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How does financial literacy impact on inclusive finance?

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Abstract

Inclusive finance is a core concept of finance that makes various financial products and services accessible and affordable to all individuals and businesses, especially those excluded from the formal financial system. One of the leading forces affecting people's ability to access financial services in rural areas is financial literacy. This study investigated the impacts of financial knowledge on financial access through banking, microfinance, and fintech access using the Bangladesh rural population data. We employed three econometrics models: logistic regression, probit regression, and complementary log–log regression to examine whether financial literacy significantly affects removing the barriers that prevent people from participating and using financial services to improve their lives. The empirical findings showed that knowledge regarding various financial services factors had significant impacts on getting financial access. Some variables such as profession, income level, knowledge regarding depositing and withdrawing money, and knowledge regarding interest rate highly affected the overall access to finance. The study's results provide valuable recommendations for the policymaker to improve financial inclusion in the developing country context. A comprehensive and long-term education program should be delivered broadly to the rural population to make a big stride in financial inclusion, a key driver of poverty reduction and prosperity boosting.

Keywords: Financial knowledge, Financial literacy, Bank, Microfinance, FinTech, Financial inclusion, Inclusive finance, Bangladesh, Knowledge economy

JEL Classification: G2, G4, G5, D1, D9, O2, R1

Introduction

With the support of inclusive finance, the rural population has contributed significantly to the entire economy's development (Hasan et al. 2020b; Johnston 2005; Le et al. 2019; Stein 2010). Therefore, promoting financial services access to inclusive people will deeply connect them with the significant growth of the whole financial systems (Hasan et al. 2020b, 2020c; Rashidin et al. 2020b). Access to financial services is the most critical factor working behind the financial exclusion of the rural population. Chao et al. (2021) mentioned that financial inclusion is deeply connected to poverty reduction. However, both formal and informal financial institutions are responsible for providing financial access to those financially excluded people (Helms

2006; Hussain et al. 2018; Zulkhibri 2016). The crucial obstacle of financial inclusion process is financial illiteracy (Bongomin et al. 2016a; Grohmann et al. 2018; Hasan et al. 2020a; Kodongo 2018; Koomson et al. 2019; Lyons and Kass-Hanna 2019; Mogilevskii and Asadov 2018; Segre 2018).

Nowadays, consumers have to specify a comprehensive range of financial products and services. Financial literacy, particularly the saliency and relevance of financial education regarding financial products, services, and activities (Fernandes et al. 2014; Sun et al. 2020), has played a crucial role in helping people select suitable financial products (Bianchi 2018; van Rooij et al. 2011; Von Gaudecker 2015). Financial literacy has a strong link with the development of every country's financial systems. It has dramatical implications on financially personal decisions making (Kezar and Yang 2010; Lusardi and Mitchell 2014; Maturana and Nickerson 2019; Paiella 2016; Rashidin et al. 2020a) and economic development by increasing economic security and decreasing unemployment (Berry et al. 2018; Hogarth 2006; Pompei and Selezneva 2019). Financial education improves people's understanding of different financial products and concepts through various instructions, information, and advice to develop financial risks and opportunities recognition skills. As a person with a low-level knowledge of financial activities is more likely to make financial errors, investors should enhance their financial knowledge to improve their portfolio performance. Financial education involves planning, investing, and saving, relying on formal financial methods such as financial calculators, methods, financial education-related seminars to help people make a sound financial decision (Lusardi 2012; Lusardi and Mitchell 2011).

Bangladesh is an emerging market economy with an overpopulation of around 166 million people. The country's high population density is leading to different financial and economic problems. One of the prevalent burning issues in such countries consists of access to financial products and services. Almost 53% of adult people are excluded from financial access, especially low-income groups (LightCastle Partners 2019). Although the number of banks is increasing day by day, no noticeable improvement has been reported. A large proportion of the rural population is still out of formal financial services. Millions of people in the countryside do not know about banking services, FinTech, and microfinance. Thus, research on financial literacy and financial access has been highly demanded in Bangladesh. However, limited studies are investigating the impact of financial knowledge on finance access for rural areas. These issues motivate us to conduct an empirical analysis to show the impact of financial literacy on the rural population's finance services access.

This study aims to investigate the impact of financial literacy on financial access through three sections: (i) impact on banking access, (ii) impact on microfinance access, and (iii) impact on mobile banking access. We employ logit and probit models to examine financial literacy's impact on getting financial access. Also, a robustness test is conducted using complementary log–log regression to prove the significance of our expected models.

The empirical findings show that financial knowledge has a significant effect on getting financial access. Some variables such as profession, income level, education level, knowledge regarding depositing and withdrawing money, and knowledge regarding interest rate are highly significant for overall financial access. However, training on different

services is insignificant because of the low response rate in all cases. In most circumstances, rural residents are not aware of financial service training.

This study is a reflection of the timely demand of financial literacy because knowledge regarding financial services is receiving significant attention from researchers, government officials and educators, and policymakers (Berry et al. 2018; Frisancho 2019; Lusardi et al. 2019; Opletalová 2015; Postmus et al. 2013; Urban et al. 2018). It will significantly contribute to the current literature in inclusive finance, rural development, financial literacy, economic development, banking, and microfinance.

The paper is divided into six sections. The first to third sections include an introduction, review of the literature, and theoretical discussion, respectively. The methodology is explained in section four. The results and findings are reported in Sect. 5. Finally, Sect. 6 discusses the results, theoretical and practical implications, and future research directions.

Literature review

Financial literacy and banking access

Kou et al. (2021) identified access to finance as a challenge; thereby, financial literacy is treated as one of the influential financial inclusion components by different national and international organisations. Lyons and Kass-Hanna (2019) found that economically vulnerable populations are considerably less likely to be included in the financial systems. Also, higher levels of financially literate people are more likely to be engaged in positive savings behaviours and less likely to borrow from different informal sources. Financial literacy helps educate and empower people to evaluate various financial products and services. Bongomin et al. (2016b) raised questions about financial literacy's impact on financial inclusion, emphasising social capital. The findings showed that *financial literacy indirectly affected financial inclusion through complete mediation of social capital. The absence of social capital might lead to financial literacy failure in boosting the level of financial inclusion among Uganda poor rural households.* Hussain et al. (2018) examined the relationship between education level and business owners' engagement with financial services. They identified that financial literacy positively influenced a firm's access to finance and a firm's growth. Shen et al. (2019) showed a statistically meaningful association between digital financial product usage and financial literacy, except internet usage.

