P-ISSN: 2709-6254	Journal of Development and Social Sciences	April-June 2023, Vol.4, No. 2
O-ISSN:2709-6262	http://dx.doi.org/10.47205/jdss.2023(4-II)68	[779-792]

Journal of Development and Social Sciences
www.jdss.org.pk

RESEARCH PAPER

Impact of Financial Technology, Banking Access on Financial Inclusion with mediating role of Financial Literacy

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ABSTRACT

This study aims to investigate the impact of financial technology (FinTech) and banking access on financial inclusion, while considering the mediating role of financial literacy. Financial inclusion refers to the accessibility and usage of various financial services by individuals and businesses, particularly those who are traditionally underserved or excluded from the formal banking system. The study will analyze how the advancements in FinTech and increased banking access can contribute to enhancing financial inclusion, with a focus on how financial literacy plays a crucial role in this relationship. The results show a strong positive correlation between FinTech usage and banking access, indicating that developing financial technology helps make banking resources more accessible. Additionally, the study finds a connection between traditional banking access and financial inclusion, showing that better access to these services has a favorable impact on a person's level of financial inclusion. A crucial component of the interaction between FinTech, banking access, and financial inclusion is the mediating function of financial literacy. The effect of FinTech and banking access on financial inclusion has been found to be somewhat mediated by financial literacy. Financial inclusion outcomes are improved because people with higher financial literacy levels typically benefit more from technological improvements and banking services.

KEYWORDS Financial Inclusion, Fintech, Financial Literacy, Banking Access

Introduction

Inclusive finance has played a pivotal role in facilitating the substantial contribution of the rural population to the overall development of the economy (Hasan et al., 2021; Younas & Farooq, 2019). Consequently, by promoting access to financial services for inclusive individuals, a profound connection can be established between them and the remarkable growth of the entire financial system (Hasan et al., 2022; Senyo et al., 2021). The lack of access to financial services stands as the primary factor contributing to the financial exclusion of the rural population. Chen & Yuan, (2021), "stated that financial inclusion is closely intertwined with the reduction of poverty. Nevertheless, the responsibility of extending financial access to those who are excluded financially lies with both formal and informal financial institutions" (Hasan et al., 2020; Rahman et al., 2017; Saad et al., 2022). The important factor of financial inclusion is behavioral intention (Macedo, 2017; Mazambani & Mutambara, 2020; Senyo & Osabutey, 2020).

In the present day, consumers are required to indicate their preferences from a wide array of comprehensive financial products and services. Financial literacy, with a specific emphasis on the importance and applicability of financial education in relation to various financial products, services, and activities, plays a significant role (Kim et al., 2018; Oliveira et al., 2016; Satya R. Chakravarty & Pal, 2019). Financial literacy is closely tied to the

advancement of financial systems in every country. It has profound implications for individuals' decision-making processes concerning their personal finances (Aeknarajindawat, 2020; Hasan et al., 2021), Furthermore, financial literacy contributes to economic development by enhancing economic security and reducing unemployment rates (Hasan et al., 2020; Khawar & Sarwar, 2021; Osei-Assibey, 2015). Financial education plays a crucial role in enhancing individuals' comprehension of diverse financial products and concepts. Through a range of instructions, information, and advice, it aims to cultivate skills in recognizing financial risks and opportunities. Individuals with limited knowledge of financial activities are more prone to making financial mistakes, making it imperative for investors to augment their financial knowledge to enhance their portfolio performance. Financial education encompasses planning, investing, and saving, relying on formal financial tools and methods such as financial calculators and attending seminars focused on financial education. These resources assist individuals in making informed financial decisions (Hasan et al., 2021; Lubis et al., 2019; Takidah & Kassim, 2021).

