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Exploring the Nexus Between Digital Financial Inclusion and Financial Stability: A Systematic Review of the Literature

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ABSTRACT

The rapid pace of technological advancement has driven the widespread adoption of digital infrastructure in the financial sector, significantly promoting digital financial inclusion. In pursuit of the Sustainable Development Goals, digital infrastructure is bridging financial gaps for marginalised communities. Nevertheless, concerns arise across the globe regarding potential challenges accompanying financial service digitilisation. This systematic review comprehensively examines the relationship between digital financial inclusion and financial stability by synthesizing existing research findings. The current research employed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses framework for accessing articles from Scopus databases. Inclusion criteria comprised peer-reviewed articles published in English between 2017 and 2024 inclusive. The literature survey findings indicated that 41.4% of studies reported negative effects of digital financial inclusion on financial stability, while 17.9% yielded mixed results. Although digital financial technology has been instrumental in promoting digital financial inclusion, majority of studies reviewed highlight potential negative implications for financial stability. The study reveals regulatory framework challenges, severe competition in the financial sector, systemic and cybersecurity vulnerabilities and financial literacy gaps as significant challenges arising from digital financial inclusion. Although digital financial inclusion significantly contributes to the economy, its effectiveness hinges on addressing regulatory, security and literacy concerns. In line with the above findings and conclusions, this study recommends the strengthening of the regulatory frameworks to safeguard financial stability. Policymakers, financial institutions and stakeholders should prioritize digital financial inclusion while establishing robust regulatory frameworks that balance expansion with effective risk management.

1. Introduction

The 21st century has witnessed a seismic shift in the global financial landscape, driven by the unprecedented growth of digital financial technologies. Digital financial inclusion (DFI) emerged from leveraging digital financial technologies (DFT) and internet connectivity to deliver financial products and services to previously unbanked populations (Gallego-Losada et al., 2023). DFI involves using cost-

effective digital channels to provide formal financial services tailored to the needs of financially excluded and underserved populations (Ozili, 2019). Financial inclusion (FI) has emerged as a vital component of achieving some of the United Nations' Sustainable Development Goals (SDGs). DFI represents the fourth phase of the financial revolution, building on the foundations of microcredit, microfinance and FI (Wang & Fu, 2022). FI is fundamental to economic development, empowering individuals and small businesses to access financial services, mitigate risks, and integrate into the formal economy.

The concept of digital access to finance gained significant traction following the groundbreaking success of M-PESA, a pioneering payment technology innovation launched in Kenya in 2007 (Beck et al., 2018; Wang & Fu, 2022). M-PESA's revolutionary mobile-based financial services model demonstrated the potential of digital finance to transform the lives of millions, particularly in underserved communities. Compared to FI, the paradigm shift to DFI emphasizes the utilization of technology to broaden access to conventional financial services, surpassing the limitations of traditional FI (Tay et al., 2022). At the forefront of this revolution are mobile money and digital payment systems, such as M-Pesa and PayPal, which facilitate real-time transactions and instant access to financial services (Ndung'u, 2021). The widespread adoption of the internet and smartphones has been instrumental in driving this transformation. On the supply side, new financial products and services have emerged, leveraging innovative delivery channels such as agent banking. Fintech innovations, such as peer-to-peer lending and crowdfunding, have increased access to financial services for underserved communities (Alamoodi & Selamat, 2021; Hasan et al., 2024; Mashizha et al., 2024). Additionally, blockchain technology and cryptocurrency enhance financial transactions by fostering transparency, security, and efficiency (Javaid et al., 2022; Almadadha, 2024; Philip & Babajide, 2024).

Globally, around 1.4 billion adults remain without access to formal financial services (Lucciana & Edoardo, 2022). The World Bank (2025) identifies the unbanked population as predominantly comprising women, low-income individuals, those with limited educational attainment, and rural dwellers, who are often the hardest to reach. Through DFT, underserved populations are gaining unprecedented access to financial services, experiencing improved efficiency, lower costs, enhanced financial knowledge, and newfound economic opportunities (Mpofu & Mhlanga, 2022). A collaborative effort between governments, private employers, financial service providers and fintech companies is essential to remove obstacles and enhance physical, data and digital financial infrastructure, promoting inclusive financial access (Lutfi et al., 2021). The high penetration rate of mobile phones and social media offers a strategic platform for tackling financial exclusion, enhancing financial access, and promoting economic empowerment (Tay et al., 2022). Ozili (2018) highlights that digital finance allows individuals to access payment, savings, and credit facilities affordably online, without requiring physical bank visits. Globally, mobile payment systems present a significant opportunity for countries to achieve economic development and financial stability through inclusive financial systems.

However, as DFI continues to gain momentum, concerns about its impact on financial stability (FS) have begun to emerge. Despite the growing significance of digital finance, the interplay between these two concepts remains poorly understood, largely due to the limited availability of research and data (Demirguc-Kunt et al., 2017). Some scholars (Grohmann & Menkhoff, 2017; Aziz & Naima, 2021) warn that DFI may also introduce risks, including systemic instability, regulatory challenges, cybersecurity threats and financial exclusion. The intersection of DFI and FS has sparked intense debate among experts, yielding mixed feelings regarding the potential consequences of this rapidly evolving phenomenon. On one hand, proponents (Ajemunigbohun & Azeez, 2024) argue that DFI enhances FS by expanding access to formal financial services, increasing financial literacy and awareness, and improving risk management through data-driven decision-making. However, skeptics raise concerns that DFI may compromise FS. This disparity arises from the intricate relationship between digital finance and FS. Without clear insights into the relationship between DFI and FS, policymakers and regulators face challenges in designing effective frameworks to mitigate potential risks. To gain an understanding of the nexus between DFI and FS, this study critically reviews and synthesizes the literature to explore the implications of DFI on FS. The research paper sought to answer the following research question: What are the impacts of DFI on FS?

2. Literature Review

This section presents a comprehensive review of theoretical and empirical literature, providing an in-depth examination of the public good theory and relevant empirical studies. By analyzing empirical evidence, agreements and contradictions are identified, revealing research gaps. The theoretical framework serves as a lens to contextualize and understand the study's findings.

