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Integrating FinTech into Sustainable Development Planning: A Systematic Review and Expert Insights on Financial Inclusion in Indonesia

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ABSTRACT

This study examines how financial technology (FinTech) contributes to sustainable and inclusive development in Indonesia, with a particular focus on financial inclusion as a development-enabling outcome. A systematic review of 844 Scopus-indexed studies published between 2015 and 2023 is complemented by expert insights from Indonesian financial advisors with professional experience in FinTech and banking. The synthesis indicates that FinTech can expand access to formal financial services, reduce transaction frictions, and improve service responsiveness, thereby supporting inclusion-oriented development goals. However, the evidence also highlights persistent barriers related to digital literacy, uneven infrastructure, consumer protection, and regulatory capacity, which may limit inclusive outcomes if not addressed through coordinated planning. The study translates these findings into planning and policy implications, including targeted digital financial literacy programs, interoperable payment infrastructure, risk-based regulation, and safeguards for vulnerable users. By linking FinTech-driven transformation to inclusion and development planning priorities, this study offers a structured evidence base for policymakers and planners in emerging economies.

1. INTRODUCTION

The financial industry's extensive history has not witnessed a transformation as substantial as the current one [1, 2]. Banking has traditionally been strongly associated with physical establishments and direct services [3], tangible transactions [4], and labor-intensive manual verification. The financial landscape is undergoing a significant transformation driven by the emergence of financial technology (FinTech) [5-7]. This evolution, facilitated by technological advancements [8], alters the nature of financial transactions [9] and investment strategies [10], and customer interactions [11]. FinTech has precipitated a significant transformation in the financial industry, particularly in banking. Organizations are increasingly recognizing financial services beyond traditional banking institutions, and technological advancements are facilitating access for individuals previously excluded from conventional banking services. Providing financial services to remote areas presents a significant challenge for developing countries and is particularly difficult to accomplish through conventional banking methods [12]. This challenge is not only operational but also developmental in nature. Access to formal financial services is widely recognized as a critical enabler of sustainable development, contributing to poverty reduction, inclusive economic growth, and social equity. In many emerging economies, including Indonesia, financial exclusion remains a structural barrier to development, particularly in

rural and marginalized communities. Within this context, FinTech is increasingly viewed not merely as a technological innovation but as a potential instrument for advancing sustainable and inclusive development objectives.

The evolution of the digital industry encompasses the banking sector, which is experiencing a transformative impetus to adopt novel technologies for service enhancement. Households are increasingly transitioning to user-centric platforms that offer accessibility and transcend physical and temporal limitations [13]. Blockchain technology, initially met with skepticism, has now demonstrated its applicability in the traditionally conservative financial industry, indicating its readiness for adoption by the sector [14-16]. The emergence of Regulatory Technology (RegTech) exemplifies this evolution, synergizing regulatory compliance with technology-driven solutions for enhanced transparency [1]. In the current era of rapid technological advancement, it is crucial to consider not only the adoption of new technologies but also their alignment with broader sustainability and development goals. From a development planning perspective, digital financial innovation must be assessed in terms of its capacity to support inclusive growth, institutional resilience, and long-term socio-economic stability. This shift in perspective reframes FinTech not simply as a market-driven innovation, but as a potential component of national development strategies. Investments in FinTech, as elucidated by Sahabuddin et al. [8], are accompanied by inherent challenges

that necessitate the development of novel decision-making frameworks to address them. The definition of FinTech remains fluid, reflecting its ongoing evolution and the disparity between industrial and academic interpretations [10]. Looking forward, the interaction between emerging FinTech entities and established banks suggests a dynamic of both competition and potential collaboration [17, 18].

Research on the foundations and evolution of FinTech has expanded rapidly in recent years [8, 18]. However, much of the existing literature primarily examines technological innovation, business models, and organizational performance, while offering limited insight into how FinTech contributes to broader sustainable development outcomes, particularly in emerging economies. In particular, there is a lack of systematic analysis of FinTech's role in promoting financial inclusion, reducing structural inequalities in access to financial services, and supporting development planning and policy formulation.

This study addresses this gap by adopting a development-oriented perspective on FinTech. By synthesizing global research and contextualizing it within Indonesia's development environment, this study examines how FinTech-driven transformation intersects with inclusion, institutional capacity, and planning priorities. In doing so, the study contributes to the literature by reframing FinTech not only as a technological or industrial phenomenon, but also as a component of sustainable and inclusive development strategies.

This study distinguishes itself from previous systematic reviews by not only synthesizing and critically evaluating significant scientific literature, but also examining how global FinTech developments translate into development-relevant outcomes in the Indonesian context through expert testimony. Specifically, insights were obtained from leading financial advisors in Indonesia who possess a comprehensive understanding of the financial sector's evolution.

Interviews with these advisors were conducted to corroborate the findings of the systematic review and to assess whether the trends identified in the global literature correspond to Indonesia's financial inclusion challenges, institutional conditions, and development priorities. Through the engagement of these experts, this study evaluates the extent to which FinTech adoption aligns with inclusive development objectives and planning-relevant considerations in Indonesia.

This study is guided by the following research questions:

(RQ1) How does FinTech contribute to financial inclusion as a component of sustainable development in Indonesia?

(RQ2) What institutional, infrastructural, and regulatory conditions shape the developmental impact of FinTech adoption?

(RQ3) What are the implications of FinTech-driven transformation for development planning and policy design in emerging economies?

This study is significant for both research and practice as it provides an evidence-based foundation for integrating FinTech into sustainable development planning. By translating fragmented empirical findings into development-relevant insights, this study supports policymakers, planners, and regulators in designing digital finance strategies that promote inclusion, resilience, and long-term socio-economic development.

The second section delineates the methodology of this study, elucidating the mechanisms of the scientific paper search and the interview methods employed. The third section presents the findings and provides insights into the impact of FinTech on the efficiency, developmental outcomes, and inclusiveness of the financial industry. The fourth section analyzes the findings and examines their theoretical and practical implications. The fifth section proposes future research directions and identifies areas requiring further investigation. The sixth section explores the practical implications for industry stakeholders. The seventh concludes the study by synthesizing key insights and contributions to the understanding of FinTech's role in the contemporary financial industry.

2. METHODOLOGY

This research methodology employs a systematic review for the precise identification of scientific literature, establishment of appropriate criteria, and subsequent data extraction and analysis [19]. The meticulous steps of this search process ensured a rigorous and transparent methodology that facilitated the replication and validation of the study's findings. This investigation utilized a specific database to elucidate the inclusion and exclusion criteria for studies to enhance data analysis robustness. Following the literature search, the study proceeded to the verification phase, which encompassed interviews with five financial advisors with substantial expertise in FinTech and the financial industry in Indonesia.

2.1 Data collection

This study collected scientific papers using a strict process following the rules of systematic review, and in the search for scientific papers in Scopus, 844 scientific papers were obtained. All of these scientific papers were obtained from the database using the following query [20-22]:
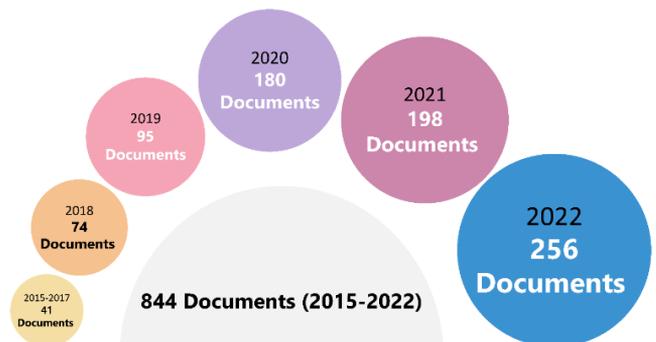

Figure 1. Documents by year

The exploration of FinTech and banking, as represented in academic documents, shows an unmistakable trend of growing scholarly interest from 2015 to 2022 (see Figure 1). In the early phase, from 2015 to 2017, the number of publications was a modest 41, indicating that although FinTech was on the academic radar, it was still in its infancy in terms of research. However, by 2018, there was a discernible uptick, with 74 publications, more than doubling the earlier count, signaling the emerging recognition of FinTech's potential.

Figure 2 shows that the dissemination of research pertaining to FinTech and banking across various academic journals between 2015 and 2022 reveals distinct contribution patterns.