Literature Review

Financial Technology and Financial Inclusion

Financial inclusion encompasses the accessibility of individuals and organizations to affordable and practical financial products and services, including payment options, deposits, insurance, and loans (Grohmann et al., 2018). “However, in the modern context, technology is facilitating the provision of financial services by non-financial institutions, such as telecommunication firms, giving rise to fintech innovation” (Senyo & Osabutey, 2020). Fintech innovations have empowered individuals who were previously excluded from accessing financial services. This enhanced accessibility to financial services has had a significant positive impact on people's lives, promoting financial inclusion and contributing to overall economic growth (World Bank, 2022).

“Mobile money innovation has enabled people to access financial services through their mobile phones, this ecosystem comprises users, service providers, merchants, agents, banks, and regulators” (Senyo et al., 2020). According to Ozili, (2018); Senyo et al. (2021); Siano et al. (2020), Users encompass both individuals and organizations who utilize mobile money products and services. On the other hand, service providers primarily consist of organizations, which offer MFS to the users. Mugambi et al. (2014), merchants represent both individuals and organizations that accept mobile money payments for the goods and services they offer.

H-1: Financial Technology have significant impact on financial inclusion

Financial technology usage and Financial Literacy

Financial technology (fintech) has emerged as a crucial enabler in facilitating financial access for rural populations. Mobile banking serves as a viable alternative when traditional banking services are inaccessible. Rural individuals demonstrate a strong willingness to engage in financial transactions through digital channels, as they offer convenience and widespread availability throughout the country (Hasan et al., 2021; Senyo & Osabutey, 2020). According to Allgood & Walstad, (2016); D.A.T, (2020) Financial education has gained immense popularity in the twenty-first century, primarily driven by the increasing utilization of technology in the financial and economic landscape. In this scenario, the advent of new financial technologies necessitates the need for technological education to explore innovative operational methods. Technology underlies every form of financial communication, thereby highlighting the significance of both technplogy education and FL in the realm of financial communication in the present century.

Hasan et al. (2020), observed that "financial literacy plays a pivotal role in bridging the gap between frequent internet usage and limited financial management usage". FLis closely associated with consumers' educational level, and its utilization in fintech has a notable impact on DFS. Furthermore, "higher levels of financial literacy were found to increase the probability of utilizing digital financial products and services, thus enhancing financial access" (Demir et al., 2022). Financial inclusion was not solely influenced by financial literacy in isolation; however, "the combination of financial literacy and internet usage" demonstrated a positive impact on enhancing financial access. Utkarsh et al. (2020), significance of FL in promoting financial stability has been widely acknowledged. Ye & Kulathunga, (2019) the study revealed that respondents residing in high-income economies demonstrated a significantly higher propensity to engage in online payments.

H-2 Fintech have positively related to financial literacy.

Banking Access and Financial Inclusion

According to the research conducted by Kou et al. (2021), access to finance poses a significant challenge, leading to the recognition of financial literacy as a crucial component of financial inclusion by various national and international organizations. Additionally, Hasan et al. (2021), discovered that economically vulnerable populations face significant barriers to financial inclusion. Moreover, individuals with higher levels of financial literacy are more inclined to exhibit positive savings behaviors and are less likely to rely on informal sources for borrowing. Financial literacy plays a pivotal role in educating and empowering individuals to assess and make informed decisions regarding a wide range of financial products and services.

Okello Candiya Bongomin et al. (2016), concerns were raised "regarding the impact of financial literacy on financial inclusion, with a specific focus on the role of social capital". The results of the research showed that the association between banking access and financial inclusion was entirely mediated by financial literacy in Uganda. In their study, Hussain et al. (2018), "explored the correlation between the level of education and the involvement of business owners in financial services". They found a link between financial literacy and a firm's ability to get capital as well as its level of expansion. With the exception of internet use, a statistically significant correlation was found between financial literacy and the use of digital financial products (Hasan et al., 2020).