2.1 Financial Inclusion

According to the World Bank (2025), 'FI involves the delivery of these services in a responsible and sustainable manner'. This concept has garnered great attention from policymakers and academics due to its multifaceted benefits. There are four primary reasons why FI has become a focal point. Firstly, it is considered a key strategy for achieving the United Nation's SDGs (Demirguc-Kunt et al., 2017). Through providing access to financial services, individuals and businesses can contribute to economic growth and development, ultimately supporting the realization of these goals. Secondly, FI plays a crucial role in enhancing social inclusion (Hasan, Dowla & Tarannum, 2024). By connecting the financially included and excluded, it fosters equal opportunities and social unity, potentially resulting in a more balanced allocation of resources and opportunities. A study by Emezie (2021) revealed that increased FI is positively related to deposit mobilization. Thirdly, Neaime and Gaysset (2018) revealed that FI is instrumental in reducing poverty levels as households are in a better position to borrow money and support their income generating projects. FI also brings numerous socioeconomic advantages (Ifediora et al., 2022) and these benefits can include improved economic growth, increased FS and enhanced economic opportunities. Through promoting FI, governments and policymakers can create a more conducive environment for economic development and social progress.

2.2 Financial Stability

Federal Reserve Bank (2021) defined FS as the ability of a financial system to perform its essential functions without disruption, ensuring the smooth flow of resources and minimizing risks. This involves a well-functioning financial infrastructure, stable markets and the ability to withstand shocks. A stable financial system comprises several key components, including well-functioning financial safety nets, payment systems and market infrastructure. These elements work together to ensure smooth operations and prevent systemic risks that could destabilize the financial system. The World Bank (2025) emphasizes that a stable financial system plays a crucial role in allocating resources efficiently, managing financial risks, and supporting employment levels that align with the economy's potential. A stable financial system prevents significant fluctuations in asset prices that could disrupt monetary stability or impact employment. The IMF (2004) stated that a stable financial system should support economic performance and absorb financial shocks, whether caused by internal factors or unexpected external events.

2.3 Public good theory

Paul Samuelson is often recognized for developing the modern theory of public goods through mathematical framework, building upon the earlier contributions of Wicksell and Lindahl (Eecke, 1999). This theory posits that access to formal financial services is a public good, warranting universal provision for the collective benefit (Ozili, 2020). Financial access is a fundamental right that should be universally available, without restrictions. The public good theory of FI underscores the importance of recognizing FI as a collective responsibility, essential for social and economic well-being (Ozili, 2020). As a public good, conventional financial services exhibit non-rivalry and non-excludability, meaning that one individual's access does not diminish availability for others. This perspective asserts that FI benefits all individuals, regardless of socioeconomic income level, status or demographic differences. According to Ozili (2020), the universality of FI ensures that everyone can participate in the conventional financial sector, ultimately leading to inclusive economic growth and social cohesion. The public good theory is pertinent to this study as it underscores the importance of universal access to financial services, aligning with the objectives of DFI proponents. Through investigating the impact of digital financial systems on the underserved, this study explores the nexus between expanding financial access and FS, thereby contributing to the discourse on the role of DFI in promoting broader economic benefits

2.4 Empirical Review

Siddik and Kabiraj (2018) carried out a study in order to examine the link between FI and FS, using metrics like SME borrower ratios and non-performing loan rates and found that greater FI correlates with enhanced FS. Further supporting this notion, Han and Melecky (2013) posit that FI is intricately linked to FS due to its ability to provide a more diversified funding base for financial institutions. By increasing deposits from a wide array of sources, FI enhances the resilience of these institutions to economic shocks, thereby promoting stability. Morgan and Pontines (2014) further argue that FI enhances savings intermediation, thereby shrinking the informal economy. This reduction benefits the overall stability of the financial system by bringing more economic activities under formal supervision and regulation. In addition to these benefits, García and José (2016) highlight another critical aspect of FI in relation to FS. They contend that FI enables better monitoring and enforcement of laws against money laundering and terrorism financing, thereby safeguarding the financial system's integrity and stability by preventing illicit activities.

Oanh et al (2023) examined the link between FI and FS using principal component analysis, and surprisingly found a negative relationship, contrary to expectations. However, a more nuanced understanding emerges from Oanh and Dinh's (2024) examination of digital FI and FS. Using quantile wavelet analysis and regression, they found that DFI positively impacts FS under normal circumstances but turns negative during global financial crises. Han and Melecky (2013) suggest that greater FI enhances FS by broadening banks' deposit bases. Dinh (2024) also found that increased access to financial services promotes economic growth and reduces gender inequality. Conversely, Ozili (2024) concluded that FI can contribute to financial crises, based on an analysis of 28 countries.

Research by Feghali et al (2021) sheds light on the potential risks associated with excessive credit expansion or inclusive credit. Their research shows that unchecked credit growth, particularly when lenders disregard borrowers' repayment capacity, can threaten FS. Similarly, Oanh and Dinh (2024) found that Vietnam's rapid digital financial expansion during the global economic crisis contributed to financial instability. These findings suggest that unmanaged DFI growth can lead to financial crises, especially in vulnerable financial systems where risks may be exacerbated.

The relationship between DFI and FS remains a contentious issue among scholars, with differing opinions on its impact. Some researchers (Han & Melecky, 2013; Morgan & Pontines, 2014; Siddik & Kabiraj, 2018) argue that DFI has a positive effect on FS, while others (Feghali et al., 2021; Oanh & Dinh, 2024) contend that it has a negative relationship. Given these conflicting findings, this research aims to contribute to the ongoing debate by conducting a systematic review of existing literature, providing a comprehensive analysis of the current state of knowledge on this topic.

3. Methodology

3.1 Research design

This research employed PRISMA methodology to guide the comprehensive search and selection of articles informing this manuscript. PRISMA's primary objective is to enhance the transparency and quality of systematic reviews and meta-analyses. To ensure rigor and consistency, this study adhered to the University of North Carolina's ten-step framework for conducting PRISMA systematic reviews. This structured approach comprises the following stages: (1) preparation; (2) doing a database search; (3) removing all duplicates; (4) records screening (title/abstract Screening); (5) identifying records excluded (title/abstract screening); (6) identifying reports sought for retrieval; (7) identifying reports not retrieved; (8) assessing reports for eligibility; (9) identifying reports for exclusion and (10) identifying reports to be included in the studies.