The exploration of FinTech and banking from 2015 to 2022

saw a broad spectrum of academic contributions stemming from diverse global affiliations (see Figure 3).
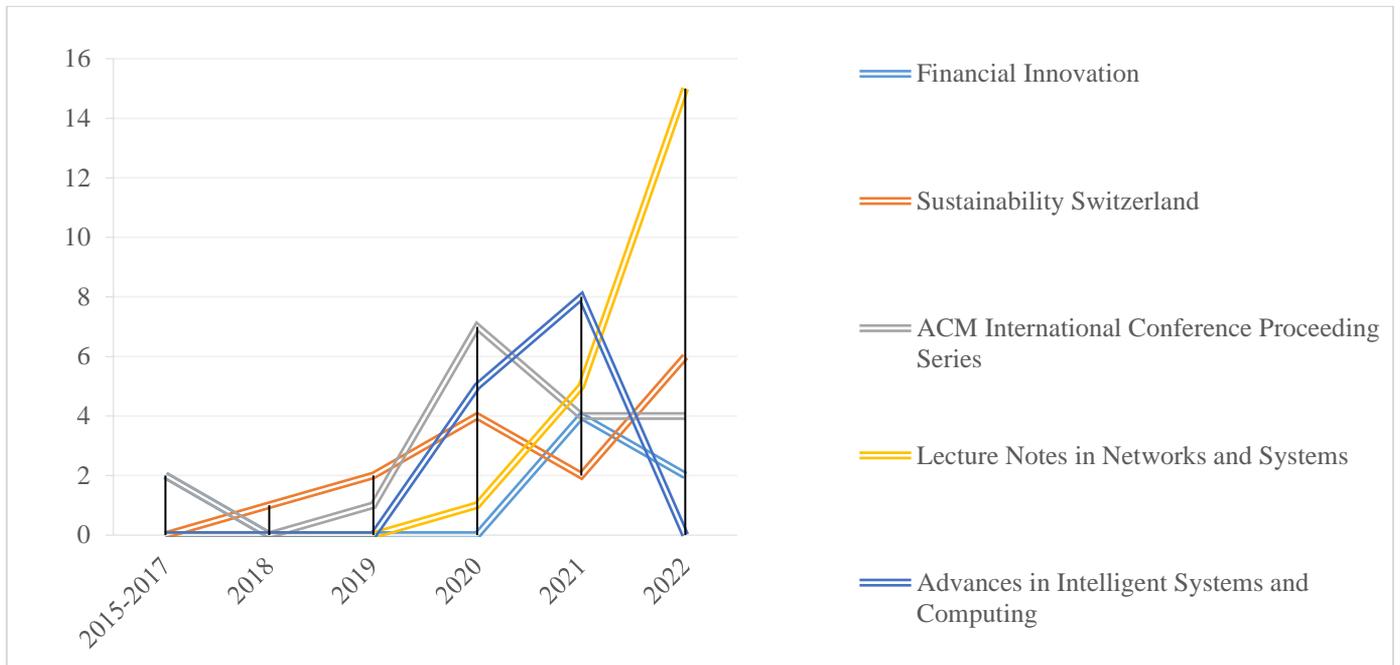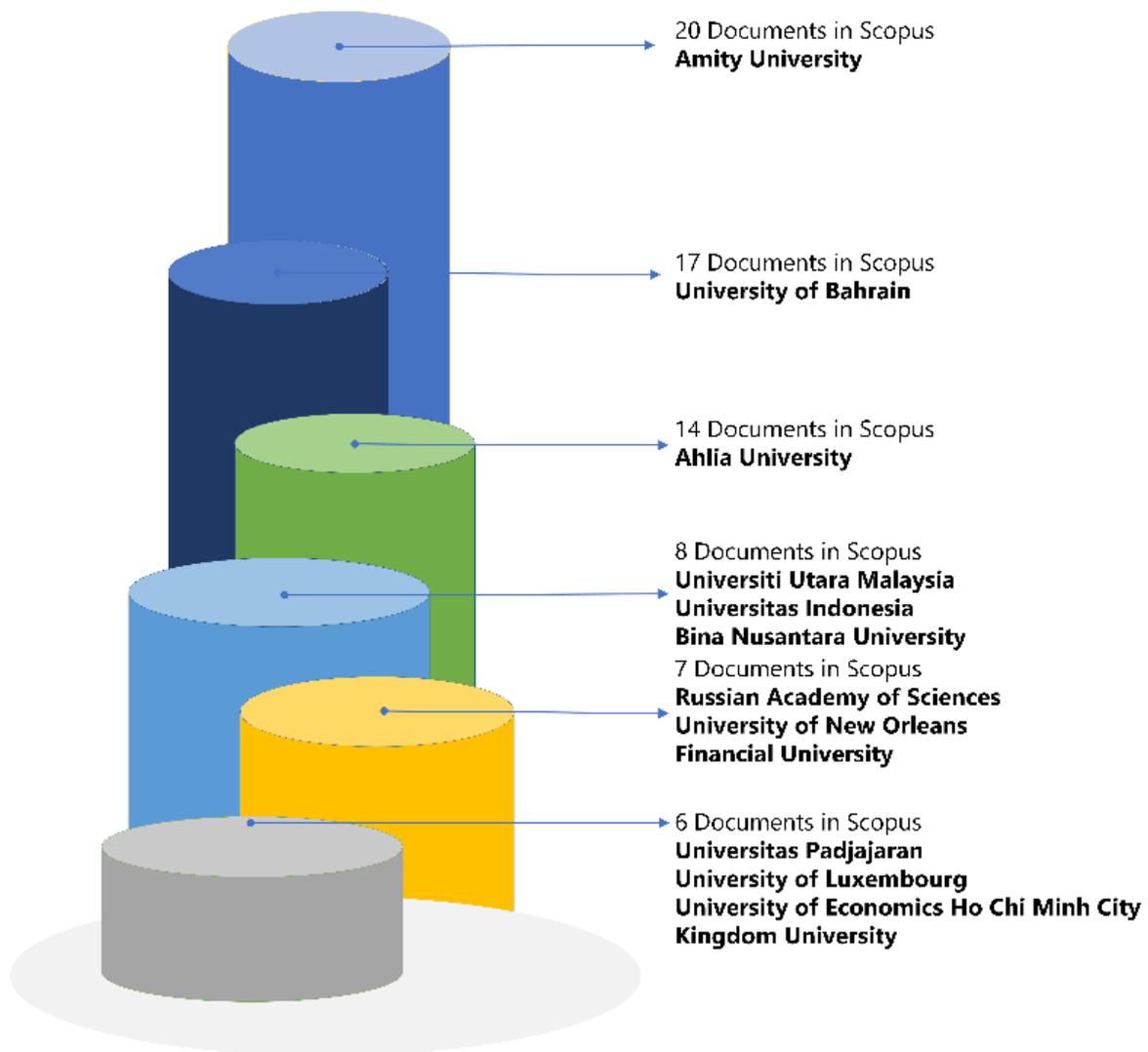

Figure 2. Documents per year by source

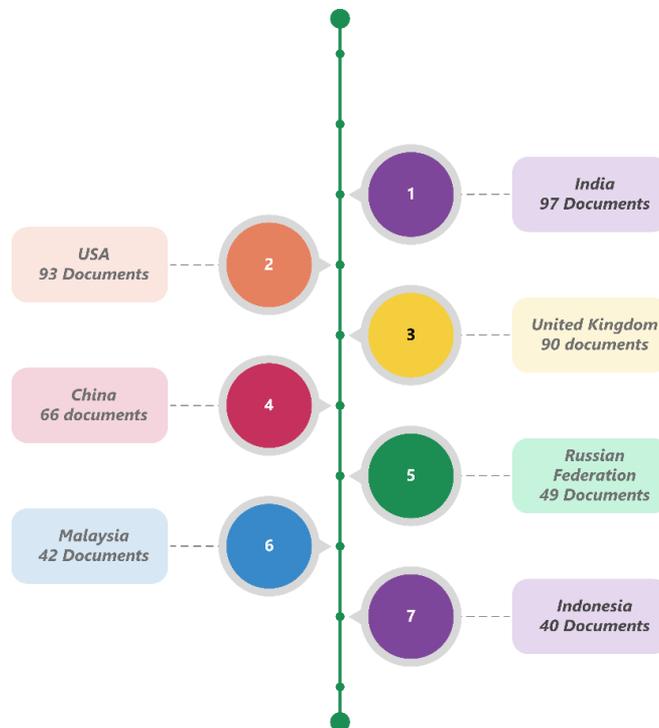**Figure 3.** Document of affiliations

Figure 4. Documents by country

Figure 4's global exploration of the nexus of FinTech and banking from 2015 to 2022 shows remarkable contributions from several countries, reflecting the universal implications of the FinTech phenomenon. India led the chart with 97 documents.

Figure 5. Documents by author

Diving deeper into the realm of FinTech and banking research from 2015 to 2022 (see Figure 5), certain scholars have emerged as prominent figures, showcasing consistent contributions and potentially guiding the academic discourse in this dynamic domain.

The search strategy was designed to capture not only technological and organizational studies, but also research addressing financial inclusion, development outcomes, and policy implications related to digital finance.