Financial literacy and microfinance

Nawaz (2015) focused on financial literacy with women empowerment. A right socio-economic empowerment level is possible for women who can utilise their money effectively and efficiently with enough financial literacy competence. They usually gain training programs offered by the different microfinance agencies. Many NGOs are offering various training programs to their account holders. This financial literacy training helps women better understand the productive use of money, such as remaining bank accounts, utilising money effectively and efficiently, advising their husband and other family members about different economic activities. The women can take control of the overall financial situation of their families. The author finally concluded that the financial training component should be a must for all microfinance programs. Bijli (2012) highlighted that the financial literacy regarding microfinance included four thematic areas;

budgeting, saving, debt management, and bank services. These four thematic areas are considered into two aspects; current behaviour and desired behaviour. The current behaviour related to budgeting for day-to-day living, reactive financial behaviour, lack of forwarding financial planning, wasteful expenditures, irregular savings, savings not linked to goals, borrow for emergencies, over-indebtedness, borrowing with little understanding of terms, limited knowledge of bank services, limited use of bank services. The desired behaviours involved planning for expenditures, making a budget, using a budget to manage money, avoiding unnecessary spending, having a savings plan, saving regularly, maintaining an emergency savings account, making a plan to reduce debt, avoiding excessive debt, borrowing with a full understanding of terms, knowing about financial options, their terms and conditions, and using bank services to support financial goals.

Financial literacy and FinTech usage

Financial technology is playing a very significant role in providing financial access to rural people. Mobile banking is an alternative replacement when people fail to reach banking services. They are very willing to deals in financial communication as it is comparatively easy to access and available everywhere in the country (Hasan et al. 2020b). Brown and Slagter van Tryon (2010) mentioned financial education as one of the most popular financial and economic terms of this Twenty-first century because of the growing use of technologies. In this case, it required tech education to look for new ways to operate new financial technologies. Every type of financial communication is based on technology, causing tech education and financial education in the current century's financial communication. Shen et al. (2019) specified that financial literacy worked as a significant force in bridging the gap between frequent internet usage and low financial management usage. Financial literacy reflected consumers' educational level, and the usage of financial literacy in FinTech influenced digital financial inclusion. Also, financial literacy increased the likelihood of using digital financial products and services to improve financial access (Hasan et al. 2020c). Only financial literacy alone did not influence financial inclusion, but the combination of financial literacy and internet usage could improve better financial access. Belayeth Hussain et al. (2019) recognised the reliability of financial education and financial literacy for financial stability. Lyons and Kass-Hanna (2019) found that respondents from the high-income economies' areas were significantly more likely to engage in online payments. They were also expected to make financial transactions using their mobile phones more frequently than in low-income economies where most people are uneducated.

Theoretical discussion

Financial literacy for rural people

Financial literacy arises with the debate of financial exclusion, financial market fluctuation, deprivation of financial access, and inability to financial communication. Different literature expressed the meaning of financial literacy with specified areas where they find interest. This study highlights every definition in the perspectives of financial access. Recently, financial literacy has become a prominent issue on the financial and economic agenda worldwide (Williams and Satchell 2011; Postmus et al. 2013). Financial literacy is treated as having the proper knowledge of making the right decision in

choosing financial products and services (Fernandes et al. 2014). Understanding financial language is crucial to improve financial education. Worthington (2016) highlighted financial literacy as the ability to decision-making in all aspects of people's budgeting, saving, and spending matters. Huston (2010) specified financial knowledge as an input to model the need for financial education and explain variation in financial outcomes. Wang et al. (2020) identified that poor knowledge regarding financial issues increases the chances of making unsecured P2P loans and personal loans.

In this study, the rural population's financial literacy represents their knowledge about financial services and activities in formal and informal economic sectors. The financial knowledge level of the rural group is completely different from the educated group. The basic financial knowledge is whether they know various financial services or not and how much they know about the general financial terms relating to banking, microfinance, and mobile banking.

Access through banking

The first aspect of financial access is banking services, which are the formal way of providing financial communication and services. Being able to access a bank account is the first step toward greater financial inclusion because a transaction account helps people reach broader financial services (Bhaskar 2013; Helms 2006; Patwardhan et al. 2018). It is suggested that all adults have access to appropriate financial products and services, mainly by banks (Demirguc-Kunt et al. 2017). Financial access through banking allows the countryside households to save money, support their business and family plans, hedge against everyday risks, and promote their economic activities (Sinha et al. 2018; Sun 2017; Wall 2017).

Access through microfinance

The second most effective way of financial access is microfinance, which is regarded as a valuable and powerful tool for poverty reduction. It is also specified as the provision of financial services for poor households. Cull and Morduch (2018) proposed a broader notion, "financial inclusion", for microfinance activities, such as providing savings, insurance, and payment services in under-served communities. Microfinance is also a solution to bring credit markets to underprivileged people on self-employment. It provides self-employment opportunities for the rural population (Cull et al. 2009; Morduch 1999). In remote areas where banks cannot deliver their services, microfinance replaces banks to provide the countryside residents with financial assistance.

Access through FinTech

FinTech is trendy in the present financial market, and its rapid development is an emerging issue of the financial world (Casanova et al. 2018; Gai et al. 2018; Gimpel et al. 2017; Hasan et al. 2020b, 2020c). FinTech refers to a combined form of 'Finance' & 'Technology' (Zavolokina et al. 2016). The terms' Internet finance', 'FinTech', and 'digital finance', 'mobile banking' are almost similar in meaning and used interchangeably worldwide (Hasan et al. 2020b, 2020c). Beyond the traditional financial systems, the involvement of digital financial services in the inclusive financial sector is reflected by the emerging issue' FinTech.' It relates to a wide range of financial services such as online banking,

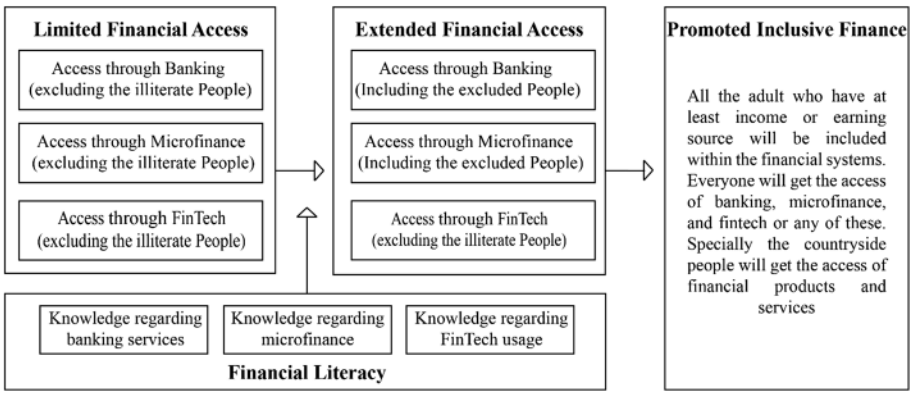

Fig. 1 Theoretical framework. *Source*: Author's Explanation

third-party payment, direct sales of funds, online insurance, crowdfunding, and online banking (Claessens et al. 2002; Hill and Hill 2018; Salampasis and Mention 2018).

