al. 2023).

Using advanced technology, fintech platforms can mobilize small funds and distribute microloans, thereby creating a more inclusive financial ecosystem (Yang and Zhang 2022). This could provide the impoverished with access to financial services and assist in reducing poverty (Lagna and Ravishankar 2022; Avom et al. 2023; Djahini-Afawoubo et al. 2023). Fintech innovations such as mobile money can positively impact financial inclusion (Avom et al. 2023). It has also been argued that access to financial services is crucial for growth because it promotes the mobilization of capital for productive investment and consumption smoothing (Munyegera and Matsumoto 2016; Apeti 2023). Fintech diffusion and financial inclusion can have long-term effects on GDP per capita (Kanga et al. 2022).

Fintech solutions can leverage data gathered from behavior patterns of the unbanked population, such as mobile phone or social media usage, to improve creditworthiness algorithms (Gabor and Brooks 2017). This allows for customer assessment tools that minimize the need for administrative documents, which are often lacking in underserved and rural communities (Dodgson et al. 2015). Mobile money platforms provide data-based certifications and unified access to services, enabling them to fill institutional voids and expand credit access (Agarwal and Assenova 2023). This can also reduce usury and enhance the transparency of social inclusion initiatives by curbing corruption (Dodgson et al. 2015). Fintech can facilitate access to financial resources for impoverished households and enhance healthcare (Ahmed and Cowan 2021), thus supporting the fight against poverty (Abiona and Koppensteiner 2022; Sakyi-Nyarko et al. 2022). Additionally, fintech can mitigate the financial inclusion gaps in emerging economies by increasing women's economic participation through access to financial services (Hua and Huang 2021; Chen et al. 2023). However, there is a gap in the research exploring how fintech ecosystems influence financial inclusion (Demirgüç-Kunt et al. 2020; Senyo

et al. 2022) and mitigate the financial inclusion gaps in emerging economies, such as gender and wealth disparities (Demirgüç-Kunt et al. 2020; Hua and Huang 2021; Asongu and Le Roux 2023b; McBride and Liyala 2023; Chen et al. 2023).

Fintech can transform traditional practices of saving and remitting money overseas through mobile banking, while promoting financial literacy and trust among users (Bu et al. 2024). According to Figueroa-Armijos and Berns (2021), mobile banking can promote saving practices among individuals. Further, Masino and Niño-Zarazúa (2020) emphasize the role of remittances in transmitting electronic payments and cash transfer programs, helping vulnerable populations manage their risks. Mobile money adoption is associated with the increased sending and receiving of financial support during unexpected financial challenges, particularly in female-headed and rural households (Koomson et al. 2021). In addition, research suggests that prosocial lenders on crowdfunding platforms are motivated by non-monetary rewards such as contributing to a larger social good (Jancenelle and Javalgi 2018). Mobile money increases local economic activity in Kenya (Fabregas and Yokossi 2022) and smooths household consumption volatility in China by promoting entrepreneurship and reducing income volatility (Song et al. 2024).

Fintech, particularly mobile money, promotes savings for microenterprises (Koomson et al. 2023), with a more significant impact when complemented by bank accounts, especially for poor women (Adbi and Natarajan 2023). Similarly, FinCredit positively influences income inequality, but its effectiveness increases when coupled with financial inclusion initiatives (Pham and Luu 2023). These insights underscore the importance of combining fintech solutions with traditional banking to enhance financial equity.

Previous research has associated fintech with the financialization process. However, the evolution of technological and financial markets has increased inequality and restricted financial inclusion (Jancenelle and Javalgi 2018; Economides and Jeziorski 2017). For instance, processes have become more complex and various scoring systems rely heavily on the infrastructure of financial systems. Additionally, Bhagat and Roderick (2020) argues that the direct transfer of aid funds to refugees starting small enterprises, with an expectation of loan repayment, masks profit and corporate dominance. Further research must provide appropriate explanations and practices that countries can implement to achieve financial inclusion and sustainable growth by leveraging the potential of inclusive digital financing (Zhang et al. 2024; Qiu 2022).

Cluster 3: the roles of stakeholders in the fintech ecosystem

The successful adoption and benefits of fintech reach far beyond the mere application of digital technology. This requires an integrated ecosystem that includes an efficient payment system, robust physical infrastructure, suitable regulations, and effective consumer protection measures (Demirgüç-Kunt et al. 2020; Lagna and Ravishankar 2022). The introduction of new technologies has significantly influenced banking and financial sectors (Bernards 2019a; Bhagat and Roderick 2020; Stringham 2023).

This cluster emphasizes the critical roles of various stakeholders, including governments, financial institutions, startups, and consumers, in promoting a thriving fintech ecosystem. Collaboration among these stakeholders is essential for leveraging fintech's potential to promote financial inclusion. Governments and regulators are pivotal in

establishing supportive policies, while financial institutions and startups drive technological advancement (Senyo et al. 2022; Iheanachor and Umukoro 2022).

Developing robust fintech ecosystems requires collaboration among stakeholders to address challenges and take advantage of opportunities in the fintech landscape (Palmié et al. 2020; Dong et al. 2023). Policymakers must balance innovation promotion by implementing regulations that protect consumers and ensure fair market practices (Lai and Samers 2021). Educating consumers about fintech services enhances their ability to make informed financial decisions, and thus contributes to further financial inclusion (Yang et al. 2023). By empowering consumers with knowledge and tools to navigate the digital financial landscape, stakeholders can facilitate greater participation in the financial system and drive positive social and economic outcomes (Lashitew et al. 2022).