2.2 Filtering process

Before presenting the PRISMA flow diagram (Figure 6) [23], the research paper typically includes a section explaining the methodology used in the systematic review. This explanation sets the stage for the flow diagram by describing how the studies were identified, screened, assessed for eligibility, and ultimately included or excluded from the review process. Our review begins with a comprehensive collection of 844 papers published between 2015 and 2022, highlighting the vibrant realm of FinTech and its interplay with banking. Given the extensive nature of this collection, a structured and layered selection strategy was paramount to narrow our focus to the most impactful and contextually pertinent studies [24]. At the start of the screening process, this study excluded papers that were not directly related to FinTech. Non-English papers, papers without abstracts, and those without critical data were excluded. A relevance assessment was conducted through a meticulous evaluation of the abstract and methodology of each paper to ensure congruence with the research question regarding the integration of FinTech into the financial industry. In addition, studies were included if they addressed at least one of the following dimensions: (i) financial inclusion or access to financial services, (ii) socio-economic or development-related outcomes of FinTech adoption, or (iii) regulatory, institutional, or policy implications relevant to development planning. This study employed a double-review system, wherein each paper was independently assessed by two team members to mitigate bias and ensure comprehensive evaluation. After this initial screening, the full texts of potentially relevant papers were analyzed using a systematic approach [25]. Four criteria were applied to the full-text screening process: validity, reliability, credibility, and integrity [26]. Two researchers independently identified relevant scientific papers adhering to the quality criteria proposed by Macpherson and Holt [27] and classified the papers according to the topics intended for investigating FinTech and the financial industry. Discrepancies between researchers were deliberated to reach a consensus, with Cohen's kappa coefficient > 0.85. In total, 353 studies were included in the final analyses.
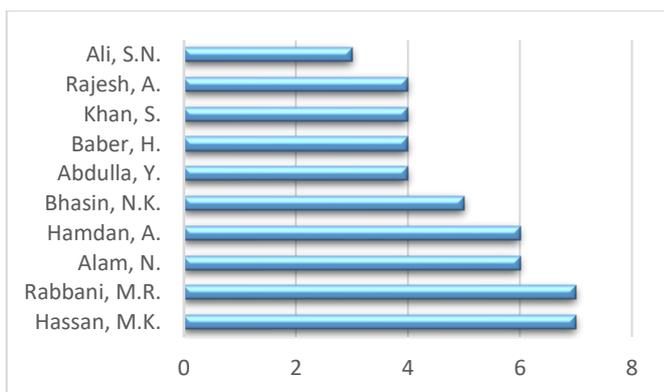
Figure 6. PRISMA flow diagram

Table 1. Top-cited (highest number)

No.	Title	Authors	Source	Year	Citations	Weighted Citations
1	FinTech: Ecosystem, business models, investment decisions, and challenges	Lee, I. & Shin, Y.J. [10]	Business Horizons, 61(1), pp. 35-46	2018	543	108.60
2	FinTech and banking: What do we know?	Thakor, A.V. [18]	Journal of Financial Intermediation, 41, 100833	2020	285	95.00
3	Taming the beast: A scientific definition of FinTech	Schueffel, P. [28]	Journal of Innovation Management, 4(4), pp. 32-54	2016	219	31.29
4	Blockchain Technology: Transforming Libertarian Cryptocurrency Dreams to Finance and Banking Realities	Eyal, I. [29]	Computer, 50(9), pp. 38-49	2017	212	35.33
5	FinTech and RegTech: Impact on regulators and banks	Anagnostopoulos, I. [1]	Journal of Economics and Business, 100, pp. 7-25	2018	194	38.80
6	FinTech investments in European banks: a hybrid IT2 fuzzy multidimensional decision-making approach	Kou, G. et al. [30]	Financial Innovation, 7(1), 39	2021	174	87.00
7	Do FinTech lenders penetrate areas that are underserved by traditional banks?	Jagtiani, J. & Lemieux, C. [31]	Journal of Economics and Business, 100, pp. 43-54	2018	145	29.00
8	Banking goes digital: The adoption of FinTech services by German households	Jünger, M. & Mietzner, M. [4]	Finance Research Letters, 34, 101260	2020	106	35.33
9	A new method for probabilistic linguistic multi-attribute group decision making: Application to FinTech selection	Mao, X.B. et al. [32]	Applied Soft Computing Journal, 77, pp. 155-175	2019	103	25.75
10	Does FinTech innovation improve bank efficiency? Evidence from China's banking industry	Lee, C.C. et al. [33]	International Review of Economics and Finance, 74	2021	102	51.00

The rigorous selection process resulted in a core set of 353 studies for analysis, while ten highly cited and influential studies were highlighted to illustrate key thematic and conceptual developments. This ensured that the conclusions were based on the most pertinent and superior data, thereby enhancing the robustness and the validity of the findings. Such a meticulous and discerning approach is characteristic of a systematic review conducted with diligence, prioritizing depth and relevance over quantity. Recognizing that the pulse of a paper's significance often lies in its reception, we initiated impact and citation phases. A high citation count, as shown in Table 1, serves as a testament to the resonance of this paper within academic and professional echelons. This belief guided our preference for highly cited research. The subsequent content analysis phase was conducted in-depth. The 'granular exploration' mentioned refers to an in-depth analysis in which each scientific paper was subjected to a line-by-line review. This entailed a critical evaluation of the research design, methodologies used, results, and discussion sections of each study to extract nuanced insights relevant to the development-relevant impacts of FinTech, favoring studies that provided novel insights or broke new ground in terms of financial inclusion, institutional change, or policy-relevant perspectives. In the additional criteria segment, accessibility was the main focus. We vouched for papers with definitive digital pathways (URLs/DOIs) to ensure clear and accurate references. Emphasizing tangibility, we prioritize empirically rich papers over theoretical ones. The weighted citation score was used to evaluate the impact of a research paper relative to the time since its publication. It offers an average annual citation count, providing a normalized measure of a paper's influence in its field.

Table 1 provides a succinct overview of seminal research on the FinTech and banking nexus from 2015 to 2022. Serving as the foundation for our exploration, this curated selection chronicles the banking industry's transformative journey in the face of relentless technological innovations. In the table provided earlier, the highest weighted citation score belongs to the paper titled "FinTech: Ecosystem, business models, investment decisions, and challenges" by Lee, I. & Shin, Y.J. [10], published in 2018. This study obtained a weighted citation score of 108.60. This score was calculated by dividing the total number of citations (543) by the number of years since publication (five years, as of 2023).

A high weighted citation score signifies that the paper has been frequently cited, on average, each year since its publication, indicating that it was influential and relevant to its field during this period. In the context of this specific paper, a score of 108.60 suggests a significant impact and strong presence in the academic discourse surrounding FinTech, reflecting its importance and relevance in ongoing research and discussions in the field. By capturing the multifaceted challenges, breakthroughs, and prospects at these crossroads,

Table 1 offers a roadmap for understanding how digital finance is reshaping financial systems and development pathways.

2.3 Verification through expert interviews

The primary objective of the expert interviews was to validate the findings of the literature review [34] and assess their relevance to inclusive development and planning in the Indonesian context. Each financial advisor was presented with the key findings from the literature review and asked to offer insights into the extent to which these findings were consistent with the current state of FinTech and traditional banking in Indonesia. Financial advisors were selected based on their expertise in digital finance, financial inclusion, and financial sector development in the Indonesian context. This expertise ensured a diverse and informed perspective on the subject. Interviews were conducted in a semi-structured format comprising standard questions and open-ended discussions. This methodology allowed experts to provide detailed insights and experiences as financial advisors pertinent to the research questions. Key topics addressed during the interviews included the impact of FinTech on financial inclusion, access to financial services, institutional capacity, and development-relevant outcomes in the Indonesian financial system. The advisors were also requested to comment on the general trends and prospects of FinTech in Indonesia.

Interviews with financial advisors were used to identify common themes and findings that aligned with or contradicted the findings of this systematic review [35]. The data obtained from the interviews were compared with the global trends identified in the systematic review to determine the extent to which these trends can be observed in the Indonesian context. The methodology employed in this study aims to elucidate the development of FinTech in Indonesia compared to global developments, particularly in the context of the role of FinTech in shaping financial inclusion, institutional change, and development pathways. The systematic review provides a global perspective, while expert interviews offer practical perspectives specific to Indonesia, ensuring the relevance and accuracy of the study's conclusions in the context of Indonesia's financial system and its future development trajectory.

3. RESULT AND DISCUSSION

3.1 Result

The research collated in Table 1 offers a comprehensive look at how the financial landscape has evolved over the years, with FinTech playing an increasingly significant role. The key takeaways from this analysis include (see Table 2).

Table 2. Connected topics in the literature

No.	Connected Topic	Key Findings or Observations	Relevant Papers (From Initial Review)
1	Definitions of FinTech	Academic and industry perspectives on the evolving definition of FinTech.	[8, 28, 36]
2	Blockchain and Cryptography	Transition of blockchain from a libertarian dream to real-world applications in finance and banking.	[15, 29, 37]
3	Regulatory Technology	RegTech's impact on banks and regulators, enhancing transparency and regulatory compliance.	[1, 38, 39]
4	Investment in FinTech	Patterns and impacts of investments in FinTech, including benefits and	[40, 41, 42]

5	FinTech Ecosystem	Examination of FinTech's business models, interactions with the wider financial ecosystem.	[10, 18, 43]
6	FinTech and Efficiency	Investigation into how FinTech innovations can streamline operations and increase banking efficiency.	[44, 45, 46]
7	Decision-making in FinTech	Novel approaches to decision-making processes in FinTech adoption and investments.	[10, 30]
8	Digital Banking	Increasing adoption of digital banking solutions in households, faster and user-friendly interfaces.	[4, 13]
9	FinTech vs Traditional Banks	Comparison of reach, services, and user adoption between FinTech lenders and traditional banking systems.	[17, 40, 41]
10	Financial Innovations	An overview of new technologies and methods arising in the financial sector, spearheaded by FinTech.	[8, 47]

3.1.1 Definitions of FinTech

The term "FinTech" has seen an unprecedented surge in its use over the past decade [28]. As in any evolving field, encapsulating the essence of FinTech in a single definition is challenging. This complexity arises from the multifaceted nature of the domain and the varying perspectives of its stakeholders and serves as an insightful foray into FinTech's definitions [48]. The juxtaposition of academic and industrial perspectives, highlighted by Werth et al. [49], reveals the depth and breadth of this term. From the industry's perspective, FinTech is often perceived in a straightforward manner by integrating technology into financial services. This encompasses a broad spectrum of mobile banking applications and e-wallets for sophisticated AI-driven trading algorithms [50]. The industry's emphasis is largely on the "tech" part of FinTech, focusing on the tools, platforms, and software that augment financial processes. This definition celebrates the pragmatic application of technology in finance, showing tangible solutions that improve efficiency, customer experience and accessibility.