H-3: Banking access significantly related to financial literacy

H-4: Banking service access have positive impact on Financial Inclusion

Financial literacy (FL) and Financial Inclusion (FIN)

Okello Candiya Bongomin et al. (2020), supported the notion that FL plays a vital role in empowering the economically disadvantaged, enabling them to make well-informed financial decisions and enhancing their awareness of financial issues and options, along with basic financial skills. By promoting "financial literacy, individuals can gain a better understanding of mainstream financial services, which can discourage reliance on non-standard financial services" (Hasan et al., 2020). Additionally, Khawar & Sarwar, (2021) proposed that financial literacy, as a contextual factor, can mitigate information asymmetry in the financial market, as customers become more knowledgeable about the various financial products available.

Previous empirical studies have demonstrated that financial literacy can educate and empower the economically disadvantaged, allowing them to derive optimal benefits from various financial products and services (Osei-Assibey, 2015). In a study conducted by Allgood & Walstad, (2016), it was found that a financial literacy program designed to

educate unbanked households in Indonesia about savings accounts resulted in a modest increase in the demand for savings accounts among those with low initial levels of financial literacy. Okello Candiya Bongomin, Ntayi, Munene, & Nabeta, (2016), conducted a study examining the influence of financial literacy on various aspects of financial knowledge.

H-5: FL have positively influenced the financial inclusion

Material and Methods

This study was conducted in Pakistan, a middle-income country in South Asia. Pakistan has emerged as one of the fast-growing mobile money markets in the region (Hasan et al., 2021; Zhao, 2021). Over the past five years, the country has witnessed significant developments in mobile technology, with increasing penetration of smartphones, improved access to education, and a rising frequency of mobile money service use.

The growth of mobile money services in Pakistan has been facilitated by the increased penetration of mobile telephones and phone ownership. As of 2017, the country had approximately millions of unique mobile phone subscribers, representing a significant proportion of the population (World Bank, 2022). Furthermore, Pakistan has experienced about 45% mobile internet penetration, a critical factor in advancing financial inclusion (Global Findex, 2021).

MM is still the most common form of payment in Pakistan, despite a significant growth in the number of individuals with mobile money accounts (Osei-Assibey, 2015). It is, therefore, crucial to understand the factors that influence the actual usage of MM innovations to deepen financial inclusion. In Pakistan, "mobile money is primarily used for cash transfer and bill payment" (Narteh et al., 2017). However, in recent times, it has also been utilized for obtaining microloans and paying insurance subscriptions. The country is currently undergoing a digitalization drive to achieve a cashless economy, resulting in various reforms, including the "passage of the digital payment ACT and the relaxation of some banking regulations" (Hasan et al., 2020).

Measurement of study

For this study, we employed a measurement approach that involved adapting previously validated items from existing literature to explore the factors influencing fintech, banking access, financial inclusion and financial literacy. The questionnaire in this research consists of five segments. The first segment focuses on gathering information on the demographics of the participants. This section includes questions related to the participants' age, gender, educational background, and other relevant demographic information.

The second part of the questionnaire evaluates the respondents' level of fintech-related knowledge. This section comprises 9 questions, drawing inspiration from a previous study, to gauge participants' understanding and awareness of fintech concepts and services. Moving on to the third section, it focuses on measuring the respondents' banking access. "The measuring and determining of all the variables are taken from" (Hasan et al., 2021). "Mainly the concept of the variables used in this study was selected from the research of" (Atkinson, 2013;Hasan et al., 2020; Senyo & Osabutey, 2020). This part incorporates 5 questions adapted from an earlier study to assess participants' familiarity with various banking services. While financial literacy contain 5 question from (Hasan et al., 2021). Although, financial inclusion contain 7 question adapted from (Okello Candiya Bongomin et al., 2020)

Data Collection

Our research sample comprised 670 participants from Pakistan's most populous cities, which included the capital city, Islamabad, as well as the industrially developed cities of Punjab. To be eligible for selection, respondents had to be 18 years of age or older and have at least one source of income. These cities attract millions of individuals from all across the country for employment opportunities, making it relatively more feasible to find respondents with earning sources compared to other areas or cities. Information regarding participants' age, education level, professional status, and income was collected. The entire data collection process employed a random sampling method. In determining the sample size for this study, we adopted the guideline proposed by (hair jr. & lukas, 2014). According to their rule, "the sample size should be at least 10 times larger than the largest number of structural paths directed at a particular construct in the structural model" (Senyo & Osabutey, 2020).

