Exploration of the Dominant Features of Mobile Banking Transactions in Bangladesh During the Covid-19 Pandemic

Rony Kumar Datta[1*], Sakila Zabin[2], Tasfia Akter[3], Md. Tarek Hussain Prodhan[4],

1.PhD Fellow, Institute of Bangladesh Studies, University of Rajshahi, Bangladesh, and
Associate Professor**,** Department of Finance and Banking, Hajee Mohammad Danesh
Science and Technology University (HSTU), Dinajpur, Bangladesh.
2. Lecturer**,** Department of Finance and Banking, Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, Bangladesh.
3. MBA in Finance,Department of Finance and Banking, Hajee Mohammad Danesh Science andTechnology University (HSTU), Dinajpur, Bangladesh.
4. Principal Officer, Mercantile Bank PLC, Bangladesh.
Corresponding Author**: Rony Kumar Datta**
DOI: 10.54882/13202313202317739

Abstract

This study attempts to investigate the key factors affects the mobile banking transactions in Bangladesh during thecovid-19 pandemic. Based on a survey of 200 mobile banking usersof Bangladesh, this studycollected primary data through anonline based semi-structured questionnaire. Data has been analyzed by applying exploratory factor analysis and descriptive statistics. The principal axis factoring (PAF) extraction method with an oblique rotation (Promax) method has been applied to extract and select the influential factors based on the communalities (factor loading), Eigenvalue value, and pattern matrix. Following the factor analysis, this study consideredfive main factors namely transactions volume and cost, facilities offered by service providers, transactions reliability and secrecy, covid-19 aspects, and demographic features of the respondents. The results of this study indicated that the number and amount of transactions, agent's location, ATM facilities, prompt and quick service, the attractiveness of product and features, trustworthiness, privacy issue, and technological security have a positive impact whereas transactions cost and internet cost have a negative impact on the volume of mobile banking transactions. Additionally, the study revealed that imposed lockdown by the Government, safety measures taken by agents, and avoiding bank branch visits due to the restrictions of the covid-19 pandemic have a noteworthy positive influence on the volume of mobile banking transactions. The empirical findings of this study are beneficial to mobile banking service providers in designing their products and strategies, as well as to the regulatory authorities and stakeholders of bank and non-bank financial institutions.

Key Words: Covid-19, Mobile Banking, E-Banking, FinTech, Financial Inclusion.

1. Introduction

Now a day's mobile whether it is a smartphone or feature phone is an indispensable instrument for our everyday life and many of our essential functions are assisted by mobile especially financial transactions. Mobile banking is an m-commerce program that allows clients to use their mobile devices to access their bank accounts and conduct and complete bank-related operations such as balancing checks, checking account statuses, transferring money, and

selling securities (Kim et al. 2009). Mobile banking, according to Luo et al. (2010), is a new approach for receiving financial services via a channel in which a consumer interacts with a bank via a mobile device. Mobile phones have evolved into a tool for everyday usage, opening the door for banking services to reach traditionally unbanked populations through mobile banking.Mobile banking makes basic financial services more accessible to low-income people by reducing travel time and distance to retail bank locations (Ivatury and Pickens, 2006).

As per the view of the World Bank, greater use of digital finance contributes to greater financial inclusion. World Bank also stated that the theoretical underpinning for the relationship between digital finance and financial inclusion is the premise that the provision of financial services via mobile phones and related devices can increase access to finance for a major portion of the excluded population owns (or has) a cell phone (World Bank, 2014).Since 2011, 1.2 billion adults worldwide have gained access to a bank account, indicating significant progress toward financial inclusion. Now adults have 69 percent accounts. For countries where 80 percent or more of the population has accounts, the next step is moving from account access to account usage (China, Kenya, India, and Thailand).However, according to the latest Findex data,close to one-third of adults (1.7 billion) are still unbanked. 76% of all individuals around the globe now have an account, including 71% of those living in developing nations. About 40% of individuals in developing economies paid their utility bills directly from an account (18% of adults). Women from low-income rural homes or those who are unemployed makeup about half of the unbanked population. Even though the gender disparity in account ownership has dropped to 6 percentage points from 9 percentage points in developing countries, making it difficult for women to successfully manage their finances (Demirgüç-Kunt et al., 2022). Nevertheless, gender inequality is lower in countries where mobile money accounts are widely used.So, in this regard, there are huge opportunities for developing countries like Bangladesh to penetrate the unbanked population into the space of banking services through mobile banking as financial inclusion for sustainable development in the financial sector.