3.1.2 Blockchain and cryptography

Blockchain and cryptography, terms initially confined to obscure corridors of digital innovation, have now emerged at the forefront of financial revolutions [29, 51]. The marriage between these two has created a system that promises transparency, security, and decentralization. Although the beginnings of blockchain are intrinsically linked to cryptocurrencies, its potential applications extend far beyond, particularly in the realm of banking and finance [15]. Blockchain's initial allure primarily revolved around its role as the underlying technology of Bitcoin, the first cryptocurrency. Its libertarian promise is its ability to conduct transactions without the need for traditional intermediaries, thus providing a sense of autonomy and privacy. However, as Akhtar [52] rightly noted, the metamorphosis of blockchain from this libertarian dream is noteworthy.

3.1.3 Regulatory technology (RegTech)

In a financial landscape that is evolving rapidly and becoming more complex, Regulatory Technology, more commonly referred to as 'RegTech,' emerges as the knight in shining armor [1]. By balancing the scale between innovation and compliance, RegTech is at the confluence of digital advancements and the increasing need for regulatory compliance. The fusion of technology with regulations has the potential to revolutionize the interaction of financial entities with legal frameworks and mandates. RegTech is not merely a contemporary term in the current financial landscape but closely aligns with governmental policies regulating the financial industry ecosystem. Governments worldwide are endeavoring to employ a transformative approach to address some of the most intricate challenges in the modern financial sector. Traditional regulatory compliance systems are often complex, manual, and inefficient in nature. With the proliferation of digital transactions, the globalization of financial services, the emergence of novel financial products, the volume of data, and regulatory complexity have become nearly unmanageable using conventional methods [53].

3.1.4 Investment in FinTech

FinTech has emerged as a transformative force that has given quite a shock and change in a short time to all elements of the financial industry, especially the banking industry, which is reshaping the way businesses and consumers interact with financial services [54]. Innovation capacity promises a combination of significant rewards and inherent risks; therefore, many investors are interested in investing in FinTech. Understanding this duality is crucial for stakeholders who wish to capitalize on the growing potential of FinTech. The FinTech sector, with its myriad start-ups and innovative solutions, represents the dynamism and uncertainty of modern finance. Adapting to a new digital financial environment creates more difficult challenges, such as those related to personal data and security. FinTech provides a wider market, promising high returns, market disruption, and interest in defining the future of finance. However, they carry risks associated with regulatory uncertainty, technological change, and market volatility [30].

3.1.5 FinTech ecosystem

FinTech is at the center of contemporary financial industry transformations, leading to digital financial transformation [8]. This transformation continues to progress as an increasing number of traditional financial institutions adopt the latest technology in their operations, ensuring that the growth and maturity of this technology do not evolve in isolation but rather become interconnected with the broader financial system. This evolution encompasses not only emerging devices and platforms but also the changing dynamics between FinTech businesses and the traditional financial system. FinTech constitutes a novel and more complex ecosystem that encapsulates the intricate network of interactions in the modern financial industry. This ecosystem comprises innovative startups, governments, established financial institutions, regulators, consumers and stakeholders. Within this ecosystem, diverse business models compete for dominance, each possessing its own strengths, weaknesses, and implications that may determine the future of finance [1].

3.1.6 FinTech and efficiency

The financial industry has consistently been characterized

by dynamism, with ongoing innovation leading to more efficient operations. Technology presents significant potential for this sector to streamline traditional financial processes that have historically been exclusive and limited in scope. Financial Technology (FinTech) has been recognized as a transformative advancement. Efficiency is central to this transition. Marhaeni et al. [13] provided invaluable insights into this complex matter. Banking sector efficiency encompasses multiple dimensions, including cost and time savings, quality of service provided to customers, regulatory compliance, risk management, and additional factors. Traditional banking systems, encumbered by legacy frameworks, frequently encounter obstacles, manual processes, and siloed operations [55].

3.1.7 Decision-making in FinTech

FinTech is one of the fastest-growing innovations in the financial industry [30]. This transformation is accompanied by an increasingly complex integration of finance and technology, necessitating the recalibration of the decision-making process in this domain. While traditional financial strategies remain relevant, they must be supplemented with more contemporary data-driven methodologies to address FinTech's unique challenges and opportunities [56]. Lee and Shin [10] observed that decision-making in the FinTech sector has undergone a profound evolution. Their study elucidates that with the proliferation of digital devices, decision-makers have access to vast amounts of data. These data, encompassing user behavior metrics and global financial trends, provide invaluable insights into the adoption and scaling of fintech solutions [57]. The role of technology continues to undergo significant transformations, leading to its use as a tool and as an intelligent agent capable of autonomous decision-making without human intervention. This phenomenon presents a challenge for the emerging financial industry, and the readiness of the environment to support novel methods entirely regulated by programmed technology systems fundamentally alters the landscape of the traditional financial industry and potentially diminishes the role of human cognition as the primary decision-making factor in finance.

3.1.8 Digital banking

Traditional banking is experiencing rapid transformation, particularly in the realm of digital financial innovation, necessitating a reevaluation of financial service delivery methods. Digital banking, the convergence of technology and finance, has emerged as a significant response to this challenge. This transformation is deeply rooted in consumer behavior and technological advancements, offering a combination of accessibility, efficiency and innovation. The transition from the traditional banking paradigm to digital media has been substantial. The household sector exemplifies this behavioral shift. Banking tasks are often associated with visiting physical branches, queuing, and adhering to banking hours. Today, these tasks have been seamlessly integrated into daily life, facilitated by sophisticated technology adopted in digital banking. In Indonesia, banks have begun to reduce their physical infrastructure and relocate their services to shopping centers, with some large banks establishing digital bank subsidiaries. Banks have effectively addressed the evolving needs of the community as they adapt to these changes and strive to develop new, more integrated infrastructure without compromising the quality of their products.

3.1.9 FinTech vs. traditional banks

The financial industry has undergone a significant shift since the emergence of financial technology (FinTech). These digital-first entities challenge the long-standing dominance of traditional banks, leading to dynamic interplay between competition and collaboration. At the heart of this debate is the innovative agility of FinTech versus the trust and infrastructure of legal banking institutions. Langley and Leyshon [43] provided a compelling analysis of FinTech, emphasizing its broad reach. FinTech platforms, unencumbered by the physical infrastructure and legacy systems of traditional banks, are agile, allowing them to penetrate markets that banks have historically overlooked or underserved. The digital-first model means that anyone with a smartphone or Internet connection can potentially access financial services, leveling the playing field for remote or underserved communities [58, 59]. This advancement is accompanied by increasing risks, particularly in developing nations such as Indonesia, where financial literacy is low and the technology is not yet sufficiently mature for effective utilization in the field. The layered security implemented by several fintech platforms is inadequate for preventing financial crimes within Indonesia's fintech ecosystem. This significant transformation presents a novel challenge, wherein adoption is not the primary concern; rather, of equal importance is how the newly formed ecosystem can engender improved environmental changes to facilitate safe adaptation to the technology employed by the financial sector.

3.1.10 Financial innovations

The financial industry risks obsolescence if entities within this sector fail to address their technological lag and effectively leverage innovation to deliver financial services to customers. The emergence of FinTech as a significant force has accelerated the pace of change and produced a series of innovations that promise to redefine the contours of the financial world [48]. Werth et al. [49] provide an in-depth analysis of this transformative era, highlighting the numerous innovations emerging from the FinTech sector. From digital banks and peer-to-peer lending platforms to sophisticated algorithmic trading systems, the financial landscape is evolving at an unprecedented rate [16]. However, these innovations do not merely introduce new tools or platforms. Fundamentally, these are challenging and often improve traditional financial methods. For instance, the emergence of decentralized finance (DeFi) platforms promises to democratize access to financial services, eliminate intermediaries, and potentially offer more inclusive, transparent, and efficient financial solutions [37].

3.1.11 Narration analysis

The rapid evolution of technology, coupled with high adoption rates in the financial industry, has rendered the convergence of FinTech with traditional banking a key driving force of transformation, as evidenced by the insights of financial advisors who are experts in the financial sector. The far-reaching effects of this convergence are characterized by the implementation of digital innovations, customer-centric strategies, and adaptive market approaches. The critical role of digital transformation and automation in the financial services sector was emphasized by a financial advisor, who stated,

"Digital transformation and automation are making their mark in several industries, not least of which is the financial services industry."