Conceptual framework

Financial access is categorised into three parts; financial access through banking, financial access through microfinance, and financial access through *financial technology* (mobile banking). This research's theoretical structure is given in Fig. 1.

According to Fig. 1, there are three stages of promoting rural finance or inclusive finance: limited financial access, extended financial access, and advanced inclusive finance. The concept of promoted inclusive finance has been taken from (Hasan et al. 2020b). In the limited financial access stages, illiterate people are completely excluded from financial institutions' products and services. The second stage is financial access extension, where financial literacy works as moderating factor. Financial literacy helps to provide necessary financial knowledge to the rural illiterate people. After achieving proper financial knowledge relating to financial activities and services, those people are also included in the financial access group. Finally, the theory of more financial involvement of rural people contributes more to the rural economy, and the country's entire economy positively affects rural finance promotion. All the adults who have at least an income or earning source will be included within the financial systems.

Methodology

Research procedure and sample characteristics

Our sample consisted of 852 participants from three main populous cities in Bangladesh, including the capital (Dhaka) and the other two industrially developed cities (Gazipur and Narayongonj). We selected the respondents if they were 18 years of age or over and should have at least earning sources. Millions of people are working in these cities from all around the country. Therefore, getting a respondent who has at least earning source is comparatively more possible than in other areas or cities. Participants' age, level of education, professional status, as well as income were obtained. A random sampling process was applied in the entire data collection process. The study followed an analysis of literature review and reports to develop a set

Table 1 Sample distribution. *Source*: Survey Questionnaire

Variables	Categories	Frequency	%
Age	Below 25	228	26.7
	26 to 30 years	252	29.5
	31 to 35 years	180	21.1
	36–40 years	102	11.9
	40 years plus	90	10.5
Education	No Education	6	0.70
	Primary Level	228	26.7
	Secondary Education	354	41.4
	Higher Secondary	162	18.9
	Graduation	102	11.9
Profession	Business/Self employment	345	40.5
	Job	507	59.5
Income	Below 10,000 (below USD 120)	186	21.8
	10,001–20,000 (USD120 to USD 235)	456	53.5
	20,001–30,000 (USD 235 to USD 350)	126	14.8
	30,001–50,000 (USD 350 to USD 600)	60	7
	50,000 Plus (USD 600 plus)	24	2.8

of questionnaires. The questionnaire will be sent to targeted respondents randomly after a direct presence in some local residency areas. An invitation 852 completed questionnaires were received and analysed. Table 1 provides general information collected from the participants. We divided respondents into 5 age groups: 26.7% were below 25, 29.5% were between 26 and 30 years old, 21.1% were between 31 and 35 years old, 11.9% were between 36 and 40 years old, and 10.5% were 40 or over. More than 87% of respondents had a higher secondary education level or lower. 40% of the participants had their own business while the remaining were employees. The majority of respondents had an income between BDT10001 and 20,000 (USD 120—$235), our study's prominent target. The detailed sample distribution is shown in Table 1.

The measurement of the questionnaire was segmented into four sections. The first section dealt with social-demographic information: name, age, educational level, income range, and location. The last three sections involved participants' usage of banking, micro-finance, and FinTech. Participants were asked about their access to banking services, microfinance, and FinTech. The answers were coded to be "1" if the respondents have utilised the services and "0" if they did not use them. We measured and defined the variables based on different perspectives. The respondent's knowledge level toward banking services and microfinance was assessed on a five-point Likert scale ranging from 1 (poor) to 5 (excellent). The measuring and determining of all the variables are taken from Kadoya et al. (2018). Mainly the concept of the variables used in this study was selected from the research of Adele Atkinson (2017), Atkinson (2015), Atkinson and Messy (2012), Bongini et al. (2018), OECD (2011), Williams and Satchell (2011). Table 2 presents the measurement of the variables.

Table 2 Measurement of variables. *Source*: Authors' experiment

Variables	Definition and Measurement
Common variables	
Profession	The profession of the respondents (1 = Job, 0 = Business)
Education	The educational level of the respondents (Higher education = 5, Below HSC = 4, Below SSC = 3, Primary = 2, No = 1)
Income	The income range of the respondents (50,000 Plus = 5, 30,000–50,000 = 4, 20,000–30,000 = 3, 10,000–20,000 = 2, Below 10,000 = 1)
Banking variables	
Bank account	Whether the respondent has a bank account or not (dummy)
Deposit & withdraw ability	Respondents' ability to deposit into a bank account (dummy)
Bank training	Whether the respondents have training on banking services (dummy)
Kn DPS & loan	The knowledge level of respondents on bank deposits or savings (Excellent = 5, Very Good = 4, Good = 3, Fair = 2, Poor = 1)
Kn DPS & Loan Int. rate	The knowledge level of respondents on saving interest rate (Excellent = 5, Very Good = 4, Good = 3, Fair = 2, Poor = 1)
Kn of security money	The knowledge level of respondents on bank security money (Excellent = 5, Very Good = 4, Good = 3, Fair = 2, Poor = 1)
Bank Kn instalments	The knowledge level of respondents on bank instalments (Excellent = 5, Very Good = 4, Good = 3, Fair = 2, Poor = 1)
Microfinance variables	
Microfinance account	Whether the respondent has a Microfinance or NBFIs account (dummy)
Deposit & withdraw ability	Respondents' ability to deposit money to their account (dummy)
MF training	Whether the respondents have training on different services relating to microfinance or NBFIs (dummy)
Kn savings & loan	The knowledge level of respondents on deposits or savings to micro-finance (Excellent = 5, Very Good = 4, Good = 3, Fair = 2, Poor = 1)
Kn savings & loan Int, rate	The knowledge level of respondents on the micro-finance saving interest rate (Excellent = 5, Very Good = 4, Good = 3, Fair = 2, Poor = 1)
Kn security money	The knowledge level of respondents on micro-finance security money (Excellent = 5, Very Good = 4, Good = 3, Fair = 2, Poor = 1)
Kn installment	The knowledge level of respondents on micro-finance instalments (Excellent = 5, Very Good = 4, Good = 3, Fair = 2, Poor = 1)
FinTech variables	
FinTech account	Whether the respondent has a mobile banking account (dummy)
Send & withdraw money	Whether the user can send money to others account (dummy)
FT training	Whether the users have training on mobile banking (dummy)
FT bill pay	The ability to pay different bills of government services such as electricity bills, gas bills, and other government services bill (dummy)