3.2 Search strategy

To conduct a comprehensive literature search, this study employed a strategic search approach utilizing the search terms were carefully crafted and combined in the following configuration: *TITLE-ABS-KEY ("Digital Financial Inclusion" OR "Digital Technology" OR "Digital Economy" OR "FinTech" OR "Digitalisation" OR "Blockchain" OR "Crypto Currencies" OR "Artificial Intelligence") AND ("Financial Stability" OR "Bank Stability").* A comprehensive literature search was conducted in the Scopus database, covering publications from 2017 to 2024. This study concentrates on literature from 2017 to 2024, a period marked by the rapid emergence of the Fourth Industrial Revolution and the widespread adoption of digital finance by financial institutions. The search terms were meticulously examined within study texts, titles, keywords, and abstracts.

3.3 Inclusion and exclusion criteria

After conducting a comprehensive search of the Scopus database, the researchers undertook a rigorous filtering process to refine the initial pool of articles. The first step involved eliminating duplicates to ensure uniqueness and avoid bias. After removing duplicates, a meticulous screening exercise was conducted, where researchers scrutinized paper titles and abstracts to determine their relevance to the study. This initial assessment enabled the researchers to gauge the potential value of each article. The screening process was further refined by focusing on specific subject areas. Articles falling under Economics, Econometrics and Finance, Business Management and Accounting, and Social Sciences were deemed relevant and included. Conversely, articles outside these subject areas were systematically filtered out. To maintain methodological consistency, the researchers exclusively considered empirical research papers, which provided firsthand insights from primary research. Conference papers, book chapters and other non-peer-reviewed publications were excluded to ensure the highest standards of academic rigor. The language criterion was also crucial, with only English-language articles considered, as it was the sole language comprehensible to the researchers. This ensured that the analysis was unbiased and based on a uniform understanding of the content. This systematic filtering process yielded a refined dataset, tailored to the study's objectives and scope. By focusing on empirical research papers within specific subject areas and languages, the researchers established a robust foundation for analysing the complex relationships between DFI and FS. This meticulous approach ensured that the final dataset consisted of high-quality, relevant studies, providing a reliable basis for drawing meaningful conclusions.

3.4 Data extraction

The data extraction process commenced with the seamless export of research articles from the Scopus database to a Microsoft Excel sheet via a CSV file. This efficient transfer ensured that all relevant data was captured and organized for further analysis. To guarantee that the extracted data aligned with the research objectives, a rigorous screening process was initiated. This meticulous exercise involved thoroughly reading each article's abstract to assess its relevance to the study. To maintain objectivity and minimize bias, the researchers conducted this screening process independently. A systematic coding system was employed to categorize the articles. Research papers that directly addressed the study's objectives were assigned a code of "1," indicating acceptance, while those that failed to meet the criteria were coded with a "0" and "2" was assigned for those articles the authors needed a second look. This clear distinction enabled the researchers to distinguish between accepted and rejected studies. Following the independent coding process, the researchers convened to share notes and discuss the rationale behind rejecting certain papers. This collaborative review ensured that the exclusion criteria were consistently applied and provided an opportunity to address any potential discrepancies or ambiguities. Through this transparent and systematic screening process, the researchers ensured that the final dataset consisted of high-quality studies that directly addressed the research questions.

3.5 Data reliability

Upon completing the independent screening process, the researchers assessed inter-rater reliability by calculating the Cohen's Kappa coefficient. This metric assesses inter-rater reliability, measuring agreement between two raters while accounting for chance. Cohen's Kappa coefficient provides a quantitative indicator of reliability, ranging from -1 (perfect disagreement) to 1 (perfect agreement), with values above 0.6

generally indicating substantial agreement (Li et al., 2023). The interpretation of Cohen's Kappa coefficient in this study was guided by the framework established by Bernet et al (2019). According to this framework, the level of agreement is categorized as follows: coefficients below 0.2 indicate poor agreement, those ranging from 0.2 to 0.4 suggest fair agreement, values between 0.41 and 0.6 represent moderate agreement, coefficients from 0.61 to 0.8 signify substantial agreement, and values exceeding 0.8 reflect great or very good agreement. Notably, the calculated Kappa coefficient for this study was 0.892, surpassing the threshold for almost perfect agreement. This exceptionally high coefficient indicates a remarkable consistency and reliability in the researchers' independent assessments. The achievement of such a high Kappa coefficient underscores the rigorous and systematic approach employed in the screening process.