During the covid-19 pandemic, almost entire world suffersbadly and the economic activities remains stuck of a sudden. The pandemic has already damaged real economic activity, and the limit is yet to know. People were about to prisoned in their homes and they were not performing their normal lives. During that hard period most individuals depends on digital tools mostly on mobile phones and trying to do all types of financial transactions such as paying bills for necessary consumer goods and utility bills, transfer money, mobile recharge, donations, withdraw money, loan installment, insurance premium, etc. through mobile banking technologies. Due to health safety measures, every individual attempt to fulfill their daily financial and banking needs from home instead of going outside. In these circumstances, peoples were more inclined to use mobile banking in this pandemic period as compare to before the covid-19 pandemic period. Covid-19's behavior has been dubbed "the once-in-a-century pathogen" by Gates (2020).Covid-19 wreaks havoc on a country's economy unlike any other natural or man-made disaster, including climate change, nuclear warfare, natural disasters, and local tragedies (Goodell, 2020). According to him, covid-19 has a wide variety of effects on financial sectors, including banking and insurance, the stock market, and leasing.To cope up with the adverse effect of covid-19 on the financial sector, the financial institutions tries to provide their continuous financial services through mobile banking and other online banking platforms and also the customers are welcomed and habituating to take services in this way. Since a major portion of the population lives in rural areas, there are many scopes and opportunities for banks and other non-bank financial institutions to provide banking services through mobile Banking. But numerous factors can affect mobile banking transactions especially this covid-19 pandemic period. This study aims to unearth those factors of mobile banking transactions which are so much significant and equally important in the context of Bangladesh. Therefore, based on the discussion above this study has the following specific objectives:

i)To observe the demographic characteristics of the mobile banking users in Bangladesh.
ii)To explore and evaluate the key factors that can influence the transactions of mobile bankingin Bangladesh during the covid-19 pandemic.

2. Literature review

There are plentiful pieces of literatureof different scholars regarding mobile Banking and its factors that can affect its transactions both at home and abroad. But there are very few numbers of works of literature in the context of Bangladesh during this pandemic. Many scholars have worked on various factors especially risk factors and other common factors about mobile Banking transactions.But so far in my knowledge, no outright attempt has been found to examine the effectiveness of common factors of mobile Banking transactions during this pandemic period in Bangladesh.Some significant studies that are related to this research issue have been summarized.

Mobile banking is a cutting-edge financial solution that allows users to access interactive bank services while on the go using a smartphone and software apps. SIM-type cell phones and other portable electronic devices are considered mobile banking instruments (Ho et al., 2020).Sharma et al. (2022) pointed out that the "new age transaction" method that promises to upend the world economy is mobile banking.

Due to Daragmeh A. (2021)'s observations on FinTech payments in covid-19 social distancing and the necessity to decrease in-person transactions, entities such as the World Health Organization are promoting the usage of contactless payment systems. According to the study, Hungarian Generation X's behavioral intents to utilize mobile payment services during the pandemic are highly influenced by perceived covid-19 risk, perceived utility, and subjective norms. The adoption of fintech and the spread of covid-19 were found to be significantly positively correlated in the study of Fu and Mishra (2022), suggesting that countries with higher covid-19 death rates also had higher fintech adoption rates. During the Covid-19 epidemic, Sleiman et al. (2023) aimed tostudy consumer intents based on technical perceptions to investigate the reasons driving the acceptance of mobile payments in China by applying the unified theory of acceptance and use of technology (UTAUT) model. When compared to a number of explanatory variables, such as age, gender, income range in RMB, and high education attainment, acceptance of payments was significantly impacted by perceived effort expectancy during the Covid-19 outbreak.Additionally, acceptance of payments was negatively impacted by performance expectations, trust, perceived security, and high education attainment.Tut (2023) conducted the study to capture the impact of the covid-19 pandemic on electronic payment systems and the adoption of FinTech in Kenya. It draws attention to the rise in transactions made through mobile banking, the fall in the use of electronic payment cards, and the contribution of FinTech to mitigating the pandemic's harmful effects.

George (2012) observed the factors determining the use of mobile financial services in Kenya by applying a multinomial logit model that used three types of financial services i.e. mobile money transfers, mobile payments, and mobile banking against various explanatory factors such as age, gender, and education level, the tariff of service and volume of transactions. The study found that the use of mobile payments and mobile banking is influenced by a person's gender, education, and wealth, as well as the service rates and transaction volume. Andrianaivo and Kpodar (2011) conducted a study amongfinancial inclusion, information and communication technology (ICT), and growth employing data from African countries. They used a sample of African countries from the year 1988 to 2007 and shown the mobile phone rollout as an impact of information and communication technologies (ICT) on economic growth.