Building up the ecosystem

The fintech ecosystem aims to foster a conducive environment for the practical cooperation of diverse fintech services. Such an ecosystem is typically developed through partnerships between governments, financial service providers, and startups (Senyo et al. 2022; Coffie and Hongjiang 2023; Iheanachor and Umukoro 2022). Each participant contributes to the evolution and advancement of the ecosystem (Palmié et al. 2020; Zhao et al. 2022; Huarng and Yu 2022; Ehret and Olaniyan 2023). As Palmié et al. (2020) emphasize, the development and growth of fintech ecosystems play a crucial role in promoting the advancement of fintech. The fintech entities are revolutionizing traditional financial practices and industry dynamics through innovative and disruptive avenues, including payment, lending, borrowing, and investment (Lai and Samers 2021; Gabor and Brooks 2017; Hua and Huang 2021). When designing two-sided crowdfunding and microfinance systems, it is crucial to consider the incentives of agents on both sides of the platform and those of other ecosystem stakeholders (Bollinger and Yao 2018; Adbi and Natarajan 2023).

As Senyo et al. (2020) highlight, mobile money operates within a multi-actor ecosystem that includes users, retailers, service providers, agents, banks, and regulators. They argued that the mobile money ecosystem is still emerging relative to the conventional banking sector. For the digital financial ecosystem to mature, collaboration among mobile money regulators, standard-setting bodies, telecom firms, and other stakeholders must be encouraged (Koomson et al. 2021; David-West et al. 2022). Mobile money services act as reliable drivers of digital financial inclusion, and mobile money agents play a key role in the transformation of traditional money services to mobile money services (Shaikh et al. 2023; Johnen et al. 2023). However, merely measuring the distance to agents overshadows the fact that agents are a heterogeneous group offering different services and abilities to customers, which can affect mobile money adoption (Iheanachor et al. 2021; Sinha et al. 2024).

Various actors, relationships, and practices shape the development of the fintech ecosystem. Senyo et al. (2022) conceptualize three practices as building blocks at the ecosystem level: innovative and collaborative practices, protectionist and equitable practices, and legitimizing and sustaining practices. These practices shape financial inclusion and explain how they are scaled in developing countries. The government, mobile phones, telcos, mobile money agents, customers, and traditional banks have been identified as

key actors in the fintech market (Coffie and Hongjiang 2023). Partnerships play a crucial role in unlocking digital financial services' potential to increase access to affordable and scalable services in emerging markets (Iheanachor and Umukoro 2022). A well-developed ecosystem built on effective partnerships is critical in driving financial inclusion (Lashitew et al. 2022; Visconti-Caparrós and Campos-Blázquez 2022; Macartney et al. 2022). Information and communications technology can help create social value by reducing the costs of coordinating boundary-spanning business models that integrate diverse societal stakeholders (Lashitew et al. 2022). However, it is important to note the potential for uneven distributional outcomes in the self-governing social value creation strategies in which the focal firm coordinates.

Developing financial platforms and infrastructure

The deployment of fintech requires the development of robust platforms and infrastructure along with strong coordination among service providers (Kabakova et al. 2016; Rodima-Taylor and Grimes 2019; Iheanachor and Umukoro 2022). This is because fintech provides financial services through ICT platforms. As emphasized by Senyo et al. (2020), leveraging mobile money to enhance financial inclusion depends on high-performance expectations, significant effort expectations, and favorable facilitating conditions. Moreover, the employment of payment apps relies on the accompanying infrastructure, such as Internet access or smartphones (Pal et al. 2020). The development of fintech market and financial inclusion in Ghana are driven by key actors such as the government, mobile phones, telcos, mobile money agents, mobile money customers, and traditional banks, who ride on information technology infrastructure (Coffie and Hongjiang 2023).

Various recommendations for implementing mobile money services were suggested by Lashitew et al. (2019), who called for collaborative efforts between telecom companies and financial institutions. These entities can take turns serving as primary service providers. In Kenya, Tanzania, and Uganda, telecom companies have become the dominant operators, offering services such as interest-bearing deposits and microcredit in partnership with banks. Mobile money services depend on advanced IT platforms for customer service (Lashitew et al. 2019). However, having a mobile money account does not imply that it is actively used because high fees, insufficient physical infrastructure, and a lack of financial education can hinder mobile money usage (Hamdan et al. 2022).

Bernards (2019a) highlights the crucial role that credit information systems-characterized by key infrastructural features-play in facilitating credit flows. Similarly, Economides and Jeziorski (2017) investigate the implications of new banking technology on the lack of banking services in developing countries, often because of deficiencies in their financial infrastructure. The diffusion of fintech, such as ATMs and associated digital networks, as well as mobile phone and payment systems, has long-term effects on financial inclusion and GDP per capita (Kanga et al. 2022).

Digital multisided platforms such as mobile money platforms fill institutional voids by enabling data-based certification, providing unified access to distributed services, and scaling through network effects to reach previously excluded market participants (Agarwal and Assenova 2023). The fintech-philanthropy-development complex generates digital ecosystems that map, expand, and monetize digital footprints, offering the

state new ways of expanding the inclusion of the 'legible' and global finance new forms of 'profiling' poor households into generators of financial assets (Gabor and Brooks 2017).

Fintech development is driven by supply shortages in the formal financial market, strong government support to promote financial inclusion through digital technology, and a more 'tolerant' regulatory environment (Hua and Huang 2021). The rise in fintech and the introduction of stablecoins and central bank digital currencies have important implications for the financial system (Allen et al. 2022). Digital inclusive finance significantly alleviates the financing constraints of SMEs by reducing financing costs, controlling leverage levels, and increasing the internal sources of enterprise funds (Bu et al. 2024).