4. Findings and Analysis

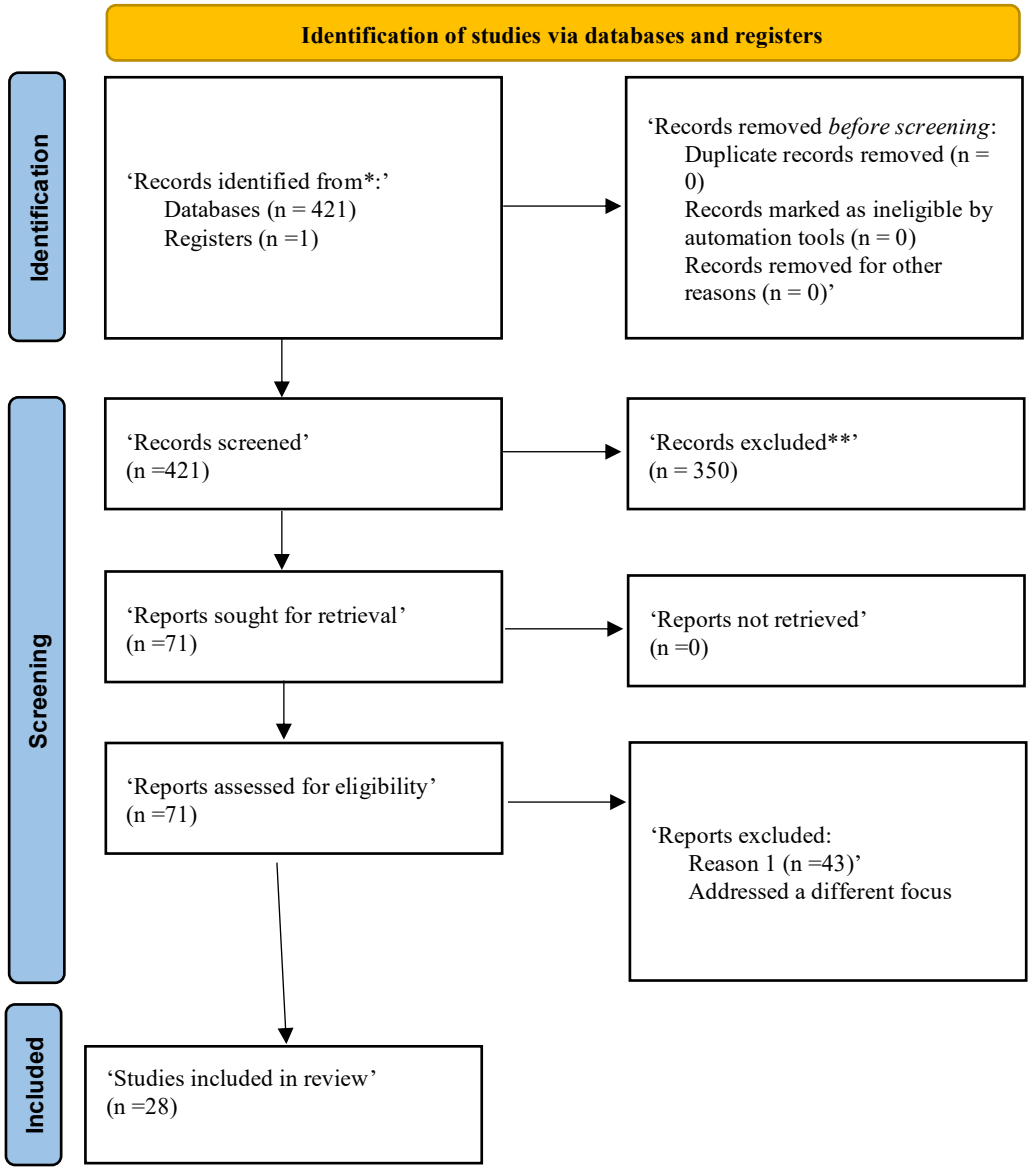

Figure 1: The PRISMA process adopted in screening literature for analysis

As shown in the PRISMA flowchart, the initial search query yielded a substantial pool of 421 research documents from the Scopus database. To refine this corpus, the researchers employed a multi-stage filtering

process. Firstly, a temporal filter was applied, limiting the documents to those published between 2017 and 2024, inclusive. This resulted in the exclusion of 10 documents. This was followed by a subject-based filter narrowing the focus to relevant fields, which reduced the pool to 304 documents. To ensure methodological rigor, the researchers then filtered the documents to include only empirical research papers, yielding 203 articles. A keyword filtering process was subsequently conducted, utilizing 15 pertinent terms, including "financial stability", "fintech", "financial inclusion", "blockchain'', "financial technology", "digitilisation", "artificial intelligence", "digital finance", "financial crisis", "digital technologies", "digital economy", "banking stability", "machine learning", "crypto currencies", "cyber risk." This step winnowed the pool to 144 articles. Further refinement occurred through language filtering, resulting in 135 documents remaining. To facilitate accessibility and transparency, the researchers then applied an open-access filter, which reduced the pool to 71 articles. The final screening stage involved a meticulous review of abstracts, leading to the rejection of 43 articles. Ultimately, 28 articles remained, forming the foundation of the current study. Through this systematic and iterative filtering process, the researchers ensured the inclusion of only the most relevant, rigorous, and accessible studies, providing a robust evidence base for exploring the complex relationships between DFI and FS.

4.1 Publications by year

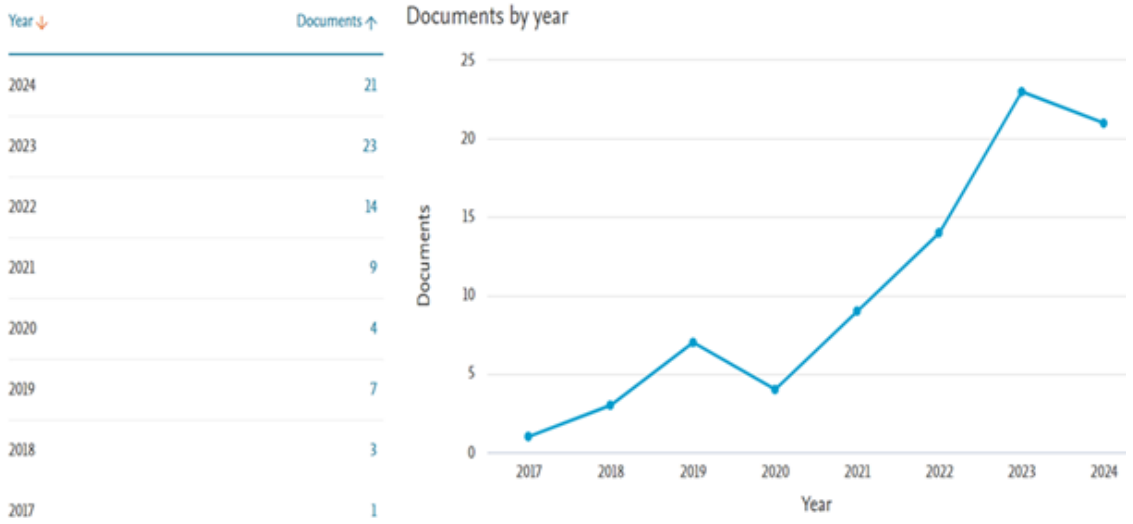

Figure 2: Documents published by year

Figure 2 illustrates the upward trend in academic publications focusing on DFI and Fs. A closer examination of the graph reveals an accelerating growth rate in the number of articles published over the years. The data indicates a significant spike in 2023, with a record 21 articles published, marking the highest annual total. Conversely, 2017 recorded the lowest number of publications. This striking contrast underscores the burgeoning interest in DFI and FS within the academic community. The escalating attention devoted to this subject can be attributed, in part, to the profound impact of the Fourth Industrial Revolution on various aspects of life. As digital technologies continue to reshape the financial landscape, academics are increasingly drawn to exploring the complex relationships between DFI and FS. Notably, the publication trend exhibits a marked increase from 2020 onward, suggesting a surge in scholarly interest. The accelerating pace of research in this area underscores the expanding awareness of DFI's potential to transform financial systems. As the academic community continues to probe the intricacies of this relationship, the body of knowledge will likely continue to grow, informing policy decisions and shaping the future of financial stability.