In India,the study of Kaur and Kaur (2013) showed that there is no significant difference in facilities determining the customers' usage of internet banking services of public-sector, private-sector, and foreign banks in India. Performance expectancy, effort expectancy, social influence, enabling condition, trust, and behavioral intents were all elements evaluated in a study done in Malaysia by Mohan et al. (2013), who employed the technology acceptance model (TAM).According to the study, self-efficiency and trust are not positively associated with the intention to use online banking; however, perceived ease of use increases the intention to use online banking.Paramasivan and Ganeshkumar (2013) conducted a study on the overview of financial inclusion in India and found a significant impact of branch density on financial inclusion. According to Oruo (2013), economic growth in Kenya has a significant positive link with branch networks and a weak positive relationship with the number of mobile money users/accounts.The study also discovered a modest negative association between the

country's number of automated teller machines and a big negative relationship between Kenya's bank lending interest rates.According to a study conducted in India by Kamboj (2014), the number of bank branch networks and ATMs in the country has a positive link with the country's GDP growth rate.

Malady (2016) suggested that, despite having digital banking credentials to access the digital financial system, consumers in many emerging markets are not active users of digital channels due to a lack of consumer trust and confidence in new channels.Customers' lack of faith in digital finance channels hurts a digital-finance-led financial inclusion program in emerging and developing countries, and the problem is worsened in countries with poor consumer protection organizations and regulations. As a result, increased financial data inclusion (or having digital banking credentials) does not necessarily improve poor people's access to finance if they do not trust digital channels.Uma et al. (2013) evaluated the economic and general impact of financial inclusion in Hunsur taluk, Mysore district, India, and found that financial inclusion had a beneficial impact on saral saving account holders.Datta (2021) examined a study to show the influence of financial inclusion on the GDP of Bangladesh and found a positive significant relationship between active mobile money accounts and financial inclusion.

A little number of kinds of literature on factor analysis regarding mobile banking is available in the context of Bangladesh. According to Islam et al. (2018), the ease of use and responsiveness of the system, transaction security in ATM booths, and technical difficulties are all important aspects that influence Bangladeshi mobile banking users' experiences.For the improvement of mobile banking services in Bangladesh, this study suggests that customers' experiences with mobile banking are influenced by issues such as transaction security at ATM booths and technological complexity, and the convenient and responsive system of mobile banking. Datta (2021) conducted a study showing an association between cashless banking and bank's profitability in Bangladesh. His findings show that there is a positive and significant influence of transactions volume of mobile financial services (MFS) on return on assets (ROA) of the banking industry of Bangladesh. Siddique et al. (2010) established a range of indicators to measure the access to banking services and identified barriers to FI in Bangladesh. According to Kabir (2013), issues such as performance risk, security/privacy risk, time risk, social risk, and financial risk are negatively associated with mobile banking usage because perceived risk causes customers to be skeptical of their security when using mobile banking.Whereas the inclination to use mobile banking services is positively associated with qualities such as ability, integrity, benevolence, perceived utility, perceived simplicity of use, relative cost, and time advantages.It was also discovered that the security and trust element is the most influential aspect, with ineffective advertising having a negative impact on mobile banking consumer happiness.Khan et.al (2017) examined demographic variables and users' perceptions that influence the adoption of mobile banking in Bangladesh and found that differences in demographic characteristics do not influence mobile banking adoption. It was also discovered that mobile banking acceptance is influenced by perceptions of security, affordability, and convenience, and the complexity of using the service. The perception of trustworthiness and the network difficulty, on the other hand, was shown to have no effect.

From the reviews of the above-mentioned works of literature, it is observed that there are numerous researches in home and aboard based on the factors affecting the mobile banking transaction behavior as well as attitude towards mobile banking in Bangladesh. But no outright attempt has been initiated to undertake any research based on the influencing factors of mobile banking transactions during the pandemic of covid-19. Therefore, the current study has intended to bridge the above-stated research gap of identifying the significant factors that are influencing mobile banking transactions during the covid-19 pandemic.

3. Materials and methods

3.1 Data collection strategy

Primary data has been used for this study based on the objectives.The respondents were adults male and female. A total of 220 respondents from Bangladesh were selected based on the random sampling method. The time frame for gathering data was November 2021 to February 2022. Responses of the respondents were collected

indiscriminately from students, business people, government, and private service holders through an online-based(Google forms) semi-structured questionnaire. Incomplete, biased, and abnormally answered responses were discarded through scrutinizing process and finally accepted 200 responses which were used in the analysis of this study. Pre-testing and reliability testing were used to determine the variables.