Table 2 (continued)

Variables	Definition and Measurement
FT software use	Whether the respondents can operate the software or they use the key-press options (dummy)
FT online deal	Whether the respondents can deal in online shopping with their mobile banking account (dummy)

Table 3 Reliability statistics. *Source*: Author explanation

Model	Cronbach's Alpha	Variables	Observation	Interpretation
Banking model	0.907	8	852	Excellent
Microfinance model	0.868	9	852	Good
FinTech model	0.795	8	852	Adequate
Overall	0.912	19	852	Excellent

Analytical procedure

The analysis was conducted in three steps: (a) based on participants' self-reported behaviour, respondents were identified as banking, microfinance, and FinTech user or non-user, respectively; (b) the confirmatory factor analysis (CFA) was used to determine whether the covariates are significantly related to their factors or not; (c) binary regression was conducted to test the real impact of financial literacy on the three elements (banking, microfinance, and FinTech access). Hassan Al-Tamimi and Anood Bin Kalli (2009), Fernandes et al. (2014), Kiliyanni and Sivaraman (2018), Agyei (2018), and Ouma et al. (2017), and Feng et al. (2019) used a probabilities regression model to estimate the impact of financial literacy in different circumstances. There are two commonly used models for binary dependent variables; these are the logit and probit models. This study followed probability distributions. The following algorithm follows the econometrics modelling of this study;

$$Log(p) = Log\left(\frac{p}{(1-p)}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n \tag{1}$$

The term $log\left(\frac{p}{1-p}\right)$ is called the logit function, and it has a natural interpretation as the logarithm of odds. The logistic model is widely used for binomial data and is implemented in many statistical programs.

Reliability test

The reliability test value ranges between 0 and 1.00, with 0 indicates no reliability and 1.00 means perfect reliability. The larger value of the reliability coefficient, the more reliable the test scores. Table 3 present the reliability statistics of this study. According to the reliability test, all models had acceptable Cronbach's alpha values. After the separate reliability test for each model (banking model, microfinance model, FinTech model), the overall reliability test with all the variables was conducted. The Cronbach's alpha value of the overall reliability test was 0.912, representing excellent reliability.

Table 4 Descriptive statistics. *Source*: Author's findings

List of variables	N	Min	Max	Mean	Std. Deviation
Profession	852	0	1	0.60	0.492
Income	852	1	5	2.15	0.938
Education	852	1	5	3.15	0.973
Phase 1—banking variables					
Bank account	852	0	1	0.61	0.490
Deposit & withdraw ability	852	0	1	0.63	0.483
DPS & loan	852	1	5	2.37	1.228
DPS & loan interest rate	852	1	5	2.26	1.157
Installment	852	1	5	2.78	1.308
Security money	852	1	5	2.24	1.224
Bank training	852	0	1	0.14	0.348
Phase 1—Microfinance variables					
Microfinance account	852	0	1	0.45	0.498
Deposit & withdraw ability	852	0	1	0.47	0.500
DPS & loan	852	1	5	2.36	1.191
DPS & loan Interest rate	852	1	5	2.02	1.131
Installment	852	1	5	2.49	1.290
Security money	852	1	5	2.17	1.189
Personal investment	852	1	5	2.25	1.294
Microfinance training	852	0	1	0.06	0.244
Phase 1—FinTech variables					
FinTech account	852	0	1	0.70	0.460
Money send & withdraw ability	852	0	1	0.62	0.486
Billpay ability	852	0	1	0.32	0.466
Software use ability	852	0	1	0.44	0.498
Online dealings ability	852	0	1	0.29	0.454
FinTech training	852	0	1	0.18	0.382

Findings and analysis

The Logit model, Probit model, and complementary log–log regression model were employed to show the likelihood of getting financial access in the rural area. Also, confirmatory factor analysis and descriptive statistics were presented as empirical findings.

Descriptive statistics

First of all, Table 4 presents the descriptive statistics of the three models' variables. This table has four phases: common variables, banking variables, microfinance variables, and financial technology variables.

According to Table 3, most of the respondents were service holders (60%), the average income structure of the respondents was 2.15, which referred to 10,001 to 20,000 BDT (USD120 to USD 240). The education level is 3.15, which means most of the respondents obtained the secondary education level (almost 42% of all the respondents). On average, 60% of the respondents had banking access, and most of the respondents know how

to deposit money into the bank and withdraw money from their accounts. Though the mean score of the knowledge regarding deposit and withdrawal ability from a bank was above the average, the knowledge regarding DPS and loan, knowledge regarding DPS & loan interest rate, and knowledge regarding security money had a below-average mean value (2.37, 2.26, and 2.24 respective). It indicated that the respondents have moderate knowledge regarding those three variables. However, the respondent had good knowledge about bank instalments for a loan or fixed deposit, with the mean value of knowledge regarding instalment was 2.78.

On the other hand, only 45% of respondents had microfinance access. As stated earlier, if someone has access to a banking account, she/he knows how to deposit and withdraw from the personal microfinance account. The mean value of the deposit and withdrawal ability was 0.47, almost similar to the microfinance account (0.45). The mean value of knowledge regarding DPS and loan was virtually more than fair (2.36); however, knowledge regarding DPS & loan interest rate was approximately fair (2.02). The respondents had good knowledge regarding instalment (2.49). The mean value of knowledge regarding security money and personal investment was good (2.17 and 2.25, respectively). The mean value of 0.06 for microfinance training, indicating respondents almost had training on microfinance activities.