4.2 Documents by country or territory

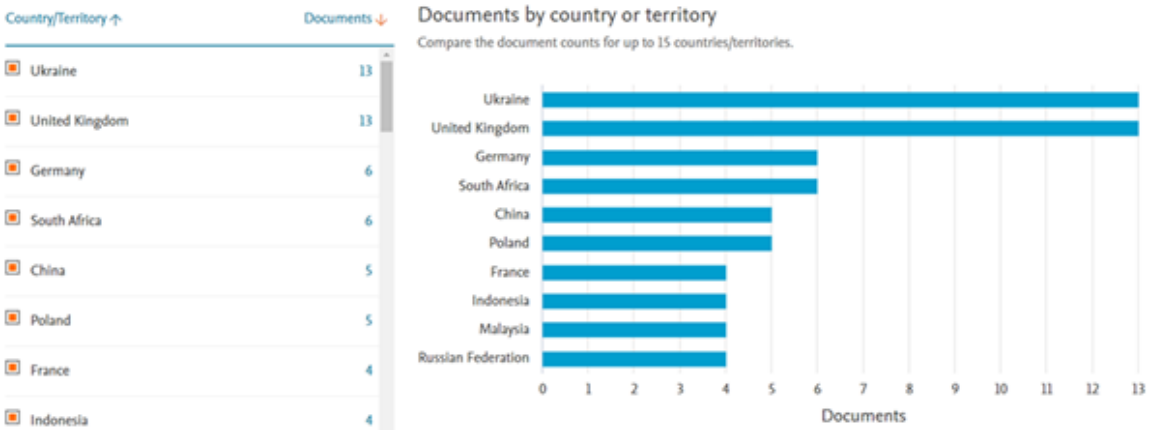

Figure 3: Documents by country or territory

Figure 3 presents a compelling visual representation of the global research landscape surrounding DFI and FS. The bar graph reveals that Ukraine and the United Kingdom are at the forefront of publishing documents on this subject, indicating their prominent positions in advancing knowledge in this field. Notably, South Africa emerges as the sole African representative on the graph, highlighting its significant contribution to the regional discourse on DFI and FS. In Asia, Indonesia, Malaysia and China are spearheading research efforts, demonstrating their great contribution on this critical area. A closer examination of the graph reveals that European Union (EU) countries dominate the list of top researchers, underscoring their leadership in exploring the intersections between DFI and FS. This concentration of research activity in EU nations is hardly surprising, given their robust economies and well-established financial sectors. A striking correlation emerges between the countries leading in research on DFI and their economic performance. The nations prominently featured in Figure 3, such as the United Kingdom, Ukraine and EU member states, boast thriving economies and are at the vanguard of the financial service's digital revolution. The geographic distribution of research activity highlights the interconnectedness between economic development, financial sector advancement and investment in DFI research.

4.3 Documents by Affiliation

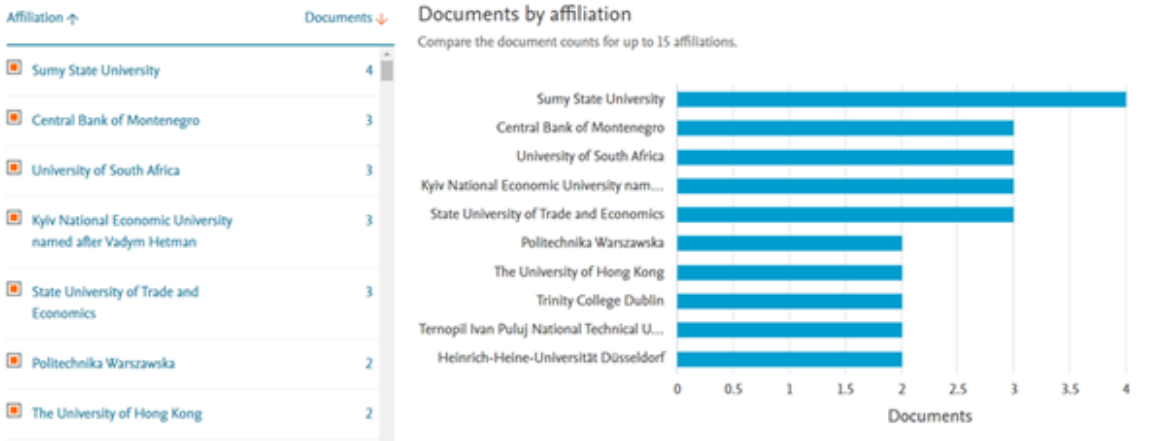

Figure 4: Documents by Affiliation

Figure 4 presents a ranking of institutions by their publication output on DFI and FS. A clear leader emerges, with Sumy State University surpassing its peers in terms of research output. A cluster of institutions, Central Bank of Montenegro, University of South Africa, Kyiv National Economic University

and State University of Trade and Economics share the second position, having produced an equal number of publications.