Adopting regulations and enhancing institutional quality

Adopting regulations and improving institutional quality are essential for successful implementing fintech. The rapid expansion of the digital economy, advancements in fintech, and the digitalization of money have caught the attention of regulators and governments worldwide (Bernards 2019b; Zhao et al. 2022). However, some countries struggled with technological adaptability (Palmié et al. 2020; Knaack and Gruin 2021; Osabutey and Jackson 2024).

Like other forms of fintech, mobile money services often outpace legislative changes, as observed by Tyce (2020); Lashitew et al. (2019). Commercial businesses cannot invest in these technologies without a legislative framework to reduce market uncertainty. Balancing conflicting regulatory objectives, such as encouraging innovation and fostering competition (Lashitew et al. 2019) or balancing innovation and risk management (Lai and Samers 2021), presents another challenge. Financial regulators must weigh various objectives, including market expansion, competitiveness, behavior and fairness, macro-prudential issues, and financial stability. P2P lending can increase access to finance for SMEs, and institutional quality positively moderates this association (Abbasi et al. 2021). Tian et al. (2023) demonstrates that fintech innovation, combined with green transformational leadership, significantly enhances green innovation, offering a new perspective on the role of technology and leadership in ecological modernization. Further, Rahman (2024) identify energy poverty as a key moderator in the relationship between financial inclusion, fintech lending, and economic growth, offering insights into energy and financial policy.

The impact of institutional quality on the relationship between P2P lending fintech and SMEs' loan accessibility is examined by Abbasi et al. (2021). Better regulations can foster a more supportive environment. Pelletier et al. (2020) argues that the absence of institutions can create favorable conditions and incentives for international investors and telecom operators to enter the market and offer mobile money. Balancing innovation and risk poses regulatory challenges (Lai and Samers 2021).

Broadening digital skills

Technology adoption is often hindered by challenges such as ease of use, familiarity with computer technology, and basic language comprehension, particularly in developing countries (Pal et al. 2020). However, it is important to emphasize that implementing technology does not require overly complex tools or technical skills (Pal et al. 2020). As

Kiconco et al. (2020) point out, cognitive abilities and skills are crucial for the effective use of mobile money services in underdeveloped nations.

Digital literacy plays a crucial role in promoting digital financial services, particularly among disadvantaged groups such as low-income families, older adults, and rural residents (Yang et al. 2023). The interaction effect of digital literacy in the relationship between the fintech of biometrics and mobile money and digital financial inclusion among unbanked poor women, youth, and persons with disabilities in rural Uganda has been demonstrated (Okello Candiya Bongomin et al. 2024). Governments in developing countries should support vulnerable groups in understanding and using fintech through digital literacy initiatives.

Financial literacy significantly boosts digital finance including mobile payments, online borrowing, and online financial products (Yang et al. 2023). The impact of financial literacy increases with the complexity of digital finance, suggesting that it is essential for the effective adoption and use of advanced digital financial services. Siddik et al. (2023) finds that fintech adoption and financial literacy significantly enhance corporate sustainability performance.

Kiconco et al. (2020) emphasizes the importance of acquiring fintech skills and outlines various learning avenues, including formal education, social interaction, and self-directed learning. The potential of social networks as a learning tool for mobile money and as a means to compensate for low literacy rates is also discussed.

Training programs significantly boost mobile-banking adoption among migrants, effectively reducing the gender gap, although men may increase digital remittances more than women (Lee et al. 2022). Incorporating technology into family networks could further reduce this disparity. Additionally, the emergence of alternative payment methods such as mobile instant payments has revolutionized traditional payment practices (Visconti-Caparrós and Campos-Blázquez 2022). This shift underscores the need for digital skills to navigate the evolving landscape of fintech and thrive within digital business ecosystems.

Financial markets and the role of fintech

Fintech has significantly influenced financial markets, institutions, and services by creating new business models, applications, processes, and products (Liu et al. 2020; Gomber et al. 2018). The financial services industry has been experiencing the recent emergence of technological innovations and process disruptions, with many fintech startups looking for new pathways for successful business models, enhanced customer experience, and service transformation (Gomber et al. 2018). Governments view fintech as a potential instrument for making the financial system more efficient, effective, and sustainable (Lagna and Ravishankar 2022).

The rise of fintech lending has the potential to improve the screening or monitoring of borrowers and increase financial inclusion, although it still accounts for only a small share of the total credit in developed economies such as the United States (Berg et al. 2022). Fintech lending can also affect credit access, interest rates, and social welfare, with analytical and numerical results suggesting that it primarily reduces the expected interest rates (Chu and Wei 2023).

Online P2P lending has emerged as an innovative fintech platform that can make financial services more inclusive and affordable than those offered by traditional financial institutions (Chung et al. 2023). Similarly, cryptocurrency markets reduce transaction costs and improve financial accessibility using disruptive technologies, such as blockchain and distributed ledgers. The interdependence between these two representative fintech markets has important implications for crowdfunding platforms' healthy growth, effective governance, and their role in upholding financial inclusion (Chung et al. 2023).

The role of mobile technology in microfinance channels has been emphasized by Wormald et al. (2023), particularly how its customization helps reduce inefficiencies in the microfinance industry. In addition, mobile money can assist small-scale and informal business owners in adopting safer and more efficient money storage and transmission methods, thereby broadening the accessibility of financial services. This could formalize and modernize the informal economy in many developing countries (Lashitew et al. 2019). The diffusion of fintech innovations, such as ATMs, digital networks, mobile phones, and payment systems, has long-term effects on financial inclusion and GDP per capita (Kanga et al. 2022).