The convergence of FinTech with traditional banking has undergone dynamic and transformative evolution, characterized by high adoption among major banking institutions in Indonesia. These institutions have initiated the acquisition of new subsidiaries and their conversion into digital banks, implemented digital innovation in their products and services, adopted consumer-centric approaches, and engaged in strategic market adaptation. This transformation aligns with global trends but is specifically tailored to the characteristics of Indonesia's financial needs. Indonesia's FinTech ecosystem is experiencing rapid growth, propelled by robust digital penetration, investor engagement, and government support in providing incentives for digital monetary transaction. This growth redefines the financial services industry, as both traditional and new technology companies adopt FinTech solutions. This sector places a heightened emphasis on profitability and sustainable economics. Startups are transitioning from a growth-at-all-costs model to value-based growth, refining distribution models, and pursuing cost-effective methods of customer acquisition. Consumers in Indonesia have demonstrated a significant inclination towards digital transactions, and the demand for digital banking services is substantially high. Many individuals have expressed a preference for transitioning to financial institutions that operate without physical branches and provide continuous services. Nevertheless, traditional bank branches remain essential for certain demographic groups and segments of the population, particularly for complex financial transactions and specialized services that require in-person assistance.

"To capitalize on these trends, Indonesian banks need to invest in new digital capabilities, integrating banking more seamlessly into customers' daily lives, and simplifying digital offerings for easier consumer adoption."

The growth of FinTech, particularly in the peer-to-peer lending sector, offers a vital lifeline to the 'unbanked' in Indonesia, a significant portion of the population that does not have traditional bank accounts. FinTech's expansion highlights its role in promoting financial inclusivity in Indonesia, reaching populations that are traditionally underserved by the formal banking system. The FinTech landscape in Indonesia is marked by rapid growth, increasing digital adoption, and a strategic shift towards more consumer-centric and innovative financial services. The sector is poised for continued evolution driven by technological advancements, consumer demand, and a progressive regulatory environment. Thus, FinTech is not only complementing traditional banking in Indonesia but is actively shaping its future trajectory. An Industry Analyst points out FinTech's success in addressing consumer needs.

"It's really about FinTech's being able to recognize that consumer pain points are still not being addressed."

This phenomenon is particularly evident in Indonesia, where the establishment of a flexible multichannel digital ecosystem has been instrumental in reducing administrative costs, expanding product ranges, and preventing fraud through real-time monitoring. The analysis demonstrates that the application of FinTech in conjunction with AI technologies in Indonesia has significant potential for fostering a robust culture of savings and family financial management. The Indonesian financial regulatory authority (OJK) and central bank (BI) are actively engaged in overseeing this integration through the development of regulations and guidelines to govern FinTech conduct and mitigate the potential risks associated with technological advancements. This encompasses the implementation of application programming interfaces to facilitate open banking and ensure the appropriate utilization of artificial intelligence and machine learning in financial services. These initiatives aim to establish legal certainty, promote safe development, and manage risks pertaining to data handling and the potentially biased impact of algorithms in financial services.

The Encouraging and Facilitating Innovation Act represents a proactive regulatory environment that has evolved to address consumer challenges in the financial sector. This has also facilitated a more personalized banking experience, resulting in increased customer satisfaction. This development suggests a shift from conventional product-driven strategies to customer-centric solutions, which is aligned with the prevailing global trend of FinTech innovation. The role of FinTech in democratizing access to financial services underscores the significant trend of financial inclusion, particularly among underserved and geographically remote populations in developing countries. The BI and OJK actively promoted this integration as a crucial component of the evolving Indonesian financial regulatory landscape. For instance, BI has implemented a standardized payment system that encompasses limitations on fees for Quick Response (QR) code transactions and protocols to ensure interoperability among systems. Consequently, these established minimum standards enable consumers to use a single payment system across multiple platforms without incurring additional costs, thereby facilitating greater access. Similarly, the OJK categorizes FinTech firms alongside other non-bank financial institutions, permitting their entry into the market through a regulatory sandbox. This environment facilitates innovation while providing minimal regulatory oversight for FinTech startups, thereby fostering a favorable ecosystem for financial technology to develop and expand its reach to a broader population.

"The growth in bank account ownership to 52% and mobile money to 18.8 million users by 2021 is a testament to FinTech's impact in Indonesia. It's truly opening doors for financial inclusion."

In Indonesia, the rapidly expanding Internet economy encompasses FinTech and is integral to the initiative for broader financial inclusion. The growth of the Internet economy is propelled by digital payments, e-commerce, and ride-hailing applications, which are progressively evolving into comprehensive platforms offering an increasing array of services. Consequently, these services are transforming into integrated financial systems, resulting in the expansion of the reach and influence of FinTech. For instance, the increasing prevalence of e-wallets demonstrates Indonesian consumers' growing confidence in digital financial services. The OJK also observed a disparity between financial literacy and inclusion on FinTech platforms, with numerous individuals being cognizant of these micro-financing services but lacking access to them. This observation prompted the Indonesian government to implement the National Strategy on Indonesian Financial Literacy for 2021-2025, with the objective of attaining 90% inclusion by 2024. This strategy includes initiatives such as developing massive open online courses (MOOCs) and providing financial calculators to assess financial health. Consequently, it is feasible to enhance financial inclusivity through FinTech in Indonesia. Furthermore, technology has a substantial impact by transforming banking systems and offering a diverse array of

secure and stable fiscal services in the country. This effect is particularly significant given that the level of financial literacy in the country is relatively low, estimated at 30% of the population. The implementation of innovative FinTech solutions within the country's favorable policy context facilitates this objective.

"The market cap of private FinTech companies has increased substantially over the past decade, yet the sector's penetration of the public market remains small."

Despite economic uncertainty, Indonesia's fintech sector has demonstrated resilience and adaptability. This is evident from the numerous developments and trends that have emerged in the industry over the past decade. During this period, multiple innovations and strategic adaptations contributed to substantial growth in Indonesia's FinTech sector. A significant aspect of this growth is the proliferation of digital banks, which are frequently supported by established traditional banks and technology giants.

"These digital banks have experienced phenomenal growth, as seen in entities such as SeaBank Indonesia and Jago, which have shown significant year-on-year growth in total assets and customer numbers."

This trend is indicative of a strategic adjustment for traditional banks, emphasizing the utilization of FinTech partnerships to enhance service offerings, strengthen revenue quality, and explore additional potential opportunities. Concurrently, the FinTech industry in Indonesia has expanded into numerous sectors, addressing the needs of underserved markets in small cities and fulfilling startup-specific financial requirements within the ecosystem. This trajectory of innovation was initially driven by online payments and subsequently evolved into electronic money, electronic wallets, and digital banking solutions, with a particularly strong focus on small and medium-sized enterprises (SMEs) and startup sectors. This development has been instrumental in increasing access to financial services in traditionally underserved areas. Furthermore, it has resulted in the emergence of FinTech unicorns, such as Akulaku and Dana, indicating the potential for continued growth in the market. This phenomenon demonstrates not only the dynamism of the FinTech landscape in Indonesia but also the numerous challenges that these entities must navigate and adapt to in order to survive. Additionally, a Financial Advisor reported that the proliferation of B2B FinTech solutions suggests significant changes in commercial relationships within the financial industry.

"Many businesses continue to rely on legacy banking infrastructure. To address these challenges, businesses are benefiting from using off-the-shelf solutions provided by digital natives."

The advent of B2B FinTech solutions in Indonesia has substantially transformed corporate participation in the financial sector. This transformation was facilitated by the transition from dependence on traditional banking infrastructure to adaptable and transaction-specific digital solutions accessible through fintech. In the Indonesian context, this phenomenon has historically been exemplified by the emergence of digital banks, frequently supported by established financial institutions and technology companies. These networks are utilized to effectively market a broader range of products and services, thereby enhancing their value propositions and revenue streams. For instance, consider the growth of SeaBank Indonesia and Jago in terms of total assets and customer numbers. Currently, Indonesian banks are increasingly aligning with FinTech companies and entrepreneurs to leverage technological innovation development to strengthen existing business lines or scale as new solution sets. The partnership is characterized as an enablement-focused collaboration, not only in terms of customer reach but also in terms of internal capabilities such as credit scoring and digital KYC. Furthermore, distribution has expanded beyond major banks, as several large financial institutions have formed alliances with e-commerce platforms and peer-to-peer (P2P) lenders to extend credit to a broader population.

3.2 Discussion

The implications of FinTech in the banking industry are extensive and cannot be adequately addressed in a single explanatory series. This technology enhances operational efficiency and customer satisfaction while simultaneously contributing to financial inclusivity. FinTech does not merely represent a technological transition for banks; rather, it signifies a shift towards a more comprehensive banking model designed to serve customers more effectively in an inclusive manner (see Table 3).