Table 1: Items/ variables under consideration

Item No.	Item Name	Item No.	Item Name
1.	AR= Age of the Respondents	15.	MN= Mobile Network
2.	GR= Gender of the Respondents	16.	MBA= Use of Mobile Banking Apps
3.	ER= Education of the Respondents	17.	RBV= Reluctant to Bank Branch Visit
4.	MR= Marital Status of the Respondents	18.	TW= Trustworthiness
5.	OCR= Occupation of the Respondents	19.	QS= Prompt and Quick Service
6.	MI= Monthly Income of the Respondents	20.	APF= Attractiveness of Mobile Banking Product and Features
7.	ME= Monthly Expenditure	21.	IC= Internet Cost
8.	MT= Type of Mobile	22.	PI= Privacy Issue
9.	MBBP= Mobile Banking Brand Preference	23.	TS= Technological Security
10.	NT= Number of Transactions	24.	HCP= History of Any Covid-19 Patients in the Family
11.	AMBT= Amount of Mobile Banking Transactions per day.	25.	STA= Safety Issues Taken by Agents.
12.	TC= Mobile Banking Transactions Cost	26.	GL= Imposed of Lockdown by Government
13.	AL= Mobile Banking Agents Location	27.	CAV= Covid-19 Pandemic as a Reason to Avoid Bank Branch Visit
14.	ATMF= ATM Facilities		

The questionnaire was included both closed and open-ended questions so as to obtain both quantitative and qualitative data. This study was designed the questionnaire in a multi-item scales response format by considering twenty-seven items (Table 1) based on demographic characteristics, mobile banking, and covid-19 related features of the respondents to explore the significant factorsof mobile banking transactions in Bangladesh during the covid-19 pandemic.

3.2 Methods

Based on the study of Islam et al. (2018) and Islam and Hossain (2014) this study has conducted Kaiser-Meyer-Olkin (KMO) and Bartlett'stest of sphericity to observe the accuracy of the sample. The reliability, as well as internal consistency of the data, has been analyzed on the basis of the value of Cronbach's Alpha.

This study used both descriptive and inferential statistics to analyze the data. Frequencies, percentages, mean, and standard deviation were used to observe the descriptive statistics. Exploratory factor analysis was initiated as inferential statistics to explore the factors that are affecting mobile banking transactions during the covid-19 pandemic.The principal axis factoring (PAF) extraction method with an oblique rotation (promax) method was applied and the significant factors along with their corresponding items were extracted and selected based on the communalities (factor loading), eigenvalue value, and pattern matrix. The SPSS software was used for all of the analyses.

4. Results and discussion

4.1 Descriptive statistics

This study considered age (AR), gender (GR), education (ER), marital status (MR), occupation (OCR), monthly income (MI), monthly expenditure (ME), type of mobile (MT), and mobile banking brand preference (MBBP) of the respondents as demographic characteristics. To clean the data and to avoid the error of the estimates, outliers and missing values of all factors under consideration have been observed. The frequency table of these demographic factors has been summarized in Table 2. Most of the respondents were in the 18-30 years of the age range (54%), which simplifies that usually business persons (41%) are using mobile banking and taking services. The male and female ratio of the respondents was 68% and 32% respectively and it denotes that male respondents are more likely to conduct mobile banking than female respondents. The monthly income range of the respondents is less than BDT 10,000, almost a similar range to expenditure. Most of the respondents used smartphones rather than feature phones, with a ratio of 85% and 15% respectively. Mobile banking users have mostly bkash accounts (42%) and use a combination of bkash & rocket and bkash & nagad which is 20% and 19% respectively.

Table 2: Demographic information of the respondents

Demographic Characteristics		Frequency	Percent	Valid Percent	Cumulative Percent
Age	18-30	108	54.0	54.0	54.0
	31-40	42	21.0	21.0	75.0
	41-50	16	8.0	8.0	83.0
	51-60	18	9.0	9.0	92.0
	61-above	16	8.0	8.0	100.0
Gender	Male	136	68.0	68.0	68.0
	Female	64	32.0	32.0	100.0
Education	Secondary	16	8.0	8.0	8.0
	Higher Secondary	30	15.0	15.0	23.0
	Graduation	154	77.0	77.0	100.0
Occupation	Govt. Service	16	8.0	8.0	8.0
	Private Service	18	9.0	9.0	17.0
	Student	52	26.0	26.0	43.0
	Business Person	82	41.0	41.0	84.0
	Unemployed	18	9.0	9.0	93.0
	Other	14	7.0	7.0	100
Monthly Income	0-10,000	116	58.0	58.0	58.0
	10,000-20,000	20	10.0	10.0	68.0
	20,000-30,000	24	12.0	12.0	80.0
	30,000-Above	40	20.0	20.0	100.0

Monthly Expenditure	0-10,000 10,000-20,000 20,000-30,000 30,000-Above	118 30 22 30	59.0 15.0 11.0 15.0	59.0 15.0 11.0 15.0	59.0 74.0 85.0 100.0
Type of Mobile	Smart Phone Feature Phone	170 30	85.0 15.0	85.0 15.0	85.0 100.0
Mobile Banking Brand Preference	Bkash Rocket Nagad Bkash & Rocket Bkash&Nagad	84 24 14 40 38	42.0 12.0 7.0 20.0 19.0	42.0 12.0 7.0 20.0 19.0	42.0 54.0 61.0 81.0 100.0

4.2 Extraction communalities and variance

This study has investigated communalities (factor loading) of individual variables by applying the principal axis factoring extraction method. At the start, 27 items were taken into consideration but did not discover the absolute communalities score (≥ 0.50) for all the items (Appendix 1). Therefore, seven items have been taken out from the data set as those items score was less than 0.50. The other 20 items having a score of 0.50 or above have been allowed for further analysis (Table 3).