Nowadays, almost 75 per cent of the populations have mobile banking access.[1] This study has found that nearly 70% of people had FinTech access, one of the most promising financial inclusion factors in financial technology (Hasan et al. 2020b, 2020c). It is a noticeable fact that regardless of whether the respondent has a bank account/microfinance account, respondents prefer a mobile banking account. That is why almost 62% of people could send money and withdraw money from their accounts. However, there is one critical issue that some people have FinTech access to, but they don't know how to send money to others account and withdraw from their account. In these cases, they depend entirely on others. Who are mobile banking agents for sending and withdrawing cash? Except mobile banking software using ability (mean value 0.46), other variables such as bill pay through mobile banking, online dealings ability, and FinTech training had comparatively lower mean values, suggesting that respondents are not familiar with these activities. Finally, the more educated people had a high possibility to have FinTech access.

Confirmatory Factor Analysis

The confirmatory factor analysis (CFA) was employed to achieve a clear view of the data and use the output in subsequent analyses by running logit and probit regressions. The majority of variables show statistically significant standardised factor loading value with a *p*-value of more than 0.001. The exception occurred for the income variable of microfinance accounts holders, which experienced an insignificant *p*-value, 0.173. The result suggested that the independent variables were significantly related to their factors (see Table 5). Also, Appendix 1 presents the variance and covariance of the variables.

[1] https://thefinancialexpress.com.bd/views/money-transfer-through-mobile-phones-1580483374.

Table 5 Standardised factor loading and significance tests. *Source*: Authors' experiment

Variables	Banking		Microfinance		Fintech	
	Coef	z	Coef	z	Coef	z
Profession	0.1269***	3.77	0.5331***	40.78	0.5503***	41.87
	(0.0337)		(0.0131)		(0.0131)	
Income	0.5181***	20.67	0.0466	1.36	0.2726***	8.60
	(0.0251)		(0.0342)		(0.0317)	
Education	0.4642***	17.27	-0.138***	-4.10	0.3845***	13.17
	(0.0269)		(0.0336)		(0.0292)	
Deposit & withdraw ability	0.9121***	158.32	0.9017***	140.75		
	(0.0058)		(0.0064)			
DPS & loan	0.7288***	45.36	0.8572***	130.21		
	(0.0161)		(0.0135)			
DPS & loan interest rate	0.6937***	39.03	0.6225***	29.67		
	(0.0178)		(0.0210)			
Instalment	0.6595***	34.06	0.7633***	53.38		
	(0.0194)		(0.0143)			
Security money	0.6065***	28.00	0.7298***	45.57		
	(0.0217)		(0.0160)			
Personal investment			0.6331***	30.84		
			(0.0205)			
Send & withdraw ability					0.8097***	68.65
					(0.0118)	
Billpay ability					0.4159***	14.68
					(0.0283)	
Software use Ability					0.5268***	21.29
					(0.0248)	
Online dealing ability					0.3861***	13.24
					(0.0292)	
FinTech training					0.2644***	8.30
					(0.0319)	

The Comparative fit index (CFI) value for each single model is 1.0, the value of Prob > chi2 is 0.000. *** refers the *p*-value is more than 0.001, the value within the first bracket is the OIM standard error

According to Appendix 1, the covariance of banking access and FinTech access was significant; however, the other two covariance shows insignificant *p*-values.

Regression results

Table 6, 7, 8, and 9 present the regression results of two separate models (logit and probit regression model). Each model has been shown into two categories, A and B, where part A excluded the model's common variables and part B included all variables. The banking access model is presented as in Eq. (2):

$$\begin{aligned} Logit(BankAccount) &= \beta_0 + \beta_1 * Profession + \beta_2 * Income + \beta_3 * Education \\ &+ \beta_4 * Deposit\ \&\ Withdraw\ Ability + \beta_5 * Kn\ of\ DPS\ \&\ Loan \\ &+ \beta_6 * Kn\ of\ DPS\ \&\ Loan\ Interest\ Rate + \beta_7 * Kn\ of\ Installment \\ &+ \beta_8 * Kn\ of\ Security\ Money + \varepsilon_i \end{aligned} \tag{2}$$

Table 6 Regression result of banking access and financial literacy. *Source*: Author's Study

Bank account (DV)	Logit		Probit	
	A	B	A	B
Profession		2.641***		1.253***
		(0.611)		(0.290)
Income		2.774***		1.411***
		(0.689)		(0.342)
Education		1.505***		0.814***
		(0.440)		(0.231)
Deposit & withdraw ability	6.085	7.495***	3.117	3.915***
	(0.659)	(1.016)	(0.288)	(0.484)
DPS & loan	1.176	0.803	0.585	0.448
	(0.441)	(0.527)	(0.236)	(0.278)
DPS & loan interest rate	3.295	3.765***	1.517	2.059***
	(0.574)	(0.666)	(0.249)	(0.356)
Installment	0.337	0.326	0.100	0.180
	(0.253)	(0.304)	(0.135)	(0.169)
Security money	− 1.603	− 0.493	− .607	− 0.336
	(0.523)	(0.592)	(0.249)	(0.301)
_cons	− 9.72	− 15.09	− 4.83	− 7.67
	(1.066)	(2.184)	(0.491)	(1.037)

This model presents the association between financial literacy and banking access. Part A of the logit model shows − 82.60 log-likelihood, LR chi^2 (5) is 977.61, and model fits at 85.54% Pseudo R^2 value; where part B shows − 61.84 log-likelihood, LR chi^2 (8) is 1019.12, and model fits at 89.18% Pseudo R^2 value. On the other hand, Part A of the Probit model shows − 83.57 log-likelihood, LR chi^2 (5) is 975.66, and the model fits at 85% Pseudo R^2 value; where part B shows − 62.88 log-likelihood, LR chi^2 (8) is 1017.04, and model fits at 89% Pseudo R^2 value. The value of Prob > chi^2 is 0 for all models, and the observation of A & B is 852. ***, **, * refer significance level at 99%, 95%, 90%, respectively. The value within the first bracket is the standard error value

The dependent variable was coded 1 if the respondent had a personal bank account and coded 0 if the respondent was not the bank account holder. The independent variables, including profession, and money deposit and withdrawal ability, are dummy variables. The other independent variables, such as income, education, knowledge (Kn) of savings & loans, knowledge of savings & loan interest rate, knowledge of instalment, knowledge of security money, are categorical with a five-point Likert scale.