Table 1: Data extraction instrument

Authors, Date	Aims/Purpose	Citations	Key findings
Chernyakov M.; Usacheva O.; Chernyakova M. (2021).	To map the evolution of fintech (excluding cryptocurrencies) and evaluate its effects on FS	03	Fintech instruments collectively have an insignificant impact on FS.
Fernandes C.; Borges M.R.; Macome E.; Caiado J. (2024)	To investigate the link between FI and monetary stability in Mozambique.	02	Both traditional and DFI contribute to price stability, which supports monetary stability.
Chaudhry S.M.; Ahmed R.; Huynh T.L.D.; Benjasak C. (2022)	To assess the extreme risk and systemic risk posed by technology companies.	52	Technology firms pose greater tail risk than financial firms, potentially triggering systemic risks in finance.
Hordofa D.F. (2024).	To examine how digital finance adoption affects banking sector stability in Ethiopia.	0	The findings show complex dynamics, where integrating digital finance with traditional banking and informal financial activities may counterbalance benefits like increased inclusion and efficiency.
Sadiq M.; Aysan A.F.; Kayani U.N. (2023).	To investigate the impact of blockchain and digital currency on credit supply and FS.	05	Since DFI boosts credit supply and FS, central banks should consider adopting digital currencies and blockchain-based payment systems.
Ismanto H.; Wibowo P.A.; Shofwatin T.D. (2023).	To study how banking stability and fintech influence credit performance and access for MSMEs.	02	Fintech-driven FI improves MSMEs' credit performance, increases their access to credit, and lowers non-performing loans.
Li J.; Li J.; Zhu X.; Yao Y.; Casu B. (2020).	To investigate risk transmission between FinTech companies and traditional financial institutions amid rapid technological change.	123	Risk spillover from FinTech institutions to financial institutions is associated with increased systemic risk in the financial sector.
Hua X.; Huang Y. (2021).	To explore its causes, current status, economic effects, and potential risks.	73	Fintech promotes efficiency and FI, but also heightens cyber risk exposure.
Koranteng B.; You K. (2024).	To investigate Fintech's impact on FS in 25 countries from 2013 to 2020.	05	Fintech financing supports FS both domestically and internationally.
Bozhenko V.; Boyko A.; Vondráček M.; Karácsony P. (2024).	To examine the links between the shadow economy, financial stability, and digital finance.	0	Ukraine's digital finance development and financial strength are currently robust enough to substantially reduce shadow economic activities.
Uddin M.H.; Mollah S.; Ali M.H. (2020).	To investigates how disruptive digital transformation affects bank stability	34	Investment in digital finance affects positively and negatively bank stability
Arner D.W.; Zetzsche D.A.; Buckley R.P.; Barberis J.N. (2019).	To investigate role of identity in protecting against fraud and crime	52	Digital technology and finance presents an opportunity to solve identity problems in FI.
Asep Rismana, Bambang Mulyanaa, Bayu Anggara Silvatikab, Agus Sunarya Sulaeman. (2021)	To examine the impact of FinTech firms on bank FS.	16	Market risk can temper the effect of digital finance on FS, meaning higher systemic risk diminishes digital finance's stabilizing benefits.
Haddad C.; Hornuf L. (2023)	To investigate how fintech startups affect the performance and default risk of traditional financial institutions.	20	Fintech startup formations reduce stock return volatility and systemic risk exposure for established financial institutions.
Kuznetsova V.V.; Larina O.I. (2024).	To determine the effect of non-bank financial intermediation on the banking sector.	0	Fintech financial intermediation may pose systemic risks that can impact the entire financial sector
Cuadros-Solas P.J.; Cubillas E.; Salvador C.; Suárez N. (2024).	To investigate the impact of FinTech lending on the market power and stability of traditional banks.	02	FinTech lending volume erodes bank market power and stability

| Authors, Date | Aims/Purpose | Citations | Key findings |

Vučinić M.; Luburić R. (2022).	To examine recent developments in Fintech and outline its potential benefits and associated risks.	32	Cyber risk in Fintech poses a significant and emerging threat to DFI.
Alhakim A.; Tantimin. (2024)	To critically assess current regulatory frameworks and propose enhanced approaches to mitigate cryptocurrency-related money laundering risks.	01	cryptocurrency as legal tender could help combat money laundering, a major threat to FS and national security.
Kayani U.; Hasan F. (2024).	To investigate the impact of cryptocurrencies on financial markets and traditional banking systems.	05	DFI reshapes global financial markets, traditional banking systems, and regulatory frameworks.
Ozili P.K. (2018).	To explore digital finance and its implications for FI and stability.	823	While DFI offers benefits, its widespread adoption has also amplified cyber-attacks, threatening customer data security and privacy on digital platforms.
Banna H.; Kabir Hassan M.; Rashid M. (2021).	To examine if greater fintech-based FI increases banks' risk-taking behavior.	93	The findings show that greater fintech-based FI reduces bank risk-taking, but also intensifies competition
Vučinić M. (2020).	To presents potential implications of FinTech FI to FS	81	Fintech expands financial services but introduces new micro and macro financial risks to the financial system.
Syed A.A.; Grima S.; Sood K. (2024).	To conducts an interaction analysis to measure the impact of the fintech era on Indian banking stability	02	India's second fintech era outperformed the first, reducing non-performing loans and boosting financial stability.
Huibers F. (2021).	To assess the regulatory responses to digitilisation of financial services	04	Fintech lenders should mitigate over-indebtedness risk, enhance pricing transparency, and refine lending standards.
Mashamba T.; Gani S. (2023)	To investigate Fintech's impact on bank funding and economic growth in Sub-Saharan Africa, analyzing data from 56 banks in 19 countries from 2010 to 2020.	05	Fintech disruptions have boosted bank equity funding but had minimal impact on deposits and long-term debt financing.
Anton S.G.; Afloarei Nucu A.E. (2024)	To evaluate the impact of traditional and digital FI on banking stability.	0	FI initially destabilizes banking up to a point, but beyond that threshold, further inclusion enhances stability.
Alhares A.; Dahkan A.; Abu-Asi T. (2022).	To examine the impact of FinTech firms on bank FS.	0	The growth of FinTech firms enhances FI and bank stability over time.
Gąsiorkiewicz L.; Monkiewicz J.; Monkiewicz M. (2020)	To examine the effect of fintech on FS.	08	Digital finance introduces new risks to FS, economic systems, national security, and consumer welfare.

4.4. Impacts of DFI on FS

The analysis of existing literature on DFI reveals a complex and multifaceted relationship with FS. A significant proportion of studies, accounting for 41.4% (N=12), indicate that DFI has a negative impact on FS. This negative impact is concerning; as FS is a critical component of a healthy economy. Furthermore, 35.7% (N=10) of the studies suggest that DFI hinders FS, which contradicts the primary intention of DFI initiatives. However, the literature also presents mixed outcomes, with 17.9% (N=5) of studies indicating that DFI has both positive and negative effects on FS. This ambiguity highlights the need for further research to understand the nuances of DFI's impact. Interestingly, one study found an insignificant impact of DFI on FS, suggesting that DFI may not necessarily impact the financial sector. Overall, the existing literature suggests that DFI's relationship with FS is complex suggesting the need for further investigations. Research has consistently shown that DFI has numerous benefits for FS, credit supply, and economic growth.

Research by Sadiq et al. (2023) found that it boosts credit supply and FS, recommending central banks adopt digital currencies and blockchain. Similarly, Ismanto et al. (2023) showed that fintech-based inclusion improves credit access for MSMEs and reduces non-performing loans. In Ukraine, Bozhenko et al. (2024) found that DFI reduces shadow economy activities, potentially increasing tax revenue and

economic transparency. In India, Syed et al. (2020) noted that the second era of fintech-based inclusion reduced non-performing loans and enhanced FS. Collectively, these studies highlight DFI's positive impact on FS, credit supply, and economic growth.