Table 4 shows that based on the eigenvalue- value 1 or above amongst the 20 items constituted five factors/groups which statistically can interpret approximately 42% of the field (Appendix 2). Hence, from the pattern matrix by applying the Promax rotation method, each of the 20 items has been separated for every single group/factor (Appendix 3). In Table 3, the result shows that factor- 1 has an Eigenvalue of 3.263 which is explained 12.087%, and factor-5 explained 6.037% with Eigenvalue 1.185 as the lowest. Therefore, factor-1 is the most significant factor for this present study which is related to transactional volume and cost (TVC) regarding the factors affecting mobile banking transactions during the covid-19 pandemic in Bangladesh.

In Table 3 the descriptive statistics with factor coefficients of separate items of the selected five factors have been displayed. Factor loading is the maximum correlations amid corresponding factors and the items/variables. The higher the value of the factor loading the more the variables are the pure measures of the factor. From Table 3 it is observed that there are clean measures of groups (factors) from some variables based on their higher coefficients (factor loading) and pattern matrix (Islam and Hossain, 2014). For example, GR, ER, OCR, MI, ME, and MBBP demonstrate the highest correlation with the factor demographic features (DF) and thus are considered as a group. Likewise, NT, AMBT, TC, and IC demonstrate the highest correlation with transaction volume and cost factor (TVC); AL, ATMF, QS, and APF with facilities offered by service providers (FOSP); TW, PI, and TS with transaction reliability and secrecy (TRS); and STA, GL, and CAV with covid-19 aspects (CA).

Table 3: Descriptive statistics and factor loadings of the selected variables

Factors	Item	Item name	Mean	Std. Deviation	Factors loading
Demographic Features (DF)	GR	Gender	1.32	0.469	0.608
	ER	Education	3.69	0.615	0.582
	OCR	Occupation	3.62	1.398	0.669
	MI	Monthly Income	1.94	1.229	0.946
	ME	Monthly Expenditure	1.82	1.132	0.940

	MBBP	Mobile banking Brand Preference	2.62	1.625	0.573
Transaction Volume and Cost	NT	Number of Transaction	2.54	1.176	0.586
	AMBT	Amount of Mobile Banking Transaction per day	1.95	1.527	0.636
	TC	Mobile Banking Transactions Cost	3.26	1.220	0.597
	IC	Internet Cost	1.79	1.274	0.575
Facilities Offered by Service Providers	AL	Mobile Banking Agents Location	1.52	0.522	0.791
	ATMF	ATM Facilities	1.09	0.288	0.581
	QS	Prompt and Quick Service	1.10	0.302	0.552
	APF	Attractiveness of Mobile Banking Product and Features	3.98	1.295	0.601
Transaction Reliability and Secrecy	TW	Trustworthiness	1.28	0.451	0.680
	PI	Privacy Issue	1.16	0.368	0.569
	TS	Technological Security	1.20	0.402	0.541
Covid-19 Aspects (CA)	STA	Safety Issues Taken by Agents	1.55	0.500	0.574
	GL	Imposed of Lockdown by Government	1.70	0.461	0.581
	CAV	Covid-19 Pandemic as a Reason to Avoid Bank Branch Visit	1.33	0.473	0.535

Table 4: Eigenvalue and variability of the selected factors

Factor No.	Factors	Initial Eigenvalues		
		Total	% of Variance	Cumulative %
1	TVC	3.263	12.087	12.087
2	FOSP	2.569	9.517	21.603
3	TRS	2.023	7.492	29.095
4	DF	1.970	6.797	35.892
5	CA	1.185	6.037	41.929

4.3 Scale reliability

Table 5 shows the overall reliability statistics of the twenty-seven items entirely and the result indicated that the data collection procedure is reliable with a highly recommended Cronbach's alpha score of 0.739 which is considered as a good range of reliability scale (≥ 0.70) (O'Leary-Kelly and Vokurka, 1998).

Table 6 shows the group/factor-wise statistics of reliability of the data under consideration. The result confirmed that all the factors (DF, TVC, FOSP, and TRS) except CA are consistent with the highly recommended Cronbach's alpha score. Although the factor CA's alpha score of 0.654 is below 0.70, this study has considered this factor because of having a high factor loading score(Islam and Hossain, 2014).