Table 3. Advantages of FinTech in banking industry

Research Question	Advantage in Banking Industry	Explanation
1. Does the adoption of FinTech solutions lead to increased operational efficiency in traditional banking institutions?	Enhanced Operational Efficiency	FinTech utilizes advanced mechanisms such as artificial intelligence, machine learning, and automation to enhance banking functions. This implementation results in improved processing times, reduced manual errors, and decreased overall operational costs. For example, automated customer service systems can address frequently asked questions, enabling human resources to focus on more complex transactions and inquiries.
2. Does FinTech innovation positively influence customer satisfaction levels in the banking sector?	Improved Customer Satisfaction	The customer experience is enhanced by FinTech solutions, which provide user-friendly interfaces, personalized services, and continuous accessibility. Mobile banking applications and digital platforms offer more accessible means to conduct financial transactions, resulting in increased customer satisfaction. Moreover, artificial intelligence-based personalization enables banks to deliver tailored advisory and financial services to individual customers, thereby strengthening customer interactions.
3. What is the potential of FinTech in enhancing financial inclusivity across different demographics?	Increased Financial Inclusivity	FinTech facilitates access to financial services for unbanked populations. Digital platforms contribute to the reduction of entry barriers for banking services and enable increased participation in the financial system, even for individuals residing in remote areas or lacking proximity to traditional banking institutions. The availability of services such as microloans, electronic wallets, and P2P lending platforms expands the scope of financial inclusivity across diverse demographic groups.

3.2.1 Increased operational efficiency in traditional banking institutions

The adoption of FinTech solutions by traditional banking institutions significantly enhances their operational efficiency. This advancement is primarily attributed to the integration of advanced technologies, such as AI, machine learning, and automation [15]. In a dynamic financial environment, Indonesian banks have acknowledged the need to adapt and incorporate these technologies to remain competitive and avoid becoming obsolete. These technologies automate typical banking tasks, such as data entry and customer inquiries, significantly reducing processing times and eliminating manual errors to enhance bank operations [13]. The implementation of AI-powered customer service bots by Indonesian banks is a notable example of this. These automated systems effectively improve the efficiency of customer service operations by providing continuous responses and increasing response rates to numerous customer inquiries [60]. Digital engagement in Indonesia is growing, and such AI solutions can not only reduce response times but also enable bank employees to focus on addressing more complex queries and strategic issues. This transition to AI-driven customer service reflects the broader landscape of Indonesia's banking sector, which is shifting towards digital transformation to accommodate evolving consumer demands.

3.2.2 Positive influence on customer satisfaction levels in the banking sector

FinTech has significantly enhanced customer service by increasing convenience, customization, and accessibility. A notable development is the substantial increase in digital platform utilization, encompassing mobile banking applications and online financial services [13]. This advancement enables Indonesian customers to access financial services more conveniently, transitioning away from traditional banking hours and the necessity of visiting bank branches. Convenience is one of the most critical factors in Indonesia, an archipelagic country where accessing physical bank branches can be highly complex, particularly in remote areas [61]. These digital platforms are designed to be user-friendly, targeting Indonesia's growing tech-savvy population. This has significantly reduced the barrier to entry for many banking users, especially younger generations who prefer digital interactions. Additionally, the utilization of AI and data analytics enables financial institutions to provide personalized financial advisory services and tailor products to meet individual customer requirements [8, 37]. This personalization is particularly significant in the Indonesian context, a nation characterized by diverse levels of financial literacy and the need to enhance the inclusivity of these services in accordance with individual preferences or requirements [56].

3.2.3 Enhancing financial inclusivity across different demographics

FinTech represents a significant transformation in the financial services sector, particularly in accessibility and inclusivity. Traditional banking systems inadvertently contribute to the exclusion of diverse demographic segments, including rural populations, unbanked individuals and low-income groups [4, 13]. A primary factor contributing to this exclusion is the limited physical reach of formal banking solutions, which typically necessitate direct in-branch interactions accompanied by stringent documentation requirements and an established credit history. These barriers have also prevented a significant portion of the population from accessing or utilizing formal financial services. This situation is poised to change as FinTech solutions are transforming this scenario through mobile and digital platforms [62, 63]. The utilization of technology enables these platforms to overcome long-standing obstacles that impede individuals' access to financial services. Mobile wallets, microloan facilities, and P2P lending platforms are among the innovations that have demonstrated particularly high social return on investment. Facilitating access to banking services in remote areas is crucial, as it contributes to financial inclusion, which is instrumental in poverty reduction and enhancing economic well-being. In remote regions, the availability of adequate banking services is often constrained, impeding individuals' ability to save, obtain loans, or utilize other financial services that can support economic activities such as microenterprises and agricultural endeavors. Financial inclusion has the potential to provide access to capital, enhance financial stability, and mitigate dependence on informal lending practices that frequently entail high-interest rates [64].

4. FUTURE RESEARCH AGENDA

This study summarizes the future research directions identified in this review, which indicate previously unexplored areas that can inform the trajectory of fintech-driven development and planning and visually represent potential avenues for future scholarly inquiries. A comprehensive investigation of FinTech, from its impact on digital banking to its relationship with conventional banks, reveals an interconnected body of knowledge. However, as with any emerging field, uncertainties and areas for further exploration remain unresolved. The primary question that arises is how this rapid shift from traditional to digital finance can be aligned with sustainable development objectives [8, 65]. Because this represents only the initial phase of our digital evolution, future research should approach the identification of saturation points, obstacles, and long-term social, economic, and institutional sustainability within increasingly digital financial systems.

According to Fahlevi et al. [15], the deconstruction of blockchain represents another potential direction. The use of blockchains in finance is evolving rapidly; however, it is pertinent to consider how they might relate to other technological advancements such as quantum computing or AI. These interactions also raise questions about governance, accountability, and the distribution of benefits and risks across different social groups. These intersections raise significant questions regarding the potential synergies, conflicts, and innovations that can emerge from their interactions. RegTech has the potential to enhance transparency and regulatory compliance, thus presenting numerous research opportunities. This development facilitates the exploration of the policy, governance, and institutional implications of these technologies for development planning, particularly in jurisdictions with varying levels of regulatory sophistication, which may be potentially transformative [48]. The dynamic nature of FinTech, as discussed by Schueffel [28], indicates that definitions of FinTech are subject to continuous revision and reinterpretation, resulting in evolving definitions. A comprehensive examination of this phenomenon would necessitate a longitudinal study to document the evolution of

terminology over time and analyze the implications of such changes for regulation, policy design, and development-oriented financial governance. Furthermore, a comparison between FinTech platforms and traditional banks provides valuable context for investigating potential collaboration models, best practices, and strategies for promoting inclusion, resilience, and equitable access to financial services.

5. IMPLICATION

The findings of this study contribute to development-oriented theory by reframing FinTech not merely as a technological or industrial innovation, but as an institutional and systemic driver with implications for sustainable and inclusive development. The diffusion of digital finance, blockchain, and regulatory technologies reshapes financial systems by altering access structures, institutional arrangements, and governance mechanisms. This transformation extends beyond efficiency gains within financial firms and instead reflects a broader reconfiguration of how financial services are distributed, regulated, and embedded within socio-economic systems. From a development perspective, FinTech constitutes a mechanism through which financial inclusion, institutional resilience, and adaptive capacity can be strengthened, particularly in emerging economies where traditional financial infrastructures remain uneven or incomplete.

At the theoretical level, the results support the integration of digital innovation frameworks with development economics, institutional theory, and governance perspectives. The evidence suggests that technological change in finance cannot be adequately understood through firm-level performance models alone, but must be situated within broader development processes involving regulation, social inclusion, and state capacity. This integration advances a systemic understanding of digital finance as part of development planning rather than as an isolated market phenomenon.

From a policy and planning perspective, the findings highlight the importance of aligning FinTech development with national and regional development strategies. Digital financial innovation requires not only technical adoption but also coordinated planning in areas such as digital infrastructure, regulatory capacity, financial literacy, consumer protection, and data governance. Without such alignment, FinTech risks reinforcing existing inequalities or generating new forms of exclusion. Conversely, when embedded within inclusive development frameworks, FinTech can support poverty reduction, small enterprise development, and equitable access to financial services.

The study further indicates that regulatory innovation plays a critical role in mediating the developmental impact of FinTech. Adaptive, risk-based regulatory frameworks can enable innovation while safeguarding financial stability and protecting vulnerable users. Development-oriented regulation thus becomes an integral component of sustainable digital finance, linking market dynamics with public interest objectives.

Finally, the findings suggest that planners and policymakers should treat digital finance as part of long-term development infrastructure rather than as a short-term technological trend. Strategic investment in interoperable systems, inclusive design, and institutional coordination is essential for ensuring that FinTech contributes positively to development outcomes.

These implications underscore the need for interdisciplinary collaboration between financial regulators, development planners, technology providers, and social institutions to ensure that digital financial transformation supports inclusive, resilient, and sustainable development pathways.

6. CONCLUSION

Digital financial technologies are reshaping financial systems in Indonesia in ways that extend beyond operational transformation within banks. The diffusion of FinTech, including mobile platforms, blockchain-based infrastructures, and algorithmic systems, has altered patterns of access, reduced transaction frictions, and expanded the functional reach of formal financial services. These changes have contributed to the gradual integration of previously underserved populations into the financial system, particularly in regions where conventional banking infrastructure has historically been limited.