MFIs can deploy signals to pursue entrepreneurial opportunities on digital platforms and boost crowdfunding among refugee entrepreneurs (Gama et al. 2023). When refugee loan campaigns are affiliated with MFIs featuring lower default rates, high profitability, entrepreneurial support orientation, transnational operations, and a digital focus, they achieve better crowdfunding performance outcomes (Gama et al. 2023).

The use of fintech can increase information transparency (Pelletier et al. 2020). Competition from fintech payment providers disrupts the information spillover that occurs when a monopolist bank uses payment data to learn about consumer credit quality, which affects its pricing and loan offers (Parlour et al. 2022). While fintech competition promotes financial inclusion, it may hurt consumers with strong bank preferences and have an ambiguous effect on markets (Parlour et al. 2022).

Discussion, research gaps, and future directions

Synthesis and identification of research gaps

A content analysis of the selected literature on fintech and financial inclusion reveals several research gaps that present opportunities for future research. These gaps span the three main clusters identified in the analysis: the advent of novel services, the transformation of the market landscape, and the roles of stakeholders in the fintech ecosystem.

Within the first cluster on novel fintech services, while extensive research has been conducted on the impact of mobile money and electronic payments on financial inclusion (Bernards 2019a; Demir et al. 2022; Lagna and Ravishankar 2022; Demirgüç-Kunt et al. 2020; Pal et al. 2021), there is a lack of studies examining the specific roles and characteristics of mobile money agents in facilitating adoption and usage (Johnen et al. 2023). Moreover, the risks and challenges associated with the rapid expansion of fintech, such as regulatory uncertainties, illegal transactions, and data abuse, require further exploration (Hua and Huang 2021; Asongu et al. 2021; Qiu 2022). In the domain of fintech lending and crowdfunding, additional research is needed on how these platforms can support underrepresented entrepreneurs such as refugees and on the role

of institutional quality in enhancing the benefits of P2P lending to SMEs (Abbasi et al. 2021; Gama et al. 2023).

The second cluster focuses on the transformation of the market landscape and highlights the need for further research on the integration of fintech solutions with traditional banking to enhance financial equity (Adbi and Natarajan 2023; Pham and Luu 2023). Although studies show the potential of fintech to promote sustainable growth and alleviate poverty (Bernards 2019b; Lagna and Ravishankar 2022), there is a gap in research exploring how fintech ecosystems influence financial inclusion and mitigate the gaps in emerging economies (Demirgüç-Kunt et al. 2020; Hua and Huang 2021; Senyo et al. 2022; Chen et al. 2023). Future research should also provide appropriate explanations and practices that countries can implement to achieve financial inclusion and sustainable growth through inclusive digital financing (Qiu 2022; Zhang et al. 2024).

The third cluster examines the roles of stakeholders in the fintech ecosystem and emphasizes the importance of partnerships between the government, financial service providers, and startups to foster an environment conducive to fintech growth (Senyo et al. 2022; Coffie and Hongjiang 2023; Iheanachor and Umukoro 2022). However, there is a need for further research on the specific roles and incentives of various stakeholders in the development of fintech ecosystems (Bollinger and Yao 2018; Adbi and Natarajan 2023). Additionally, although studies have begun to investigate the influence of regulations on fintech-enabled financial inclusion (Tyce 2020; Lagna and Ravishankar 2022), numerous questions remain regarding the optimal regulatory environment that balances innovation, competition, and consumer protection.

Another significant research gap identified across the clusters was the lack of comprehensive studies on the inclusion of low-income and unbanked individuals in the fintech landscape. Although fintech has the potential to fill the void for those considered high-risk by conventional lending standards (Kaminska 2015), concerns have been raised over fintech firms that potentially prioritize business gains over societal well-being and equity (Lagna and Ravishankar 2022). Future research should investigate how low-income and unbanked individuals use fintech, how pro-inclusion firms can improve their capacities, and how they advocate societal equality.

The systematic literature review by de Sant'Anna and Figueiredo (2024) further highlights the need for research into the dual impact of fintech on financial inclusion and financial stability, especially during global crises like the COVID-19 pandemic. This review suggests that understanding the balance between financial innovation and systemic risk is crucial to ensure that fintech contributes positively to both financial inclusion and overall economic stability.

Finally, to gain a comprehensive understanding of fintech's real impact on financial inclusion, future research should focus on analyzing the complex interplay between technology adoption and human behavior, including the costs and benefits of adopting mobile money (Senyo et al. 2020), the determinants of long-term adoption (Pal et al. 2021), and the potential adverse consequences of fintech growth. Effective regulatory measures for customer protection, and the government's role in fintech's contribution to financial inclusion, warrant further investigation.

By addressing these research gaps, future studies can contribute to a more nuanced understanding of the complex relationship between fintech and financial inclusion,

informing policy decisions and practices that maximize the benefits of fintech while mitigating its risks and challenges.

Opportunities for future investigations

Despite significant advancements, the understanding fintech's role in facilitating financial inclusion remains in progress. Several untapped areas present opportunities to enhance their knowledge bases. Based on our literature review, we outlined four primary domains that call for greater scholarly attention. Each domain includes numerous potential research topics and queries to deepen our understanding of fintech's impact on financial inclusion.