Table 5: Reliability statistics (overall)

Cronbach's Alpha	N of Items
0.739	27

Table 6: Reliability statistics (group/factor wise)

Factors	Cronbach's Alpha	N of Items
Demographic Features (DF)	0.831	6
Transactions Volume and Cost (TVC)	0.776	4
Facilities Offered by Service Providers (FOSP)	0.706	4
Transactions Reliability and Secrecy (TRS)	0.730	3
Covid-19 Aspects (CA)	0.654	3

4.4 Measures of sampling adequacy

Table 7 shows the result of the KMO measure and Bartlett's test that defined the existing sample as acceptable (KMO > 50% and p < 1%) for factor analysis. The existing data of this study yielded about 61.3% accuracy at a 1% level of significance (p = 0.000).

Table 7: KMO and Bartlett's Test

Kaiser-Meyer-Olkin measure of sampling adequacy		0.613
Bartlett's test of sphericity	Approx. Chi-Square	987.700
	df	351
	Sig.	0.000

4.5 Exploratory factor analysis

Based on the Eigenvalue, this study revealed that mobile banking transactions in Bangladesh are highly influenced by mainly five factors that are discussed as follows:

Demographic features: This study has identified that demographic factors have a significant influence on mobile banking transactions in Bangladesh. This factor is constructed with six items namely gender, education, occupation, monthly income, monthly expenditure, and mobile banking brand preference of the respondents. The Cronbach's alpha of 0.831 is satisfactory within the acceptance level (0.70 or above). However, the acceptance of the factor loading score is also high and within the acceptance range (from 0.573 to 0.946).

Transaction volume and cost: From the study, it is revealed thatmobile banking transactions in Bangladesh are influenced mostly bythe factortransaction volume and cost since its eigenvalue (3.26) is higher than all other factors. This factor includes four items such as the number of transactions,amount of mobile banking transactions per day,transactions cost, and internet cost. Both the factor loading score and the Cronbach's alpha is from 0.575 to 0.636 and 0.776 respectively which is within the range of acceptable level.

Facilities offered by service providers: This study also explored that mobile banking transactions are highly affected by the facilities offered by the service providersfor their consumers. This factor including mobile banking agent's location, ATM facilities, prompt and quick service, and attractiveness of the mobile banking product and features. The factor loading score for all items is within the range from 0.552 to 0.791 and Cronbach's alpha value of 0.706 is an acceptable level.

Transaction reliability and secrecy: Transaction reliability and secrecy are other significant factors that can highly influence mobile banking transactions having a factor loading score ranging from 0.541 to 0.680 and Cronbach's alpha value of 0.730 at the acceptable level. Trustworthiness, privacy issue, and technological security are the important items under this factor.

Covid-19 aspects: This research also found that COVID-19 parameters influence mobile banking transactions in Bangladesh under the current circumstances.Safety issues taken by agents, imposed lockdown by the government, and covid-19 pandemic as a reason to avoid bank branch visits are the significant items included in this factor. The range of factor loading values is from 0.535 to 0.581 which is at the acceptable level but the value of Cronbach's alpha is 0.654 which is the nearest to an acceptable level.

5. Discussion on key findings

From the analysis of the demographic features (DF), it is observed that the users of mobile banking in Bangladesh are mostly male, graduate, and business people. Most of the users are low-income people and a significant number of users are using the mobile banking brand Bkash. This study observed that the variables of the factor transaction volume and cost (TVC) are the most influential factor for mobile banking transactions during the covid-19 pandemic. Because the volume of mobile banking transactions has a positive relationship with the number and amount of transactions per day as increased number and amount of transactions are accelerated the volume of transactions. The study of Kulu et al.(2022) concluded that the composite indicator of the performance of the banking industry is negatively impacted by mobile money transactions. Again, in the study of Asongu et al. (2021) found that people would have more cash on hand and commercial banks would have less money as a result of using mobile money.However, transactions cost and internet cost have a negative relationship since increased costs can reduce the volume of transactions.

It is also explored from this study that the factor facilities offered by service providers (FOSP) and their corresponding variables have a positive relationship with the volume of mobile banking transactions. Li et al. (2023) also showed that factors such as product uncertainty, behavior uncertainty and asset specificity are positively but dependability and convenience are negatively related to consumers' perceived transaction cost. Those mobile banking service companies whose agent's location is as near as possible and are providing ATM facilities and quick services with appealing products and services are the reasons for the increasing volume of transactions.The study also revealed that the users of mobile banking are very much concerned with the secrecy, technological safety as well as the credibility of the service provider. Consequently, the volume of mobile banking transactions has a positive relationship with the factor transaction reliability and secrecy (TRS).

Many aspects of the covid-19 outbreak, according to this study, have an impact on the number of mobile banking transactions. Due to the movement restrictions as caused by lockdown by the government, many users of banking channels are using and taking mobile banking services by avoiding the physical visit of the bank branch. These aspects of the pandemic are the noteworthy reason for the increasing volume of mobile banking transactions in Bangladesh during the continuous pandemic.