Research has highlighted the potential risks and challenges associated with DFI. Specifically, three studies (Li et al., 2020; Chaudhry et al., 2022; Kuznetsova & Larina, 2024) reveal that DFI can lead to systemic risks, where risks faced by digital and fintech service providers are transmitted to financial institutions. Furthermore, Gąsiorkiewicz et al. (2020) note that DFI can trigger the emergence of various financial risks. While the specific risks identified by the authors are not explicitly stated, common financial risks associated with DFI include credit risk, operational risk, market risk, cybersecurity risk, regulatory risk, systemic risk, and fraud risk. Vučinić and Luburić (2022) found that DFI and fintech technologies can give rise to cybersecurity risks. These findings underscore the importance of acknowledging and addressing the potential risks associated with DFI, including systemic and cybersecurity risks, to ensure a stable and secure financial system. Alhakim and Tantimin (2024) discovered that combining DFI through investments in cryptocurrencies can expose individuals and institutions to serious money laundering threats. While cryptocurrencies offer innovative opportunities, they also pose significant risks, particularly in terms of money laundering. Characteristics of cryptocurrencies that facilitate money laundering include anonymity, decentralization, borderless transactions, lack of regulation, volatility, and the existence of mixing services and privacy coins (Albrecht et al., 2019). These features enable illicit actors to conceal the origins of funds, obscure transaction trails, and integrate cleaned funds into traditional financial systems. In support of Alhakim and Tantimin (2024), a study by Hordofa (2024) revealed that DFI can serve as a conduit for informal and illegal financial services, undermining regulatory efforts and posing risks to FS. These findings underscore the need for enhanced regulatory oversight, robust anti-money laundering measures, and vigilant monitoring to mitigate these risks and ensure the integrity of the financial system.

Among the articles which indicated the dual outcomes of DFI, Ozili (2018) noted that while DFI enhances FS through various benefits, it also gives rise to cyber-attacks. Similarly, Hua and Huang (2021) found that technology-based FI improves efficiency and FI, but simultaneously increases cybersecurity risks associated with fintech. Banna et al. (2021) also identified dual outcomes, where DFI controls bank risk-taking behavior, mitigating potential instability. Conversely, fintech-based FI fosters severe competition, potentially disrupting market dynamics. These studies underscore the complexities of DFI, highlighting the need for policymakers and regulators to strike a balance between harnessing benefits and mitigating risks. Vučinić (2020) discovered that fintech expands financial services, but also introduces additional micro and macro financial risks to the financial system. Contrastingly, Anton et al. (2024) found a nuanced relationship between DFI and banking stability. Their study revealed that DFI indices initially have a negative impact on FS up to a certain threshold. However, beyond this threshold, increased financial inclusiveness positively affects FS.

5. Discussion

5.1 Relationship between DFI and FS

5.1.1 Financial stability and economic sustainability

Studies on the interplay between DFI and financial sustainability has yielded mixed findings, sparking ongoing academic debate. However, a study by Banna and Alam (2021) reveals that DFI not only enhances banking stability but also fosters an integrated digital financial system, driving inclusive and sustainable economic growth. This, in turn, contributes to achieving financial sustainability and ultimately supports the realization of the SDGs by 2030. A growing body of research, including studies by Banna and Rabiul (2021), Parvin and Panakaje (2022) and Uddin et al (2020), underscores the significance of DFI in promoting socio-economic prosperity, sustainability, and FS. These findings are reinforced by Ozili's (2022) work on the potential of fintech and cryptocurrency to expand FI. Collectively, these studies demonstrate that DFI enhances socio-economic development, reduces costs, improves efficiency, and increases competitiveness. Uddin et al.'s (2020) study reveals that DFI has a dual impact on FS, enhancing it through technological advancements while also potentially destabilizing banks due to excessive spending

on disruptive cyber technology. Meanwhile, Arner et al (2019) highlight digital technology's potential to address identity-related FI challenges through digital identity infrastructure development. Similarly, Sadiq et al.'s (2023) research aligns with Uddin et al.'s (2020) findings, demonstrating DFI's positive effects on credit supply and FS. Sadiq et al (2023) contend that central banks should leverage digital currency and blockchain technology, integrating online payment strategies to enhance FI. This assertion is reinforced by Fernandes et al's (2024) research in Mozambique, which corroborates the findings of Sadiq et al. (2023) and Uddin et al. (2020). Their studies demonstrate that DFI is a crucial driver of price stability, ultimately contributing to monetary stability. By promoting DFI, central banks can create an environment conducive to effective monetary policy. DFI enables broader access to financial services, reducing transaction costs and increasing economic efficiency. Moreover, it facilitates real-time monitoring and regulation, allowing central banks to respond promptly to economic fluctuations. In Mozambique, Fernandes et al.'s (2024) research reveals that DFI has significantly improved price stability, underscoring the potential for digital technology to enhance economic governance. Similarly, Sadiq et al.'s (2023) and Uddin et al.'s (2020) studies highlight the importance of DFI in fostering monetary stability.

5.1.2 Reduction of non-performing loans

The integration of fintech in financial inclusion has yielded promising outcomes for MSMEs and the broader financial sector. Research by Ismanto et al (2023) reveals that fintech-based FI positively impacts MSMEs' credit performance, enhances access to credit and reduces non-performing loans in the financial sector. This is achieved through digital financial technology, enabling financial institutions and fintech companies to maintain accurate records and efficiently monitor loan repayments. The consequences of this development are twofold. Firstly, the decline in non-performing loans contributes to enhanced financial stability within the sector. Secondly, fintech-driven FI promotes banking stability, as evidenced by Syed et al.'s (2020) study in the Indian financial sector. Their research demonstrates that the second wave of DFI significantly reduced non-performing loans and bolstered financial stability. Further corroborating these findings, Bozhenko et al.'s (2024) study in Ukraine highlights the potential of digital finance in curbing shadow economic operations. The current state of digital finance development in Ukraine is deemed sufficient to substantially reduce illicit financial activities. Collectively, these studies underscore the transformative impact of fintech-driven FI on MSMEs, FS and banking stability. In conclusion, Bozhenko et al (2024) propose a comprehensive strategy to foster a cashless economy, comprising measures to increase digital transactions, reduce non-performing loans, optimize banking infrastructure, promote online banking adoption, and curb fictitious direct investments. These recommendations align with the findings of Syed et al (2024) and Ismanto et al. (2023), who demonstrated that digital finance significantly mitigates non-performing loans in the financial sector. By harnessing DFT, financial institutions can streamline credit allocation, mitigate non-performing loans and foster a more transparent and stable financial environment. Bozhenko et al. (2024) recommend implementing measures to promote a cashless economy, reduce non-performing loans, optimize banking infrastructure, increase online banking adoption, and minimize fictitious direct investments. The recommendations made by Bozhenko et al (2024) resonate well with findings of Syed et al (2020) and Ismanto et al (2023) who observed that digital finance decreases the level of non-performing loans in the financial sector.