- *Regulatory Considerations:* Comprehensive, and context-specific regulations addressing urgent cybersecurity and investor protection can bolster financial stability (Gelb 2016; Venet 2019). While academic research has begun delving into the influence of regulations at various levels on fintech-enabled financial inclusion (Tyce 2020; Lagna and Ravishankar 2022), numerous questions persist. Topics encompass the requirement of banking licenses for fintech companies, the impact of digital finance on economic stability, and the government's role in fostering financial inclusion within fintech landscapes. Creating a regulatory environment that encourages competition and innovation while maintaining stringent controls is critical to maximizing fintech's potential for financial inclusion.
- *Strategic Approaches for Fintech:* Fintech companies, to bolster financial inclusion, must convey their social mission to crucial stakeholders, such as investors, clients, and the general public (Lagna and Ravishankar 2022). Such firms can embed financial inclusion and social impact within their corporate vision and objectives. For instance, select microloan providers are specifically designed to serve low-income segments (Lagna and Ravishankar 2022). Future studies could explore strategies for enhancing the uptake of mobile payment services in developing countries, like Mexico, Nigeria, and South Africa, where current usage is comparatively low (Pelletier et al. 2018). This can involve studying the unbundling of financial services and the roles of soft information, direct interactions, and digital decision-making in service provision.
- *Inclusion of Low-income Groups:* While fintech can broaden financial services access to low-income groups, comprehensive studies in this sector are limited. Fintech's revolutionary impact suggests that digital platforms could cater to individuals lacking bank accounts or credit history, thereby addressing the needs for those considered high-risk by conventional lending standards (Kaminska 2015). However, concerns have been raised over fintech firms potentially prioritizing business gains over societal well-being, equity, and sustainability (Lagna and Ravishankar 2022). Topics such as the potential of prosocial crowdfunding to support vulnerable demographics, the implications of alternative credit scoring algorithms, and their influence on social discrimination and agency among the impoverished merit further investigation. Future research should investigate how low-income and unbanked individuals use fintech, how pro-inclusion firms can improve these users' capacities, and how to advocate societal equality.

- *Understanding fintech’s Real Impact:* A comprehensive understanding of the real effect of fintech on financial inclusion requires analyzing the complex interplay between technology adoption and human behavior. Aspects such as the costs and benefits of adopting mobile money are critical (Senyo et al. 2020). In addition, the presence of unethical practices in the fintech sector necessitates protective institutional frameworks, like regulations for lending and borrowing through P2P platforms (Lagna and Ravishankar 2022). Sustainable usage of mobile payments and its contributions to financial inclusion depends on long-term adoption that persists beyond initial incentives (Pal et al. 2021). Additionally, de Sant’Anna and Figueiredo (2024) emphasize the importance of examining how fintech innovations impact financial stability, particularly during global crises such as the COVID-19 pandemic. This highlights the need for future research to explore the balance between driving financial inclusion and maintaining financial system stability, ensuring that fintech innovations do not inadvertently introduce systemic risks. Future research should concentrate on discerning the determinants of technology adoption, potential adverse consequences, effective regulatory measures for customer protection, and the government’s role in fintech’s contribution to financial inclusion.

The following Table 5 summarizes these promising research areas with a brief description and potential research questions. Each domain offers a rich set of research questions that enhance the understanding of how fintech facilitates financial inclusion.

Table 5 Potential research areas in fintech and financial inclusion

Research area	Description	Potential research questions
Regulatory Considerations	Impact of specific regulations on financial inclusion via fintech	Necessity of licenses for fintech entities Impact of fintech on economic stability Government’s role in promoting financial inclusion within fintech ecosystems
Strategic Approaches for Fintechs	Enhancement of fintech in emerging markets	Unbundling of financial services Role of soft information, face-to-face interactions, and digital decision-making in service provision
Inclusion of Low-income Groups	Fintech’s reach to financially underserved communities	Use of fintech by low-income and unbanked individuals Improvement of user capacities by pro-inclusion firms Promotion of societal equality
Understanding Fintech’s Real Impact	The interplay between fintech adoption and socio-economic outcomes	Determinants of technology adoption Potential negative consequences of new technologies Effective regulation for customer protection Balancing financial inclusion with financial stability Government’s role in fintech’s contribution to financial inclusion

This table presents potential research areas in the field of Fintech and Financial Inclusion. It is structured based on the research areas, their descriptions, and potential research questions. The research areas include Regulatory Considerations, Strategic Approaches for Fintech, Inclusion of Low-income Groups, and Understanding Digital Finance’s Impact. These areas provide a comprehensive overview of the topics relevant to the intersection of Fintech and Financial Inclusion

Conclusion

This study comprehensively explores the evolving fintech landscape and its influence on financial inclusion. The analysis draws from a pool of 96 articles out of 2951 papers indexed across the WoS, Scopus, and EBSCO databases, focusing on fintech and financial inclusion. This study used bibliometric and network analysis methodologies to trace the research trajectory and identify three dominant research themes or clusters. Further insights into the fintech–financial inclusion literature were obtained via a content analysis of articles from ABS 3, 4, and 4* journals, employing co-citation and clustering analyses.

In contrast to previous research, this study aggregates a significant body of literature on financial inclusion by systematically synthesizing theories, perspectives, and strategies to promote financial inclusion within the broader context of regional and global integration.

These findings yield several unique contributions for researchers studying fintech's impact on financial inclusion. First, we constructed a knowledge framework encapsulating fintech–financial inclusion—and identified the roles of individual journals and papers within this research domain. Second, we outline the prevalent research themes across distinct streams of research (three clusters) and supplement these insights with content analysis. These themes can guide researchers in avoiding areas of research that have reached saturation or stagnation. Finally, we propose potential avenues for future research in the fintech–financial inclusion field.