Table 6 presents the regression results of the banking access model. All common variables (profession, income, education) were found to significantly impact an individual's banking access. People with higher income and higher education are more likely to open a bank account. For the banking-related variables, the knowledge regarding deposit and withdrawal ability significantly affected the finance access ($p = 0.000$) with the highest coefficient (7.495), suggesting that rural residents considered the ability to deposit and withdraw as their primary driven factor of opening an account. Similarly, savings and loan interest rates substantially influenced people's use of banking products and services (coefficient = 3.765 and $p = 0.000$).

The microfinance access model is presented in Eq. (3) as given below:

Table 7 Regression result of microfinance access and financial literacy. *Source*: Author's Findings

Microfinance (DV)	Logit model		Probit model	
	A	B	A	B
Profession		− 1.534		− 1.051*
		(1.037)		(0.562)
Income		− 5.221***		− 2.937***
		(1.535)		(0.818)
Education		1.756***		0.845**
		(0.666)		(0.358)
Deposit & withdraw ability	10.007	22.55***	5.178	11.874***
	(1.459)	(5.487)	(0.694)	(2.822)
Savings & loan	2.523	5.911***	1.113	3.040***
	(0.504)	(1.615)	(0.225)	(0.817)
Savings & loan interest rate	1.159	4.580***	0.808	2.537***
	(0.439)	(1.475)	(0.234)	(0.775)
Installment	− 0.226	0.989	− 0.004	0.576
	(0.338)	(0.835)	(0.174)	(0.418)
Security money	2.654	4.708***	1.252	2.541***
	(0.502)	(1.160)	(0.245)	(0.608)
Personal investment	− 1.311	− 4.143***	− 0.662	− 2.138***
	(0.408)	(1.093)	(0.209)	(0.570)
_cons	− 17.418	− 39.24	− 9.196	− 20.45
	(2.551)	(10.744)	(1.289)	(5.471)

This model presents the association between financial literacy and microfinance access. Part A of the logit model shows − 63.24 log-likelihood, LR chi^2 (6) is 1046.35, and model fits at 89% Pseudo R^2 value; where part B shows − 43.701 log-likelihood, LR chi^2 (9) is 1085.41, and model fits at 93% Pseudo R^2 value. On the other hand, Part A of the Probit model shows − 65.67 log-likelihood, LR chi^2 (6) is 1041.48, and the model fits at 88% Pseudo R^2 value; where part B shows − 44.97 log-likelihood, LR chi^2 (9) is 1082.89, and model fits at 92% Pseudo R^2 value. The value of Prob > chi^2 is 0 for all models, and the observation of A & B is 852. ***, **, * refer significance level at 99%, 95%, 90%, respectively. The value within the first bracket is the standard error value

$$\begin{aligned} Logit\ (MFAcc) = {} & \beta_0 + \beta_1 * Profession + \beta_2 * Income + \beta_3 * Education \\ & + \beta_4 * Deposit\ \&\ Withdraw\ Ability + \beta_5 * Kn\ of\ DPS\ \&\ loan \\ & + \beta_6 * Kn\ DPS\ \&\ Loan\ Interest\ Rate + \beta_7 * Kn\ of\ Installment \\ & + \beta_8 * Kn\ of\ Security\ Money + \beta_9 * Kn\ of\ Personal\ Investment + \varepsilon_i \end{aligned} \tag{3}$$

The dependent variable was coded 1 if the respondent had a microfinance or NBFI account. However, it was coded 0 if the respondent was not the microfinance and NBFI holder. The independent variables such as profession and deposit & withdrawal ability are dummy variables. Other independent variables, knowledge of savings and loans, knowledge of savings and loan interest rate, knowledge of instalments, knowledge of security money, knowledge of personal investment, are categorical with a five-point Likert scale.

Table 7 presents the regression results of the microfinance access model. First, the microfinance access model's result was different from the banking access model for common demographic variables. The profession variable was not significant in the logit model; however, weakly significant at a 90% confidence level in the Probit model, suggesting that people involved in business were more willing to open a microfinance account. Other two common variables (income and education) have highly significant influence on microfinance access (coefficient = -5.221 & $p = 0.001$,

Table 8 Regression result of FinTech access and financial literacy. *Source*: Author's Findings

FinTech account (DV)	Logit model		Probit model	
	A	B	A	B
Profession		− 0.348		− 0.113
		(0.316)		(0.170)
Income		0.490***		0.275**
		(0.188)		(0.107)
Education		0.779***		0.344**
		(0.272)		(0.143)
Send & withdraw ability	5.089	5.312***	2.752	2.782***
	(0.490)	(0.502)	(0.209)	(0.206)
Billpay ability	− 0.69	− 0.750	− 0.268	− 0.323
	(0.802)	(0.859)	(0.409)	(0.431)
Software use ability	1.396	1.811***	0.839	1.045***
	(0.435)	(0.491)	(0.247)	(0.271)
Online dealing ability	1.546	2.378***	0.802	1.187**
	(0.792)	(0.887)	(0.442)	(0.477)
FinTech training	1.526	1.647***	0.869	0.903***
	(0.563)	(0.590)	(0.318)	(0.320)
_cons	− 1.56	− 0.440	− 0.957	− 0.574
	(0.155)	(0.622)	(0.086)	(0.346)

This model presents the association between financial literacy and FinTech access. Part A of the logit model shows − 182.95 log-likelihood, LR chi^2 (5) is 679.05, and model fits at 65% Pseudo R^2 value; where part B shows − 173.75 log-likelihood, LR chi^2 (8) is 697.46, and model fits at 67% Pseudo R^2 value. On the other hand, Part A of the Probit model shows − 181.77 log-likelihood, LR chi^2 (5) is 681.4, and the model fits at 65% Pseudo R^2 value; where part B shows − 176.63 log-likelihood, LR chi^2 (8) is 695.7, and model fits at 67% Pseudo R^2 value. The value of Prob > chi^2 is 0.000 for all models, and the observation of A & B is 852. ***, **, *refer significance level at 99%, 95%, 90%, respectively. The value within the first bracket is the standard error value

and coefficient = 1.756 & $p = 0.008$, respectively). The findings indicated that lower-income but comparatively higher-educated people are more likely to open a microfinance account. Though the education variable was highly significant in the logit model at 99% confidence level, the probit model showed a lower confidence level at only 95%.