The Indonesian case illustrates that financial inclusion is not a passive outcome of technological diffusion but a contingent process shaped by institutional conditions, regulatory frameworks, and socio-economic structures. Digital platforms facilitate access, yet the distribution of benefits depends on digital literacy, infrastructure availability, regulatory design, and public trust. FinTech therefore operates not only as a technological instrument but as a mediating mechanism within broader development processes.

The findings further indicate that the development potential of digital finance is closely linked to governance capacity and planning coherence. Regulatory approaches that combine flexibility with oversight appear critical for enabling innovation while limiting systemic risk and exclusionary effects. Financial technology, when embedded within coherent development strategies, can support inclusive growth, small enterprise development, and greater financial resilience among households. When disconnected from such frameworks, however, it may reproduce existing inequalities or introduce new forms of vulnerability.

Overall, the transformation of Indonesia's financial system reflects a broader pattern in which digital finance functions as part of development infrastructure rather than as a standalone market innovation. Its long-term contribution depends less on technological sophistication than on institutional alignment, policy coordination, and social integration. These findings underscore the importance of treating digital financial systems as components of sustainable development planning, with implications for policymakers, regulators, and planners seeking to build inclusive, resilient, and equitable financial futures.

AUTHOR CONTRIBUTIONS

SHS contributed as the main author by conceptualizing the research, formulating the research objectives, and designing the overall study framework. She also coordinated the literature review process, supervised data collection and interviews with financial advisors, and played a major role in interpreting the findings and drafting the manuscript. FT contributed to the systematic review of academic publications related to financial technology and traditional banking. She assisted in organizing and analyzing the bibliographic data and

contributed to writing the literature review and discussion sections. SD was responsible for data validation and analysis, particularly in synthesizing insights from the selected scientific papers and interview results. She also contributed to refining the analysis of FinTech's impact on operational efficiency, customer satisfaction, and financial inclusion. MEB contributed to the comparative and international perspective of the study, particularly in contextualizing Indonesia's FinTech development within the global financial landscape. He also assisted in reviewing the manuscript, strengthening the theoretical implications, and improving the clarity of the conclusions and policy recommendations.

DATA AVAILABILITY STATEMENT

The data presented in this study are available on request from the corresponding author due to privacy reasons.

REFERENCES

[1]   Anagnostopoulos, I. (2018). Fintech and RegTech: Impact on regulators and banks. Journal of Economics and Business, 100: 7-25. https://doi.org/10.1016/j.jeconbus.2018.07.003

[2]   Ashta, A., Herrmann, H. (2021). Artificial intelligence and fintech: An overview of opportunities and risks for banking, investments, and microfinance. Strategic Change, 30(3): 211-222. https://doi.org/10.1002/jsc.2404

[3]   Drasch, B.J., Schweizer, A., Urbach, N. (2018). Integrating the 'troublemakers': A taxonomy for cooperation between banks and fintechs. Journal of Economics and Business, 100: 26-42. https://doi.org/10.1016/j.jeconbus.2018.04.002

[4]   Jünger, M., Mietzner, M. (2020). Banking goes digital: The adoption of FinTech services by German households. Finance Research Letters, 34: 101260. https://doi.org/10.1016/j.frl.2019.08.008

[5]   Asosiasi Fintech Indonesia. (2019). FinTech Landscape di Indonesia. https://fintech.id/id/education-and-literacy/activity-agenda.

[6]   Baber, H. (2019). FinTech, crowdfunding and customer retention in Islamic banks. Vision: The Journal of Business Perspective, 24(3): 260-268. https://doi.org/10.1177/0972262919869765

[7]   Jagtiani, J., Lemieux, C. (2019). The roles of alternative data and machine learning in fintech lending: Evidence from the LendingClub consumer platform. Financial Management, 48(4): 1009-1029. https://doi.org/10.1111/fima.12295

[8]   Sahabuddin, M., Sakib, M.N., Rahman, M.M., Jibir, A., Fahlevi, M., Aljuaid, M., Grabowska, S. (2023). The evolution of FinTech in scientific research: A bibliometric analysis. Sustainability, 15(9): 7176. https://doi.org/10.3390/su15097176

[9]   Murinde, V., Rizopoulos, E., Zachariadis, M. (2022). The impact of the FinTech revolution on the future of banking: Opportunities and risks. International Review of Financial Analysis, 81: 102103. https://doi.org/10.1016/j.irfa.2022.102103

[10]   Lee, I., Shin, Y.J. (2018). Fintech: Ecosystem, business models, investment decisions, and challenges. Business Horizons, 61(1): 35-46. https://doi.org/10.1016/j.bushor.2017.09.003

[11]   Dorfleitner, G., Hornuf, L., Schmitt, M., Weber, M. (2017). FinTech in Germany. Springer International Publishing. https://doi.org/10.1007/978-3-319-54666-7

[12]   Friedline, T., Naraharisetti, S., Weaver, A. (2019). Digital redlining: Poor rural communities' access to Fintech and implications for financial inclusion. Journal of Poverty, 24(5-6): 517-541. https://doi.org/10.1080/10875549.2019.1695162

[13]   Marhaeni, A.A.I.N., Jermsittiparsert, K., Sudarmo, Indrawati, L.R., et al. (2023). Adoption of the green economy through branchless rural credit banks during the COVID-19 pandemic in Indonesia. Sustainability, 15(3): 2723. https://doi.org/10.3390/su15032723

[14]   Fahlevi, M., Moeljadi, M., Aisjah, S., Djazuli, A. (2022). Blockchain security and corporate governance. In 2022 4th International Conference on Cybernetics and Intelligent System (ICORIS), Prapat, Indonesia, pp. 1-5. https://doi.org/10.1109/icoris56080.2022.10031537

[15]   Fahlevi, M., Vional, V., Pramesti, R.M. (2022). Blockchain technology in corporate governance and future potential solution for agency problems in Indonesia. International Journal of Data and Network Science, 6(3): 721-726. https://doi.org/10.5267/j.ijdns.2022.3.010

[16]   Yusuf, M., Hakim, L., Hendra, J., Kamar, K., Idawati, W., Winarso, E., Meiden, C., Fahlevi, M. (2023). Blockchain technology for corporate governance and IT governance: A financial perspective. International Journal of Data and Network Science, 7(2): 927-932. https://doi.org/10.5267/j.ijdns.2022.12.018

[17]   Sheng, T. (2021). The effect of fintech on banks' credit provision to SMEs: Evidence from China. Finance Research Letters, 39: 101558. https://doi.org/10.1016/j.frl.2020.101558

[18]   Thakor, A.V. (2020). Fintech and banking: What do we know? Journal of Financial Intermediation, 41: 100833. https://doi.org/10.1016/j.jfi.2019.100833

[19]   Chaudhuri, S., Arora, R., Roy, P. (2020). Work-life balance policies and organisational outcomes - A review of literature from the Indian context. Industrial and Commercial Training, 52(3): 155-170. https://doi.org/10.1108/ict-01-2019-0003

[20]   Duan, P., Cao, Y., Wang, Y., Yin, P. (2021). Bibliometric analysis of coastal and marine tourism research from 1990 to 2020. Journal of Coastal Research, 38(1). https://doi.org/10.2112/jcoastres-d-20-00171.1

[21]   Khare, A., Jain, R. (2022). Mapping the conceptual and intellectual structure of the consumer vulnerability field: A bibliometric analysis. Journal of Business Research, 150: 567-584. https://doi.org/10.1016/j.jbusres.2022.06.039

[22]   Mühl, D.D., de Oliveira, L. (2022). A bibliometric and thematic approach to agriculture 4.0. Heliyon, 8(5): e09369. https://doi.org/10.1016/j.heliyon.2022.e09369

[23]   Haddaway, N.R., Page, M.J., Pritchard, C.C., McGuinness, L.A. (2022). PRISMA2020: An R package and Shiny app for producing PRISMA 2020-compliant flow diagrams, with interactivity for optimised digital transparency and open synthesis. Campbell Systematic Reviews, 18(2): e1230. https://doi.org/10.1002/cl2.1230

[24]   Huang, J., Chai, J., Cho, S. (2020). Deep learning in finance and banking: A literature review and

classification. Frontiers of Business Research in China, 14: 13. https://doi.org/10.1186/s11782-020-00082-6

[25] Loureiro, S.M.C., Guerreiro, J., Tussyadiah, I. (2021). Artificial intelligence in business: State of the art and future research agenda. Journal of Business Research, 129: 911-926. https://doi.org/10.1016/j.jbusres.2020.11.001

[26] Moher, D., Liberati, A., Tetzlaff, J., Altman, D.G. (2009). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. Annals of Internal Medicine, 151(4): 264-269. https://doi.org/10.7326/0003-4819-151-4-200908180-00135

[27] Macpherson, A., Holt, R. (2007). Knowledge, learning and small firm growth: A systematic review of the evidence. Research Policy, 36(2): 172-192. https://doi.org/10.1016/j.respol.2006.10.001

[28] Schueffel, P. (2017). Taming the beast: A scientific definition of Fintech. Journal of Innovation Management, 4(4): 32-54. https://doi.org/10.24840/2183-0606_004.004_0004