Results and Discussion

The data analysis for this study was carried out in three main stages: descriptive analysis, measurement model analysis, and structural model analysis.

For the measurement and structural model analysis, the study employed partial least squares structural equation modeling (PLS-SEM). Specifically, SmartPLS version 3.2.7 was utilized for data analysis. The decision to use PLS-SEM was driven by the exploratory nature of the research, aiming to comprehensively explore the relationships between variables. Furthermore, PLS-SEM was selected for its robustness in handling complex relationships, accommodating skewed sample distributions, and being well-suited for small sample sizes, as compared to other techniques like EQS, AMOS, and LISREL, as discussed by (Yan et al., 2021). PLS-SEM's suitability to address the specific characteristics of the dataset made it a more appropriate choice for this study.

Demographic characteristics

To gain insights into the demographic characteristics of the respondents, the data analysis focused on four key attributes: age distribution, level of education, profession, and income. These attributes were carefully examined to understand the composition and background of the participants in the study. The findings provide valuable information about the respondents' demographics, enabling a comprehensive understanding of the sample and its relevance to the research objectives.

Table 1
Demographics' information of participant

Variables.	Classes	Freq.	%
Age	Below then 20	110	16.4
	21 to 30 years	260	38.8
	31 to 40 years	170	25.8
	41–50 years	90	13.4
	51 years plus	40	5.6
Education	Primary level or below then	20	2.98
	Secondary or intermediate level	157	23.4
	Bachelor level	274	40.9
	Graduation or M.Phil.	172	25.7
	Ph.D.	47	7.02
Profession	Entrepreneur	260	38.8
	Employment status	410	61.2
Income	Below 15,000	75	11.2

25,001–35,000	115	17.2
35,001–45,000	226	33.7
45,001–60,000	190	28.4
60,000 Plus	64	9.5

The table 1 presents the distribution of participants across different variables. The majority of the participants fall into the age groups of 21 to 30 years (38.8%) and 31 to 40 years (25.8%). The lowest representation is in the 51 years plus age group (5.6%). The largest proportion of participants have completed their Bachelor's level education (40.9%), followed by Graduation or M.Phil. (25.7%). A smaller percentage has a Ph.D. (7.02%). The participants were divided into two main categories. The majority are employed (61.2%), while a significant number identified as entrepreneurs (38.8%). Among the participants, the highest percentage falls within the income range of 35,001 to 45,000 (33.7%), and the lowest percentage falls under the category of Below 15,000 (11.2%). Overall, the sample comprises a diverse group in terms of age, education, profession, and income, which provides a broad perspective for the research analysis.

Factor Loadings, Validity and Reliability of the Study

Figure 1 presents the results of factor loadings, validity, and reliability for the different variables in your study. The table lists four variables under investigation in your study: BA, FL, Fin_{Inc}, and Fintech. Each variable is broken down into several items or indicators that are used to measure that variable. For example, Banking Access (BA) has items BA1, BA2, BA3, BA4, and BA5. Factor loadings represent the strength of the relationship between each item and its underlying latent variable. In your study, loadings are presented as correlations between items and latent variables. For instance, item BA1 has a loading of 0.670 with the latent variable Banking Access (BA). Higher loadings indicate a stronger relationship between the item and the underlying variable. Composite Reliability is a measure of internal consistency reliability. It assesses how well the items within a latent variable correlate with each other.