6. Implications

6.1 Theoreticalimplications

The results of this study have the potential to generate and broaden the understanding within the fields of cashless banking, FinTech, financial inclusion, and sustainable finance for sustainable development. Furthermore, scholars and upcoming researchers can expand their investigations based on the constraints and potential avenues for future research of this work. Furthermore, the results of this study can aid in the advancement of theories pertaining to green finance and banking.

6.2 Practical implications

The findings of this research can be a guideline for the mobile Banking service providers to formulate and design their useful and cost-effective mobile banking products and services. Moreover, they can be able to determine the customer perception by prioritizing the factors under consideration and this can simplify as well as amplify the mobile banking transactions more user friendly during any contingent period or pandemic like covid-19. This study will also help the central bank along with the policymakers, development agencies, and government in formulating policies and taking necessary steps for the sustainable development of financial inclusion and the economy at large.

7.Conclusion and future research directions

Mobile Banking is a new but developing concept in Bangladesh and a significant number of populations resided in the rural and urban areas are using this who have a bank account or not.The primary purpose of this study is to identify the factors that influence the number of mobile banking transactions in Bangladesh during the covid-19 pandemic.From the findings of this study, it can be concluded that the uses, as well as the volume of mobile banking transactions, had increased significantly amid thecovid-19 pandemic. According to the factor analysis of this study, the most influential factors that can affect the volume of mobile banking transactions in Bangladesh are transactions volume and cost (TVC), facilities offered by service providers (FOSP), transactions reliability and secrecy (TRS), and covid-19 aspects (CA) as well as demographic features (DF) of the respondents.

However, this study suffers from some limitations which can be used as the opportunities for further research.Firstly, this study considered 200 respondents and the region of Bangladesh only. Secondly, this study only explored the key factors of mobile banking transactions but not observed any causal effect. Thirdly, the present study conducted during the covid-19 pandemic and did not show any comparison among pre, during and post covid-19 pandemic. Finally, this study ignored the other statistical methods to explore the factor analysis. Thus, further research can be conducted based on large sample and consider the entire Asian countries. Again, new research can be initiated to observe the causal effect in between and among the key factors. Additionally, there are scope to do research by comparing the incidents of pre, during and the post covid-19 and by considering the other statistical methods of factor analysis such as PCA, entropy weight method, cluster analysis and so on.

Funding

This work was funded by the Institute of Research and Training (IRT), Hajee Mohammad Danesh Science and Technology University (HSTU), Dinajpur, Bangladesh.

Acknowledgements

The authors are indebted to the funding institutions IRT, HSTU, Dinajpur.The authors are also grateful toevery article writers and researchers whose work has been cited in this study.

Conflicts of interest

There is no conflict of interest among the authors.