[29] Eyal, I. (2017). Blockchain technology: Transforming libertarian cryptocurrency dreams to finance and banking realities. Computer, 50(9): 38-49. https://doi.org/10.1109/mc.2017.3571042

[30] Kou, G., Olgu Akdeniz, Ö., Dincer, H., Yüksel, S. (2021). Fintech investments in European banks: A hybrid IT2 fuzzy multidimensional decision-making approach. Financial Innovation, 7: 39. https://doi.org/10.1186/s40854-021-00256-y

[31] Jagtiani, J., Lemieux, C. (2018). Do fintech lenders penetrate areas that are underserved by traditional banks? Journal of Economics and Business, 100: 43-54. https://doi.org/10.1016/j.jeconbus.2018.03.001

[32] Mao, X.B., Wu, M., Dong, J.Y., Wan, S.P., Jin, Z. (2019). A new method for probabilistic linguistic multi-attribute group decision making: Application to the selection of financial technologies. Applied Soft Computing, 77: 155-175. https://doi.org/10.1016/j.asoc.2019.01.009

[33] Lee, C.C., Li, X., Yu, C.H., Zhao, J. (2021). Does fintech innovation improve bank efficiency? Evidence from China's banking industry. International Review of Economics & Finance, 74: 468-483. https://doi.org/10.1016/j.iref.2021.03.009

[34] Baxter, P., Jack, S. (2015). Qualitative case study methodology: Study design and implementation for novice researchers. The Qualitative Report. https://doi.org/10.46743/2160-3715/2008.1573

[35] Brown, A.P. (2010). Qualitative method and compromise in applied social research. Qualitative Research, 10(2): 229-248. https://doi.org/10.1177/1468794109356743

[36] Nikkel, B. (2020). Fintech forensics: Criminal investigation and digital evidence in financial technologies. Forensic Science International: Digital Investigation, 33: 200908. https://doi.org/10.1016/j.fsidi.2020.200908

[37] Inal Glebova, E., Mihaľová, P. (2023). New currencies and new values in professional sports: Blockchain, NFT, and fintech through the stakeholder approach. Journal of Physical Education and Sport, 23(5): 1244-1252. https://doi.org/10.7752/jpes.2023.05153

[38] Nasir, A., Shaukat, K., Iqbal Khan, K., A. Hameed, I., Alam, T., Luo, S. (2021). Trends and directions of financial technology (Fintech) in society and environment: A bibliometric study. Applied Sciences, 11(21): 10353. https://doi.org/10.3390/app112110353

[39] Omarova, S.T. (2020). Technology v technocracy: Fintech as a regulatory challenge. Journal of Financial Regulation, 6(1): 75-124. https://doi.org/10.1093/jfr/fjaa004

[40] Bellardini, L., Del Gaudio, B.L., Previtali, D., Verdoliva, V. (2022). How do banks invest in fintechs? Evidence from advanced economies. Journal of International Financial Markets, Institutions and Money, 77: 101498. https://doi.org/10.1016/j.intfin.2021.101498

[41] Carlini, F., Del Gaudio, B.L., Porzio, C., Previtali, D. (2022). Banks, FinTech and stock returns. Finance Research Letters, 45: 102252. https://doi.org/10.1016/j.frl.2021.102252

[42] Lv, P., Xiong, H. (2022). Can FinTech improve corporate investment efficiency? Evidence from China. Research in International Business and Finance, 60: 101571. https://doi.org/10.1016/j.ribaf.2021.101571

[43] Langley, P., Leyshon, A. (2020). The platform political economy of FinTech: Reintermediation, consolidation and capitalisation. New Political Economy, 26(3): 376-388. https://doi.org/10.1080/13563467.2020.1766432

[44] Abbasi, K., Alam, A., Du, M., Huynh, T.L.D. (2021). FinTech, SME efficiency and national culture: Evidence from OECD countries. Technological Forecasting and Social Change, 163: 120454. https://doi.org/10.1016/j.techfore.2020.120454

[45] Muhammad, S., Pan, Y., Magazzino, C., Luo, Y., Waqas, M. (2022). The fourth industrial revolution and environmental efficiency: The role of fintech industry. Journal of Cleaner Production, 381: 135196. https://doi.org/10.1016/j.jclepro.2022.135196

[46] Wu, Y.H., Bai, L., Chen, X. (2022). How does the development of fintech affect financial efficiency? Evidence from China. Economic Research-Ekonomska Istraživanja, 36(2). https://doi.org/10.1080/1331677x.2022.2106278

[47] Stewart, H., Jürjens, J. (2018). Data security and consumer trust in FinTech innovation in Germany. Information & Computer Security, 26(1): 109-128. https://doi.org/10.1108/ics-06-2017-0039

[48] Thomas, N.M. (2023). Modeling key enablers influencing FinTechs offering SME credit services: A multi-stakeholder perspective. Electronic Markets, 33(1). https://doi.org/10.1007/s12525-023-00627-6

[49] Werth, O., Cardona, D.R., Torno, A., Breitner, M.H., Muntermann, J. (2023). What determines FinTech success? A taxonomy-based analysis of FinTech success factors. Electronic Markets, 33: 18. https://doi.org/10.1007/s12525-023-00626-7

[50] Husainah, N., Paulina, J., Misrofingah, M., Pradipta, I.A., Maulana, A.E., Fahlevi, M. (2023). Detercmining factors of digital wallet actual usage: A new model to identify changes in consumer behavior. International Journal of Data and Network Science, 7(2): 933-940. https://doi.org/10.5267/j.ijdns.2022.12.017

[51] Garg, N. (2017). Workplace spirituality and organizational performance in Indian context: Mediating effect of organizational commitment, work motivation and employee engagement. South Asian Journal of Human Resources Management, 4(2): 191-211. https://doi.org/10.1177/2322093717736134

[52] Akhtar, T. (2023). Blockchain technology: The beginning of a new era in reforming corporate governance mechanisms. Journal of the Knowledge Economy, 15(1): 3059-3084. https://doi.org/10.1007/s13132-023-01289-7

[53] Saksonova, S., Kuzmina-Merlino, I. (2017). Fintech as financial innovation - The possibilities and problems of implementation. European Research Studies Journal, XX(3A): 961-973. https://doi.org/10.35808/ersj/757

[54] Li, Y., Spigt, R., Swinkels, L. (2017). The impact of FinTech start-ups on incumbent retail banks' share prices. Financial Innovation, 3: 26. https://doi.org/10.1186/s40854-017-0076-7

[55] Sangwan, V., Harshita, H., Prakash, P., Singh, S. (2019). Financial technology: A review of extant literature. Studies in Economics and Finance, 37(1): 71-88. https://doi.org/10.1108/sef-07-2019-0270

[56] Jaksič, M., Marinč, M. (2018). Relationship banking and information technology: The role of artificial intelligence and FinTech. Risk Management, 21(1): 1-18. https://doi.org/10.1057/s41283-018-0039-y

[57] Jung, H.S., Kim, K.H., Lee, C.H. (2014). Influences of perceived product innovation upon usage behavior for MMORPG: Product capability, technology capability, and user centered design. Journal of Business Research, 67(10): 2171-2178. https://doi.org/10.1016/j.jbusres.2014.04.027

[58] Bondarouk, T.V., Ruël, H.J.M. (2009). Electronic human resource management: Challenges in the digital era. The International Journal of Human Resource Management, 20(3): 505-514. https://doi.org/10.1080/09585190802707235

[59] Cannavacciuolo, L., Capaldo, G., Ponsiglione, C. (2023). Digital innovation and organizational changes in the healthcare sector: Multiple case studies of telemedicine project implementation. Technovation, 120: 102550. https://doi.org/10.1016/j.technovation.2022.102550

[60] Aulia, F., Adviorika U, C., Yuniarty, Fahlevi, M., Prabowo, H., Muchardie, B.G. (2021). Analysis of chatbot program features towards customer satisfaction in the era of digitalization. In 2021 International Conference on Information Management and Technology (ICIMTech), Jakarta, Indonesia, pp. 604-607. https://doi.org/10.1109/icimtech53080.2021.9535034

[61] Alalwan, A.A., Dwivedi, Y.K., Rana, N.P.P., Williams, M.D. (2016). Consumer adoption of mobile banking in Jordan. Journal of Enterprise Information Management, 29(1): 118-139. https://doi.org/10.1108/jeim-04-2015-0035

[62] Anand, D., Mantrala, M. (2019). Responding to disruptive business model innovations: The case of traditional banks facing fintech entrants. Journal of Banking and Financial Technology, 3(1): 19-31. https://doi.org/10.1007/s42786-018-00004-4

[63] Das, S.R. (2019). The future of fintech. Financial Management, 48(4): 981-1007. https://doi.org/10.1111/fima.12297

[64] Vives, X. (2019). Digital disruption in banking. Annual Review of Financial Economics, 11(1): 243-272. https://doi.org/10.1146/annurev-financial-100719-120854

[65] Toumi, A., Najaf, K., Dhiaf, M.M., Li, N.S., Kanagasabapathy, S. (2023). The role of Fintech firms' sustainability during the COVID-19 period. Environmental Science and Pollution Research, 30(20): 58855-58865. https://doi.org/10.1007/s11356-023-26530-3