5.1.2 Severe competition in the financial sector

Research by Banna et al (2020) highlights the paradoxical effects of DFI. While it promotes FS by mitigating banks' risk-taking tendencies through advanced risk assessment technologies, it also sparks fierce competition among fintech companies and banks. This competitive landscape may incentivize financial institutions to adopt riskier strategies, potentially destabilizing the financial sector. Contrary to findings of Banna et al (2020) that digital financial inclusion increases competition which might be unhealthy, Hua and Huang (2021) posited that fintech based financial inclusion increase efficiency since financial institutions will be competition to provide services and products at the lowest possible cost. However, Hua and Huang, (2021) argued that fintech based FI increases cyber risks. This argument resonates well with findings of a study by Vučinić (2020) who observed that cyber risk in the digital landscape is the latest and potentially greatest threat springing from DFI.

5.1.3 Systemic risks and cyber risks

Research by Kuznetsova and Larina, (2024) sounds a cautionary note on the potential systemic risks associated with fintech financial intermediation, highlighting the vulnerability of the entire financial sector to collapse if one institution's digital infrastructure fails. This finding is corroborated by Chaudhry et al.'s (2022) study, which underscores the double-edged nature of digital financial inclusion, bringing benefits but also introducing systemic risks. Furthermore, Mutanda and Crispen's (2023) research exposes the alarming threat of cyberattacks on digital infrastructure, resulting in significant losses for clients and banks. Earlier, Li et al. (2020) had also flagged the challenges accompanying digital finance's benefits in promoting financial inclusion. The swift expansion of fintech institutions has sparked concerns about potential risk spillover to conventional financial institutions, thereby amplifying systemic risk. A consensus emerges from studies by Kuznetsova and Larina (2024), Chaudhry et al (2022), Mutanda and Chrispen (2023), Li et al. (2020), and Gąsiorkiewicz et al. (2020) that digital finance presents new risks to financial and economic systems, undermining stability, security and consumer protection. Moreover, Risman et al's (2021) research highlights market risk as a moderating factor, demonstrating that heightened systemic risk can offset digital finance's benefits to financial stability, consistent with Chaudhry et al.'s (2022) findings.

5.1.4 Regulatory Challenges

José and García (2016) warn that rapid credit growth linked to new FI initiatives and unregulated financial segments poses potential risks. Unregulated fintech companies may engage in risky lending practices, compromising FS (Gąsiorkiewicz et al., 2020). Regulatory arbitrage is another challenge. Fintech companies often operate across borders, exploiting regulatory differences and loopholes (Risman et al., 2021). This underscores the need for international cooperation and harmonized regulatory frameworks to prevent regulatory evasion. However, their study also notes that broader access to deposits can lead to a more diversified deposit base, significantly enhancing the resilience of the overall financial system and, by extension, FS. This nuanced perspective is echoed by Ozili (2023), who posited that fintech services have the potential to preserve FS, whereas cryptocurrency presents FS risks that can be mitigated through effective and robust regulations. Research by Ozili (2023) and Garcia (2016) aligns with Gregory et al.'s (2018) findings, which suggest that widespread adoption of cryptocurrencies could create parallel currencies, posing risks to monetary policy effectiveness, FS, and economic growth. However, the likelihood of cryptocurrencies supplanting traditional fiat currencies remains low, as long as central banks' currencies effectively fulfill money's three traditional functions. A system of checks and balances is necessary to hold cryptocurrency issuers accountable to society, which is inherently difficult due to cryptocurrencies' automatic and private issuance. The intersection of these findings underscores the importance of striking a balance between promoting FI and ensuring regulatory oversight. Effective regulation can mitigate risks associated with rapid credit growth and unregulated financial segments, while fostering an environment conducive to FS. Conversely, inadequate regulation can exacerbate systemic risks, compromising FS.

6. Conclusion

The systematic review of literature on the nexus between DFI and FS reveals a complex and multifaceted relationship. While DFI has the potential to enhance FS by increasing access to financial services, reducing transaction costs, and improving financial intermediation, it also poses significant risks. These risks include spillover risks from fintech institutions to traditional financial institutions, cybersecurity threats, regulatory challenges and systemic risks associated with rapid credit growth and unregulated financial segments. To effectively navigate this complex landscape, it is imperative that policymakers and stakeholders adopt a multifaceted approach. Firstly, developing and implementing robust regulatory frameworks is crucial to address the unique challenges posed by DFI. This includes ensuring effective oversight, mitigating systemic risks, and promoting transparency and accountability. Secondly, enhancing cybersecurity measures is vital to protect against cyber threats and maintain consumer trust. Financial institutions and fintech companies should prioritize robust cybersecurity measures and best practices to protect sensitive consumer data. Furthermore, promoting financial literacy is essential to empower consumers to make informed decisions about digital financial services. Governments and financial

institutions should invest in financial literacy programmes, targeting vulnerable populations and underserved communities. Encouraging collaboration between policymakers, financial institutions, and fintech companies is also critical. By fostering innovation and knowledge-sharing, stakeholders can develop solutions that balance financial inclusion with financial stability. Moreover, national financial regulators, regional financial authorities, and global financial institutions must develop and implement comprehensive regulations to govern cryptocurrencies, mitigating potential systemic risks and curbing manipulative practices. Lastly, regulatory bodies must continuously monitor the DFI landscape and adapt regulatory approaches as needed to address emerging risks. This requires a proactive and agile approach, leveraging data analytics and technological innovations to stay ahead of the curve. When these strategies are adopted, policymakers and stakeholders can promote a stable and inclusive financial system, harnessing the benefits of DFI while minimizing its risks. Ultimately, a balanced approach that prioritizes both FI and FS is essential for fostering economic growth, reducing poverty, and promoting financial well-being.

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Conflict of interest statement

The authors declare that the research was conducted without any personal, commercial, or financial conflicts of interest. Additionally, there are no conflicting interests of any sort, ensuring the integrity and impartiality of the research findings.

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