The rapid development of financial innovation has led to many questions about fintech regulations, particularly regarding the security and protection of customers and investors. Additionally, there is an urgent need for further exploration of effective business strategies for fintech-enabled financial inclusion and digital models devised to achieve the SDGs. However, the influence of digital finance on financial inclusion remains unclear. It is essential to foster collaboration among academics, regulators, and industry practitioners to address these and other emergent questions and continue generating insightful research.

Despite these contributions, this study had inherent limitations. Keywords were chosen based on our definition of fintech as financial inclusion and pertinent literature. However, it is possible that the keyword selection was not exhaustive. Fintech is a rapidly developing field, and the selection of appropriate search terms remains contested. Consequently, papers satisfying the inclusion and exclusion criteria may have been inadvertently overlooked because of the absence of both “fintech” and “financial inclusions” in their keyword sections. The use of alternate search terms can create distinct clusters, leading to different interpretations of the field state. Moreover, the restriction of content analysis to papers from ABS 3 and the above journals led to the exclusion of specific qualifying papers. The results may also be subject to different criteria and the influence of the ranking systems. Lastly, we recognize that any examination of the current state of financial innovation inherently faces limitations, given the constant evolution of the financial service industry.

Appendices

Appendix A: methodology for co-citation analysis

This study utilizes a systematic approach to co-occurrence analysis within the realms of fintech and financial inclusion, employing the VOSviewer software, a tool renowned for its efficacy in mapping and clustering based on bibliometric networks (Van Eck et al. 2010; Van Eck and Waltman 2014). In this methodology, keywords from scholarly articles are treated as nodes within a broader research network.

Co-occurrence mapping methodology

Each node represents a keyword, and the strength of the link between any two nodes (i and j) is determined by their co-occurrence in the literature, reflecting the frequency with which two keywords appear together within the same articles. The strength of association between two nodes, s_{ij} , is quantified using the normalized co-occurrence formula:

$$s_{ij} = \frac{n_{ij}}{\sqrt{k_i k_j}}$$

where n_{ij} is the number of documents in which keywords i and j co-occur, k_i and k_j are the total occurrences of keywords i and j across all documents, respectively.

The network is visualized through a mapping function that minimizes the following stress function over all pairs of nodes:

$$V(x_1, \dots, x_n) = \sum_{i < j} s_{ij} |x_i - x_j|^2$$

This function is subject to the normalization condition:

$$\frac{2}{n(n-1)} \sum_{i < j} |x_i - x_j|^2 = 1$$

Cluster optimization

To form clusters from the mapped network, we apply an optimization algorithm that groups keywords into thematically consistent clusters. This is achieved by minimizing the following objective function:

$$V(x_1, \dots, x_n) = \sum_{i < j} \delta(c_i, c_j) (s_{ij} - \gamma)$$

Here, $\delta(c_i, c_j)$ is a delta function that equals 1 if keywords i and j are in the same cluster and 0 otherwise. The parameter γ acts as a threshold that defines how strong the association needs to be for two keywords to be clustered together.

Table 6 Summary of research papers on fintech and financial inclusion

ID	Authors	Title	Cluster 1	Cluster 2	Cluster 3
1	Abbasi et al. (2021)	P2P lending Fintechs and SMEs' access to finance	X	X	X
2	Abiona and Koppensteiner (2022)	Financial Inclusion, Shocks, and Poverty: Evidence from the Expansion of Mobile Money in Tanzania		X	
3	Adbi and Natarajan (2023)	Fintech and banks as complements in microentrepreneurship			X
4	Agarwal and Assenova (2023)	Mobile Money as a Stepping Stone to Financial Inclusion: How Digital Multisided Platforms Fill Institutional Voids	X	X	X
5	Ahmed and Cowan (2021)	Mobile money and healthcare use: Evidence from East Africa		X	
6	Allen et al. (2022)	Fintech, Cryptocurrencies, and CBDC: Financial Structural Transformation in China			X
7	Apeti (2023)	Household Welfare In The Digital Age: Assessing The Effect Of Mobile Money On Household Consumption Volatility In Developing Countries		X	
8	Asongu et al. (2021)	Law, Mobile Money Drivers And Mobile Money Innovations In Developing Countries	X	X	
9	Asongu and Le Roux (2023a)	The Role of Mobile Money Innovations in Transforming Unemployed Women To Self-employed Women In Sub-saharan Africa	X		
10	Asongu and Le Roux (2023b)	The Role of Mobile Money Innovations in the Effect of Inequality on Poverty and Severity of Poverty in Sub-Saharan Africa		X	
11	Avom et al. (2023)	Do Financial Innovations Improve Financial Inclusion? Evidence From Mobile Money Adoption In Africa	X	X	
12	Balasubramanian et al. (2023)	Mobile Money Operations: Policies for Managing Cash and Digital Currency Inventories in the Developing World		X	
13	Berg et al. (2022)	FinTech Lending		X	X
14	Bernards (2019b)	Tracing Mutations of Neoliberal Development Governance: 'fintech', Failure And The Politics Of Marketization		X	X
15	Bhagat and Roderick (2020)	Banking on refugees: Racialized expropriation in the fintech era		X	X
16	Bollinger and Yao (2018)	Risk Transfer versus Cost Reduction on Two-sided Microfinance Platforms	X		X
17	Bu et al. (2024)	Digital inclusive finance: A lever for SME financing?			X
18	Coffie and Hongjiang (2023)	FinTech market development and financial inclusion in Ghana: The role of heterogeneous actors			
19	Chen et al. (2023)	The fintech gender gap		X	
20	Chiu et al. (2022)	Grasping decentralized finance through the lens of economic theory		X	

Table 6 (continued)