For the other variables, similar to the banking access model, knowledge regarding depositing into a bank and withdraw from the bank, and savings and loan interest rates variables were highly and positively significant (coefficient is 22.55 and p-value is 0.000, and the coefficient is 4.58 and p-value is 0.002, respectively). The identical results were reported for knowledge regarding savings and loan and security money variables (Coefficient is 5.911 & p-value is 0.000, and the coefficient is 4.708 & p-value is 0.002, respectively). The findings suggested that more literate respondents towards deposit, withdrawal, savings, and loans had a higher probability of getting microfinance access. The personal investment negatively impacted the participants' access to microfinance, showing the lower capability of seeking microfinance help led to a higher possibility of opening a microfinance account. Security knowledge was positively associated with microfinance access. Finally, knowledge regarding personal investment variable was found to impact microfinance access negatively. People who have better investment knowledge seemed to less use microfinance services.

Equation (4) presents the FinTech access model, which is given as below:

Table 9 Robustness checking with complementary log–log regression. *Source*: Authors' experiment

Covariates	Complementary log–log regression		
	Banking	Microfinance	FinTech
Profession	2.498***	−1.346**	−0.068
	(0.502)	(0.619)	(0.201)
Income	2.415***	−3.070***	0.266**
	(0.604)	(0.845)	(0.133)
Education	1.246***	0.650*	−0.169
	(0.325)	(0.380)	(0.181)
Deposit & withdraw ability	6.086***	10.907***	
	(0.866)	(2.697)	
DPS & loan	0.624	2.788***	
	(0.395)	(0.758)	
DPS & loan interest rate	2.734***	2.449***	
	(0.535)	(0.725)	
Installment	0.217	0.617*	
	(0.231)	(0.353)	
Security money	−0.343	2.467***	
	(0.441)	(0.667)	
Personal investment		−1.832***	
		(0.570)	
FT send & withdraw			2.738***
			(0.188)
Billpay ability			−0.309
			(0.393)
Software use ability			1.073***
			(0.342)
Online dealing ability			1.320**
			(0.531)
FinTech training			0.910**
			(0.379)
cons	−12.68	−10.016	−1.684
	(1.974)	(5.102)	(0.423)

This model defines the robustness test of all models with Complementary Log–log regression. The banking model shows −53.157 log-likelihood, LR chi^2 (8) is 1036.49, microfinance model shows −46.57 log-likelihood, LR chi^2 (9) is 1077.69, FinTech model shows −178.60 log-likelihood, LR chi^2 (8) is 687.76. The value of Prob > chi^2 is 0 for all models, and the observation of A & B is 852. ***, **, * refer significance level at 99%, 95%, 90%, respectively. The value within the first bracket is the standard error value

$$\begin{aligned} Logit\ (FinTech\ Account) &= \beta_0 + \beta_1 * Profession + \beta_2 * Income + \beta_3 * Education \\ &+ \beta_4 * Send\ \&\ Withdraw\ Ability + \beta_5 * Billpay\ Ability \\ &+ \beta_6 * Software\ Using\ Ability + \beta_7 * Online\ Dealing\ Ability + \beta_8 * FinTech\ Training \end{aligned} \tag{4}$$

In Eq. (4), the dependent variable is the usage of FinTech (mainly mobile money) account. Both the dependent and independent variables *are* dummy variables with binary code. They have coded 1if the respondent had a positive response (Yes) and coded 0 if the respondent provided a negative response (No).

Table 8 presents the regression results of the FinTech access model. This model experienced a comparatively lower value of Pseudo R^2 compared to the other two models

for banking access and microfinance access. However, there were still 70% of respondents who have access to financial technology. The majority of respondents coming from lower-income and less educated groups did not show their interest in using any FinTech devices or mobile money. Income and education showed a positive relationship with FinTech access at the significant level of99% (coefficient 0.490 & 0.779, respectively). These two variables had a lower effect on FinTech access compared to banking and microfinance access. Like the other two access methods, money sending and withdrawal ability were highly associated with Fintech access (coefficient is 5.312 and *p*-value is 0.000). Besides, software using ability, online dealing ability, and fintech training are positively related to FinTech usage, particularly for mobile money account. The result shows a currently increasing trend when more people have been using software for FinTech activities and online shopping.

Robustness

Logistic and probit regression models are commonly used for analysing binary response data, but these models' maximum likelihood estimators are not robust to outliers. The robustness of the method is tested using real and simulated data sets. This study used a complementary log–log regression model to check the other two models' acceptability, logit & probit. Table 9 and the logit models' results indicate that most of the variables' value was similar to the complementary log–log regression model. In some cases, there were slight differences in *p*-value; however, these were insignificant to consider for any decision.

Discussion & conclusion

Discussion

Financial access is the leading factor in promoting rural finance and financial inclusion. Our study aimed to examine the impact of financial knowledge on accessing financial products and services in Bangladesh, using the logit model, probit model, and complementary log–log regression model. For this study, we consider three approaches to getting financial access: banking, microfinance, and FinTech (mobile banking). Some variables showed insignificant results due to participants' poor responses, supporting the assumption that respondents were not familiar with those financial activities; Their lack of knowledge about financial activities was considered the obstacle for preventing financial access development. Overall, the empirical findings demonstrated that financial literacy had a positive effect on access to finance. Financial knowledge was one of the most influential forces to enhance financial inclusion. It is expected to provide a significant contribution toward promoting financial communication for rural and lower-income people. Proper knowledge regarding different financial services influenced strongly in getting financial access and extending other financial services. Rural respondents' knowledge was limited to a small number of banking services and activities. The financial institutions have not paid enough attention to educating people from rural areas about financial access.

The three models' results indicated that people were not familiar with any financial training, which might positively influence future financial inclusion. Only 14%, 6%, and 18% of people had proper banking, microfinance, and FinTech uses, respectively. Koomson et al. (2019) revealed that financial literacy training significantly impacted account ownership, and financial literacy training beneficiaries were more likely to intensify inclusive finance. Besides, this study recommended that financial literacy training might reduce the financial gap.

First, demographic variables significantly impacted banking, microfinance, and FinTech access. Higher-income level groups were more likely to be the bank account holder and FinTech users. Grohmann et al. (2018) specified that income was usually related to financial literacy. The opposite trends were reported for microfinance, where people at lower-income levels had a higher probability of using microfinance products and services. This can be explained by the popularity of microfinance for poor people. Microfinance, as the banking for poor people, was introduced broadly by Nobel laureate *Professor Muhammad Yunus*. Similarly, the profession also highly positively affected banking access and showed a negative influence on microfinance. Education played an important role in individuals' banking and microfinance access, although its impact on FinTech access was not clear. Though FinTech users accounted for 70% of respondents, which was higher than the number of banking and microfinance account holders (60% and 45%, respectively), respondents were less familiar with FinTech services. This result was in line with the literature (Morgan and Trinh 2019; Kodongo 2018), which emphasised financial literacy as a determinant to increase financial inclusion.