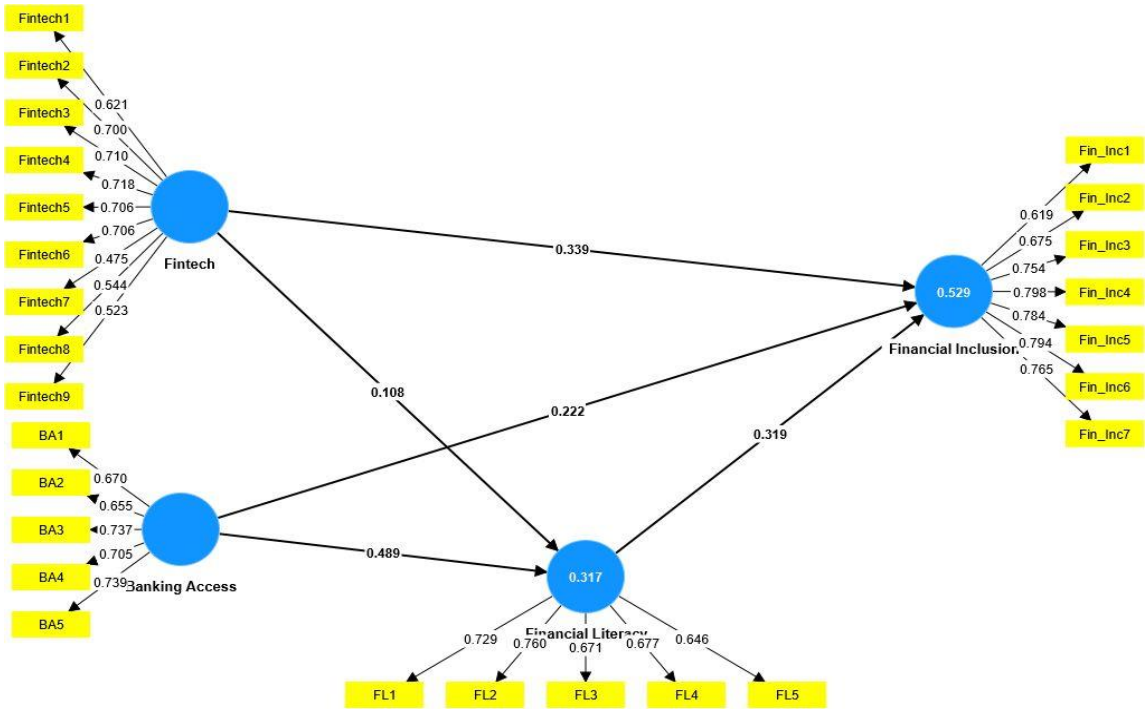

Figure 1. Factor Loadings, Validity and Reliability of the Data

Table 2
Factor Loadings, Validity and Reliability of the Data

Component	Items	Loadings	CA	CR	AVE
Banking Access (BA)	BA1	0.670	0.744	0.753	0.578
	BA2	0.655			
	BA3	0.737			
	BA4	0.705			
	BA5	0.739			
Financial Literacy (FL)	FL1	0.729	0.863	0.867	0.553
	FL2	0.760			
	FL3	0.671			
	FL4	0.677			
	FL5	0.646			
Financial Inclusion (Fin_Inc)	Fin_Inc1	0.619	0.736	0.736	0.627
	Fin_Inc2	0.675			
	Fin_Inc3	0.754			
	Fin_Inc4	0.798			
	Fin_Inc5	0.784			
	Fin_Inc6	0.794			
	Fin_Inc7	0.765			
Finnacial Technology (Fintech)	Fintech1	0.621	0.817	0.831	0.623
	Fintech2	0.700			
	Fintech3	0.710			
	Fintech4	0.718			
	Fintech5	0.706			
	Fintech6	0.706			
	Fintech7	0.475			
	Fintech8	0.544			
	Fintech9	0.523			