ID	Authors	Title	Cluster 1	Cluster 2	Cluster 3
21	Choi and Loh (2023)	Physical Frictions and Digital Banking Adoption		X	
22	Chu and Wei (2023)	Fintech Lending and Credit Market Competition	X	X	X
23	Chung et al. (2023)	Interdependence between online peer-to-peer lending and cryptocurrency markets and its effects on financial inclusion	X		X
24	David-West et al. (2022)	Diffusion of Innovations: Mobile Money Utility and Financial Inclusion in Nigeria. Insights from Agents and Unbanked Poor End Users	X		X
25	Demir et al. (2022)	Fintech, financial inclusion and income inequality: a quantile regression approach	X	X	
26	Demirgüç-Kunt et al. (2020)	The Global Findex Database 2017: Measuring Financial Inclusion and Opportunities to Expand Access to and Use of Financial Services	X	X	X
27	Djahini-Afawoubo et al. (2023)	Does mobile money contribute to reducing multidimensional poverty?		X	
28	Dodgson et al. (2015)	Managing Digital Money	X	X	
29	Dong et al. (2018)	Banking on "Mobile Money": The Implications of Mobile Money Services on the Value Chain.	X	X	
30	Dong et al. (2023)	Mobile Payment Services, Government Involvement, and Mobile Network Operator Performance			X
31	Economides and Jeziorski (2017)	Mobile Money in Tanzania	X	X	X
32	Ehret and Olaniyan (2023)	Banking the unbanked. Constitutive rules and the institutionalization of mobile payment systems in Nigeria			X
33	Erel and Liebersohn (2022)	Can FinTech reduce disparities in access to finance? Evidence from the Paycheck Protection Program		X	
34	Fabregas and Yokossi (2022)	Mobile Money and Economic Activity: Evidence from Kenya	X	X	
35	Fuster et al. (2019)	The Role of Technology in Mortgage Lending			
36	Gabor and Brooks (2017)	The digital revolution in financial inclusion: international development in the fintech era	X	X	X
37	Galak et al. (2011)	Microfinance Decision Making: A Field Study of Prosocial Lending.	X		
38	Gama et al. (2023)	Third-party signals in crowdfunded microfinance: which microfinance institutions boost crowdfunding among refugee entrepreneurs?	X		X
39	Gomber et al. (2018)	On the Fintech Revolution: Interpreting the Forces of Innovation, Disruption, and Transformation in Financial Services		X	X
40	Gupta and Kanungo (2022)	Financial inclusion through digitalisation: Economic viability for the bottom of the pyramid (BOP) segment		X	

Table 6 (continued)

ID	Authors	Title	Cluster 1	Cluster 2	Cluster 3
41	Hamdan et al. (2022)	Mobile Money, Financial Inclusion, and Unmet Opportunities. Evidence from Uganda	X		X
42	Hua and Huang (2021)	Understanding China's fintech sector: development, impacts and risks	X	X	X
43	Huang and Yu (2022)	Causal complexity analysis for fintech adoption at the country level			X
44	Iheanachor et al. (2021)	Business model innovation at the bottom of the pyramid - A case of mobile money agents			X
45	Iheanachor and Umukoro (2022)	Partnerships in digital financial services: An exploratory study of providers in an emerging market			X
46	Islam et al. (2018)	Does mobile money use increase firms' investment? Evidence from Enterprise Surveys in Kenya, Uganda, and Tanzania		X	
47	Jancenelle and Javalgi (2018)	The effect of moral foundations in prosocial crowdfunding	X	X	
48	Johnen et al. (2023)	Mobile money adoption in Kenya: The role of mobile money agents	X		X
49	Kabakova et al. (2016)	Strategizing for Financial Technology Platforms: Findings from Four Russian Case Studies			X
50	Kanga et al. (2022)	The diffusion of fintech, financial inclusion and income per capita		X	X
51	Kiconco et al. (2020)	Learning mobile money in social networks: Comparing a rural and urban region in Uganda			X
52	Knaack and Gruin (2021)	From shadow banking to digital financial inclusion: China's rise and the politics of epistemic contestation within the financial stability board			X
53	Kong and Loubere (2021)	Digitally Down to the Countryside: Fintech and Rural Development in China		X	
54	Konte and Tetteh (2023)	Mobile money, traditional financial services and firm productivity in Africa		X	
55	Koomson et al. (2021)	Mobile money adoption and response to idiosyncratic shocks: Empirics from five selected countries in sub-Saharan Africa	X	X	
56	Koomson et al. (2023)	Mobile money and entrepreneurship in East Africa: the mediating roles of digital savings and access to digital credit		X	
57	Lagna and Ravishankar (2022)	Making the world a better place with fintech research	X	X	X
58	Lashitew et al. (2019)	Mobile phones for financial inclusion: What explains the diffusion of mobile money innovations?	X	X	X
59	Lashitew et al. (2022)	Social Value Creation in Institutional Voids: A Business Model Perspective		X	X
60	Lin et al. (2013)	Judging Borrowers by the Company They Keep: Friendship Networks and Information Asymmetry in Online Peer-to-Peer Lending.	X	X	

Table 6 (continued)