People seemed to know better about banking services than those of another two access options. More knowledge regarding financial services and activities led to more accounts open in financial institutions. Knowledge regarding bank savings and loans, instalment, and security money seemed to not affect the financial access. For example, individuals' good knowledge of the instalment procedure did not affect their access to microfinance. However, in the literature, increasing financial literacy would increase account ownership (Grohmann et al. 2018).

As stated earlier in the discussion section, respondents were not familiar with FinTech products and services; thus, there is a big platform to enhance financial inclusion through FinTech access. As basic training on FinTech services was not deployed widely to the whole population, most people only used Fintech services for sending and withdrawing money. Proper knowledge regarding other FinTech activities may help them to utilise more effectively those financial technology applied services.

Theoretical and practical implication

Rural consumers' knowledge about financial services is a new aspect of inclusive finance research. This study will significantly contribute to the study on financial literacy concept. It mainly highlights the importance of knowledge regarding specific products and services to promote financial inclusion. The idea of financial literacy is still underway to be included as a core issue of finance, both in the theoretical and practical perspectives. Our research emphasises the importance of financial literacy to include excluded people from formal financial systems. These excluded people came from the unprivileged and vulnerable groups in rural areas. More financial training and education will inspire rural

consumers to involve in financial services. The rural consumers will be equipped with the knowledge to select suitable financial products and services. The study's empirical findings also provide valuable recommendations for the policymaker to improve financial inclusion in the developing country context. A comprehensive and long-term education program should be introduced broadly to the rural population to make a big stride in financial inclusion, a key driver of poverty reduction and prosperity boosting.

Conclusion

Financial literacy is considered as one of the vital factors of financial inclusion. Rural people who have better knowledge of financial services s/she has more possibility to be included into formal financial systems. Based on these concepts, this study was conducted. In order to investigate the likelihood of getting financial access (banking, microfinance, and fintech), mainly two experimental models were experimented in this study; the logit model, and probit model. Also, the complementary log–log regression model was used to test robustness of the primary models. Usually, the probit model and a complementary log–log regression model are the two common models used as the alternative model to logistic regression. Whatever, after investigating the findings of this research, this study concludes that knowledge regarding financial services is one of the most influential forces to promote inclusive finance. It also has a significant contribution to developing financial communication capabilities for rural and lower-income countryside people. Proper understanding of different financial services has a significant impact on access to financial opportunities, especially the expansion of the use of other financial services. Rural people only know a limited number of banking services and activities; this is why, they continue to be limited to these services. In most cases, they believe that the only activities of banks are also limited to deposits and withdrawals from banks. This is the reason for why they do not go for other financial services. In addition, financial institutions have not yet arranged any obvious training programs to stimulate access to financial opportunities. All the common covariates can have a significant impact on financial access, but it depends on each access pattern. In any case, there are also several challenges that exist in getting financial access. These works are considered as the major obstacle to the promotion of inclusive finance. More specifically, the interviewee only knew about the general services of banking, microfinance, and financial technology access. Even, financial institutions have not carried out such activities to literate rural people about financial access. For example, the banking training and microfinance training were insignificant and dropped from the main model due to very poor response. This is also considerd here as a significant limitation. Usually, institutions use the advertising policies to inform rural people about services; however, this study considered these advertising policies are not enough to inform the rural people about financial products or services.

Future research scope

Future studies could be undertaken for different countries and regions, such as other underdeveloped and developing countries, where financial inclusion is still an emerging issue. Studies examine the measure of financial knowledge and compare this factor between low-income rural groups and high-income educated people are in need. The

proposal of an index for financial literacy, especially in underdeveloped and developing countries, could be conducted. As financial technology has become the most emerging financial communication approach, avenues for possible future research focusing on financial innovation training and developing FinTech access to all population groups are also open.

Appendix

Source: **Authors' explanation.**

	Variance	Coef	Std. Err	[95% Conf. Interval]
Banking				
Var (e.Profession)	0.9839	0.0086	0.9673	1.0008
Var (e.Income)	0.7316	0.0260	0.6824	0.7843
Var (e.Education)	0.7845	0.0250	0.7371	0.8350
Var (e.Deposit & Withdraw Ability)	0.1682	0.0105	0.1488	0.1901
Var (e.DPS & Loan)	0.4689	0.0234	0.4252	0.5171
Var (e.DPS & Loan Interest rate)	0.5188	0.0247	0.4726	0.5694
Var (e.Instalment)	0.5651	0.0255	0.5172	0.6174
Var (e.Security Money)	0.6322	0.0263	0.5827	0.6858
Microfinance				
Var (e.Profession)	0.7158	0.0139	0.6890	0.7436
Var (e.Income)	0.9978	0.0032	0.9916	1.0041
Var (e.Education)	0.9810	0.0093	0.9630	0.9993
Var (e.Deposit & Withdraw Ability)	0.1870	0.0116	0.1657	0.2111
Var (e.DPS & Loan)	0.2364	0.0183	0.3565	0.4233
Var (e.DPS & Loan Interest rate)	0.6125	0.0261	0.5634	0.6659
Var (e.Instalment)	0.4174	0.0218	0.3767	0.4624
Var (e.Security Money)	0.4674	0.0234	0.4238	0.5156
Var (e.Personal Investment)	0.5992	0.0260	0.5503	0.6523
FinTech				
Var (e.Profession)	0.6972	0.0145	0.6694	0.7261
Var (e.Income)	0.9257	0.0173	0.8924	0.9602
Var (e.Education)	0.8522	0.0225	0.8093	0.8973
Var (e.FT Send & Withdraw)	0.3443	0.0191	0.3088	0.3839
Var (e.Billpay ability)	0.7224	0.0261	0.6731	0.7754
Var (e.Software Use Ability)	0.8509	0.0225	0.8079	0.8962
Var (e.Online Dealing Ability)	0.9301	0.0169	0.8976	0.9637
Var (e.FinTech Training)	0.8270	0.0236	0.7821	0.8745

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Authors' contributions
The concept, design, methods, result analysis, paper writing (Morshadul Hasan), Introduction, discussion, implications, and conclusion (Thi Le), editing, revising, proofreading, language editing (Ariful Hoque).

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