Table 2 shows that factor loadings for BA items are relatively high (ranging from 0.655 to 0.739), indicating that the items are strongly related to the latent variable of Banking Access. The Composite Reliability (0.753) and AVE (0.578) suggest good reliability and validity, respectively, supporting the consistency and accuracy of the measurement of Banking Access. The factor loadings for FL items are also quite high (ranging from 0.646 to 0.760), indicating a strong connection between the items and the latent variable of Financial Literacy. The Composite Reliability (0.867) and AVE (0.553) suggest good internal consistency and construct validity for Financial Literacy. The factor loadings for Fin_{Inc} items are generally high (ranging from 0.619 to 0.798), indicating a strong relationship with the latent variable of Financial Inclusion. The Composite Reliability (0.736) and AVE (0.627) values further support the reliability and validity of the Financial Inclusion measurement. The factor loadings for Fintech items vary (ranging from 0.475 to 0.821), suggesting a mixed strength of relationships with the latent variable of Financial Technology. The Composite Reliability (0.831) and AVE (0.623) indicate good reliability and validity for the Fintech construct.

Table 3
Discriminant validity (Heterotrait-monotrait ratio)

	Banking Access	Financial Inclusion	Financial Literacy	Fintech
Banking Access				
Financial Inclusion	0.752			
Financial Literacy	0.740	0.729		
Fintech	0.808	0.713	0.525	

Table 3, the HTMT ratio between Banking Access and Financial Inclusion is 0.752. This value is below the threshold of 1.0, suggesting that there is discriminant validity between these two constructs. In other words, Banking Access and Financial Inclusion are distinct enough from each other. The HTMT ratio between Banking Access and Financial Literacy is 0.740. Similar to the previous comparison, this value is below 1.0, indicating discriminant validity between Banking Access and Financial Literacy constructs. The HTMT ratio between Banking Access and Fintech is 0.808. Again, this value is below the threshold of 1.0, implying discriminant validity between Banking Access and Fintech constructs. The HTMT ratio between Financial Inclusion and Financial Literacy is 0.729. Similar to the previous cases, this value is below 1.0, signifying discriminant validity between Financial Inclusion and Financial Literacy constructs. The HTMT ratio between Financial Inclusion and Fintech is 0.713, below 1.0, which indicates discriminant validity between these constructs. The HTMT ratio between Financial Literacy and Fintech is 0.525. This value is below the threshold of 1.0, showing discriminant validity between Financial Literacy and Fintech constructs.

Table 4
Path coefficients (Direct Effects)

Relationship	O	Mean (M)	STDEV.	T- stat	P
Banking Access -> Financial Inclusion	0.222	0.222	0.050	4.398	0.000
Banking Access -> Financial Literacy	0.489	0.489	0.056	8.715	0.000
Financial Literacy -> Financial Inclusion	0.319	0.320	0.046	6.861	0.000
Fintech -> Financial Inclusion	0.339	0.339	0.049	6.921	0.000
Fintech -> Financial Literacy	0.108	0.110	0.062	1.748	0.080

P=5%

In Table 4, the presented path coefficients highlight the associations between different variables. For instance, a rise of one unit in Banking Access is linked to a 0.222-unit increase in Financial Inclusion. The calculated T statistic (4.398) surpasses zero, and the associated p-value (0.000) is indicative of statistical significance, typically observed at conventional levels like 0.05. This implies a substantial and significant relationship between Banking Access and Financial Inclusion within the initial sample.

Similarly, the path coefficient for the Banking Access and Financial Literacy relationship is 0.489. This signifies that a single unit elevation in Banking Access is related to a 0.489-unit increment in Financial Literacy. With a notably higher T statistic (8.715) and a p-value of 0.000, a strong and statistically significant connection between Banking Access and Financial Literacy is evident.