ID	Authors	Title	Cluster 1	Cluster 2	Cluster 3
61	Lee et al. (2022)	Narrowing the gender gap in mobile banking		X	X
62	Lorenz and Pommet (2021)	Mobile money, inclusive finance and enterprise innovativeness: an analysis of East African nations	X		
63	Macartney et al. (2022)	Collaboration, Adaptation, or Disruption? Wall Street, Fintech and Corporate Bond Trading		X	X
64	Maskara et al. (2021)	The role of P2P platforms in enhancing financial inclusion in the United States: An analysis of peer-to-peer lending across the rural-urban divide	X	X	
65	McBride and Liyala (2023)	Memoirs from Bukhalalire: a poetic inquiry into the lived experience of M-PESA mobile money usage in rural Kenya	X	X	
66	Michels (2012)	Do Unverifiable Disclosures Matter? Evidence from Peer-to-Peer Lending	X		
67	Mohamed (2023)	The influence of the mobile money payment on the performance of small and medium enterprises in Somalia	X	X	
68	Munyegera and Matsumoto (2016)	Mobile Money, Remittances, and Household Welfare: Panel Evidence from Rural Uganda		X	
69	Okello Candiya Bongomin et al. (2024)	Recalibrating the scope of financial inclusion through financial technologies in the digital age: the role of digital literacy as a moderator in rural Uganda			X
70	Osabutey and Jackson (2024)	Mobile money and financial inclusion in Africa: Emerging themes, challenges and policy implications			X
71	Parlour et al. (2022)	When FinTech Competes for Payment Flows			X
72	Pelletier et al. (2020)	Innovations in emerging markets: the case of mobile money	X		X
73	Pham and Luu (2023)	Effect of FinCredit on income inequality: the moderating role of financial inclusion		X	
74	Qiu (2022)	Regionalized liquidity: A cross-country analysis of mobile money deployment and inflation in developing economies	X	X	
75	Rahman (2024)	Moderating effects of energy poverty on financial inclusion, FinTech lending, and economic growth: Evidence from fsQCA, NCA, and econometric models			X
76	Rodima-Taylor and Grimes (2019)	International remittance rails as infrastructures: embeddedness, innovation and financial access in developing economies			X
77	Saiedi et al. (2022)	Distrust in Banks and Fintech Participation: The Case of Peer-to-Peer Lending	X		

Table 6 (continued)

ID	Authors	Title	Cluster 1	Cluster 2	Cluster 3
78	Sakyi-Nyarko et al. (2022)	The Gender-Differential Effect of Financial Inclusion on Household Financial Resilience	X	X	
79	Senyo et al. (2020)	Pathways to improving financial inclusion through mobile money: a fuzzy set qualitative comparative analysis	X		X
80	Senyo and Osabutey (2020)	Unearthing antecedents to financial inclusion through FinTech innovations	X	X	X
81	Senyo et al. (2021)	Pathways to improving financial inclusion through mobile money: a fuzzy set qualitative comparative analysis		X	
82	Senyo et al. (2022)	FinTech ecosystem practices shaping financial inclusion: the case of mobile money in Ghana		X	X
83	Shaikh et al. (2023)	Mobile money as a driver of digital financial inclusion	X		
84	Siddik et al. (2023)	Do fintech adoption and financial literacy improve corporate sustainability performance? The mediating role of access to finance			X
85	Sinha et al. (2024)	Mobile payments for bottom of the pyramid: Towards a positive social change			X
86	Song et al. (2024)	Exploring the impact of digital inclusive finance on consumption volatility: Insights from household entrepreneurship and income volatility	X	X	
87	Stringham (2023)	Banking regulation got you down? The rise of fintech and cryptointermediation in Africa			X
88	Suri et al. (2021)	Fintech and household resilience to shocks: Evidence from digital loans in Kenya	X		
89	Tian et al. (2023)	Does fintech innovation and green transformational leadership improve green innovation and corporate environmental performance? A hybrid SEM-ANN approach			X
90	Visconti-Caparrós and Campos-Blázquez (2022)	The development of alternate payment methods and their impact on customer behavior: The Bizum case in Spain			X
91	Wormald et al. (2023)	Pioneering digital platform ecosystems: The role of aligned capabilities and motives in shaping key choices and performance outcomes			X
92	Yang and Zhang (2022)	FinTech adoption and financial inclusion: Evidence from household consumption in China		X	
93	Yang et al. (2023)	Digital finance and financial literacy: Evidence from Chinese households			X
94	Zhang and Liu (2012)	Rational Herding in Microloan Markets.	X		

Table 6 (continued)

ID	Authors	Title	Cluster 1	Cluster 2	Cluster 3
95	Zhang et al. (2024)	Effect of digital inclusive finance on common prosperity and the underlying mechanisms		X	
96	Zhao et al. (2022)	Overcoming spatial stratification of fintech inclusion: Inferences from across Chinese provinces to guide policy makers			X

Appendix B

See Table 6.

Acknowledgements

We would like to express our sincere gratitude to the Editors and anonymous peer reviewers of the Financial Innovation Journal for their invaluable contributions to this paper. Their insightful comments, constructive feedback, and thoughtful suggestions have significantly improved the quality and clarity of our work. We deeply appreciate the time and effort they dedicated to reviewing our manuscript and providing such helpful guidance. The third author acknowledges the financial support provided by the Prague University of Economics and Business as a part of Institutional Research Support no. IP 100040 and the financial support from the Czech Science Foundation (grant number 24-100085).

Author contributions

Dao Ha: Conceptualization, Methodology, Formal analysis, Resources, Writing - Original Draft, Writing - Review & Editing, Visualization, Project administration. Phuong Le: Conceptualization, Methodology, Software, Formal analysis, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization. Duc Khuong Nguyen: Conceptualization, Methodology, Validation, Resources, Writing - Original Draft, Writing - Review & Editing, Supervision. All authors read and approved the final manuscript.

Funding

Not applicable.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Declarations

Competing interests

The authors declare that they have no competing interests

Received: 26 December 2023 Accepted: 20 December 2024

Published online: 27 January 2025

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