References

1. Andrianaivo, M., &Kpodar, K. (2011). ICT, financial inclusion, and growth: Evidence from African countries. *IMF Working Papers, 11* (73).
2. Asongu, S., Agyemang-Mintah, P., &Nting, R. T. (2021). Law, mobile money drivers and mobilemoney innovations in developing countries. *SSRN Electronic Journal*.
3. Ivatury, G., and Pickens, M. (2006). Mobile phone banking and low income customers: Evidence from South Africa. *Consultative Group to Assist the Poor (CGAP), World Bank, Washington,* 38822, 1-19.
4. Daragmeh, A., Lentner, C., &Sági, J. (2021). FinTech payments in the era of COVID 19: Factors influencing behavioral intentions of "Generation X" in Hungary to use mobile payment. *Journal of Behavioral and Experimental Finance, 32,* 100574.
5. Demirgüç-Kunt, A., Klapper, L., Singer, D., & Ansar, S. (2022). *The Global Findex Database 2021: Financial inclusion, digital payments, and resilience in the age of COVID-19*. World Bank Publications.
6. Datta, R.K.(2021).Relationship between Financial Inclusion and GDP of Bangladesh.*International Journal of Innovation and Applied Studies, 32*(4):485-493.
7. Datta, R.K.(2021).Relationship between Cashless Banking and Bank's Profitabilityof Bangladesh. *International Journal of Science and Business, 5*(7), 21-32.
8. Fu, J., & Mishra, M. (2022). Fintech in the time of COVID−19: Technological adoptionduring crises. *Journal of Financial Intermediation, 50,* 100945.
9. Gates, B. (2020). Responding to Covid-19—a once-in-a-century pandemic?. *New England Journal of medicine*, *382*(18), 1677-1679.
10. George, G. (2012). *Factors determining financial inclusion: the case of mobile money transfer services in Nairobi* (Doctoral dissertation, University of Nairobi, Kenya).
11. Goodell, J. W. (2020). COVID-19 and finance: Agendas for future research. *Finance Research Letters, 35,*101512.
12. Hair, J. F.,Black, W. C.,Babin, B. J., & Anderson, R. E.(2009). Multivariate Data Analysis, 7th ed.,Englewood Cliffs, NJ: Pearson Prentice-Hall.Available at
13. Ho, J. C., Wu, C. G., Lee, C. S., & Pham, T. T. T. (2020). Factors affecting the behavioral intention to adopt mobile banking: An international comparison. *Technology in Society*, *63*, 101360.
14. Islam, N., Mustafi, M., Rahman, M. N., Nower, N., Rafi, M. M. A., Natasha, M. T., Hassan, R., &Afrin, S. (2018). Factors Affecting Customers' Experience in Mobile Banking of Bangladesh.*SSRN Electronic Journal*.
15. Islam,M.M., & Hossain, M.E.(2014).Consumers' Attitudes towards Mobile Banking inBangladesh.The Second World Congress on Computing and Information Technology (WCIT 2014), Kuala Lumpur,Malaysia.
16. Islam, M. M., & Hossain, M. E. (2015). An Investigation of Consumers' Acceptance of Mobile Banking in Bangladesh. *International Journal of Innovation in the Digital Economy, 6*(3), 16–32.
17. Kaur, J., & Kaur, B. (2013). Determining Internet Banking service quality & customer satisfaction in India. In *AIMS international conference on management*.
18. Kim, G., Shin, B., & Lee, H. G. (2009). Understanding dynamics between initial trust and usage intentions of mobile banking. *Information Systems Journal, 19*(3), 283–311.
19. Kabir, M.R. (2013). Factors influencing the usage of mobile banking: Incident from a developingcountry. *World Review of Business Research. 3*(3), 96-114.
20. Kamboj, S. (2014). Financial inclusion and growth of Indian economy: An empirical analysis. *The International Journal of Business & Management*, *2*(9), 175.
21. Kulu, E., Opoku, A., Gbolonyo, E., &TayiKodwo, M. A. (2022, October). Mobile money transactions and banking sector performance in Ghana. *Heliyon, 8*(10), e10761.
22. Khan, S. N., Akter, M., &Akter, R. (2017). Factors influencing adoption and usage of mobile banking: Bangladesh experience. *International Journal of Finance and Banking Research, 3*(1),1-12.

23. Li, C., Khaliq, N., Chinove, L., Khaliq, U., Ullah, M., Lakner, Z., & Popp, J. (2023). Perceived transaction cost and its antecedents associated with fintech users' intention: Evidence from Pakistan. *Heliyon, 9*(4), e15140.
24. Luo, X., Li, H., Zhang, J., & Shim, J. (2010). Examining multi-dimensional trust and multi-faceted risk in initial acceptance of emerging technologies: An empirical study of mobile banking services. *Decision Support Systems, 49*(2), 222–234.
25. Malady, L. (2016). Consumer protection issues for digital financial services in emerging markets. *Banking & Finance Law Review*, *31*(2), 389-401.
26. Mohan, R. (2008). Economic Growth, Financial Deepening and Financial Inclusion* Rakesh Mohan. *Dynamics of Indian Banking: Views and Vistas*, 92-120.
27. O'Leary-Kelly, S. W., &Vokurka, R. J. (1998). The empirical assessment of construct validity. *Journal of operations management*, *16*(4), 387-405.
28. Oruo, J. (2013). *The relationship between Financial Inclusion and GDP growth in Kenya* (Doctoral dissertation, University of Nairobi).
29. Paramasivan, C., &Ganeshkumar, V. (2013). Overview of financial inclusion in India. *International Journal of Management and Development Studies, 2* (3), 45–49.
30. Sharma, M., Banerjee, S., & Paul, J. (2022). Role of social media on mobile banking adoption among consumers. *Technological Forecasting and Social Change, 180,* 121720.
31. Siddique, M. M., Mohiuddin, T. M., & Hossain, M. Z. (2010). Financial inclusion and rural banking: the case of Bangladesh. *Paper presented in a workshop organized by Bangladesh Institute of Bank Management (BIBM),11.*
32. Sleiman, K. A. A., Juanli, L., Lei, H. Z., Rong, W., Yubo, W., Li, S., ... & Amin, F. (2023). Factors that impacted mobile-payment adoption in China during the COVID-19 pandemic. *Heliyon*, *9*(5).
33. Tut, D. (2023). FinTech and the COVID-19 pandemic: Evidence from electronic payment systems. *Emerging Markets Review, 54,* 100999.
34. Uma, H. R., Rupa, K. N., & Madhu, G. (2013). Impact of bank led financial inclusion model on the socio-economic status of saral saving account holders. *Paripex-Indian Journal of Research*, *2*(9),50-52.
35. World Bank Group. (2014). *The World Bank Group A to Z 2015*. World Bank Publications.