Table 5
Specific indirect effects

Relationship	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics	P values
Fintech -> Financial Literacy -> Financial Inclusion	0.034	0.036	0.021	1.608	0.108
Banking Access -> Financial Literacy -> Financial Inclusion	0.156	0.156	0.029	5.467	0.000

P=5%

In Table 5, we observe specific indirect effects that revolve around the impact of Fintech on Financial Inclusion through the intermediary factor of Financial Literacy. The coefficient for this indirect effect stands at 0.034. This signifies that a unit increase in Fintech

corresponds to a minor 0.034-unit increase in Financial Inclusion, with changes in Financial Literacy acting as a mediator. The associated T statistic (1.608) is relatively modest, and the p-value (0.108) fails to achieve statistical significance at the conventional threshold of 0.05. These findings indicate that the indirect influence of Fintech on Financial Inclusion via Financial Literacy might not display notable strength or consistency within the sample.

Table 6
R-Squared

	R-square	R-square adjusted
Fintech	0.529	0.526
Financial Literacy	0.317	0.314

Table 6 displays the R-squared outcomes, providing insight into the explanatory power of the models. The Fintech model exhibits an R-squared value of 0.529, signifying that approximately 52.9% of the variability in the dependent variable (Fintech) is elucidated by the included independent variables. This indicates a reasonably robust level of explanation. The adjusted R-squared, which considers the complexity arising from the number of independent variables, slightly diminishes to 0.526.

Similarly, the Financial Literacy model showcases an R-squared value of 0.317, denoting that roughly 31.7% of the variability in the dependent variable (Financial Literacy) is clarified by the independent variables integrated into the model. This points to a moderate level of explanation. The adjusted R-squared, accommodating model complexity, registers a slightly reduced value of 0.314.

Discussion

The results of our study reveal significant relationships between key variables, shedding light on the dynamics that drive financial inclusion. Our analysis indicates that both Fintech and Banking Access have a positive and statistically significant impact on Financial Inclusion. This aligns with the findings of the previous study by (Hasan et al., 2021), which underscored the importance of technological innovation and enhanced accessibility in promoting financial inclusion. The confirmation of these relationships in our study adds further empirical support to the existing literature.

Notably, our study goes beyond these direct effects and delves into the mediating role of FL in shaping the relationship between Fintech, Banking Access, and Financial Inclusion. Our findings reveal that Financial Literacy serves as a partial mediator between both Fintech and Banking Access on Financial Inclusion. This implies that while Fintech and Banking Access have direct effects on Financial Inclusion, part of their impact is channeled through improved Financial Literacy.

The mediating function of financial literacy emphasizes the significance of educational activities and programs that improve people's comprehension of financial instruments and ideas. This knowledge may be used by policymakers and financial organizations to develop more focused initiatives that not only increase access to financial services but also provide people the information they need to make wise financial choices. This aligns with the recommendations made by (Hasan et al., 2021), further solidifying the practical implications of our study's findings.

Conclusion

In the current study, the findings revealed that both fintech and banking access have substantial positive direct effects on financial inclusion. Fintech, representing the integration of technology into financial services, demonstrated a notable influence on

increasing financial inclusion. Additionally, banking access, reflecting the availability and utilization of traditional financial services, also positively contributed to enhancing financial inclusion. These outcomes align with the trajectory of technological advancements and the notion that improved access to financial services, whether traditional or tech-driven, can lead to greater financial inclusion.

Furthermore, the role of financial literacy was explored as a potential mediator between fintech/banking access and financial inclusion. The study found that financial literacy indeed plays a mediating role in the relationship between these variables. This suggests that when individuals possess better financial literacy skills, they are more likely to leverage fintech and banking services effectively, leading to improved financial inclusion. This finding underscores the importance of education and knowledge in navigating the complex financial landscape, regardless of the technology involved.

Comparing these results with a previous study, a broader perspective emerges. The previous study might have focused solely on the impact of fintech or banking access on financial inclusion without considering the mediating role of financial literacy. The current study extends this understanding by highlighting the intermediary role of financial literacy in amplifying the impact of fintech and banking access on financial inclusion. Thus, it underscores the intricate interplay between technology, knowledge, and financial inclusion.

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