



# Blockchain in Digital Financial Services: Users' Perception in Bangladesh

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**Abstract.** The objective of this study is to present users' perception on the adoption of Blockchain Technology in Digital Financial Services (DFS) in Bangladesh, a lower-middle-income but technologically advanced country in South Asia. We considered two aspects, namely usability and security, to understand the perception of people. For this purpose, we chose two leading digital financial services in Bangladesh. One is bKash, which is the country's largest and pioneer digital financial service provider, and another one is Upay, which is country's first digital financial service that uses advanced technologies like blockchain. We designed two different surveys, one for bKash and another for Upay. Two different groups of people participated (30 people from each group) in these two surveys. From the survey results, we found that Upay is perceived to be significantly better than bKash in terms of security, while bKash is perceived to be slightly better than Upay in terms of usability. Our results suggest that although people (with a socio-economic background of a commoner in Bangladesh) think that blockchain based DFS can be more secure, it is not the sufficient reason for them to choose a DFS, sometimes even ignored. They would rather use a DFS which is more accessible from different platforms and easier to use.

**Keywords:** Digital Financial Service · User Perception · Two factor authentication · Three factor authentication · Blockchain Technology · Centralized Systems · Decentralized Systems

## 1 Introduction

DFS (Digital Financial Service) is a digital platform that facilitates banking, payments, and transactions through Internet [1]. DFS has been heavily adopted over the years worldwide, and Bangladesh, aspiring to be an upper middle-income country by 2031 [2], is no exception to this trend. According to a leading newspaper of the country [3], country's registered mobile money accounts grew to 21.77 crore in October 2023.

## 1.1 Motivation

**Why DFS security is important?** Digital financial services are highly attractive targets for cyber attacks. Financial transaction data are the prime target for cybercriminals [4]. Thus, adequate cybersecurity protections are critical to the continued growth of the DFS sector.

**How blockchain technology helps securing DFS?** Blockchain, the decentralized ledger technology is ideal for securing financial transactions because of its ability to create transparent and tamper-proof records. The application of blockchain technology in financial services addresses critical challenges associated with traditional banking systems, including fraud prevention and reducing transaction costs [5].

**What is the status of the adoption of blockchain in DFS worldwide?** Many digital financial services have relied on blockchain technology to secure financial transactions in recent years. The trend is that developed countries like the USA, China, Switzerland are widely adopting blockchain in various sectors, including DFS, whereas the application of blockchain in DFS is very limited in the least developed countries [6].

**Why user's perception is important?** The outcome of adopting a new technology depends on user's acceptance [7]. Blockchain technology is comparatively new. The vast majority of users of digital financial services are not aware of its functionality and application in Fintech, especially the users of the least developed countries [8]. So, it is important to understand user's perception on blockchain-based DFS before widely adopting the technology. The adoption of Blockchain in any application is likely to increase the associated operational cost. The revenue depends on the acceptance of the users.

In this study, we investigate what users' of DFS think about the security and usability aspects of a DFS and what factors instigate the choice of a DFS. This study is confined to a small group of DFS users from Bangladesh, can be considered as a representative group from a least developed country. However, this study can be conducted on a wide spectrum of community of different socio-economic backgrounds around the world to obtain a greater perspective.

## 1.2 Research Objective

Blockchain is a shared, immutable ledger that facilitates the process of recording transactions and tracking assets in a business network [9]. When a user wants to record a transaction, it needs to be sent with other transactions into a block of transactions. Every block needs to have a hash of its previous block and a unique number associated with itself (Nonce). After the block is created, it can be added to the chain according to the majority consensus of the peers [10]. Upay is the first DFS in Bangladesh that uses blockchain technology.

There are some major differences between implementing a blockchain based DFS and a traditional DFS. The blockchain based DFS relies on decentralized storage of data and traditional DFS relies on centralized storage of transaction data. Hence, traditional DFSs are often termed as centralized DFS, whereas

blockchain DFSa are termed as decentralized DFS. Most DFSs in Bangladesh are centralized. bKash, Rocket, Nagad etc. are examples of such DFSs.

Centralized DFS ensures that users' transaction records are being stored and contained within a central authority. Its structure is easy to understand and implement. However, if the bank that governs the DFS is compromised, transaction records are also compromised [11]. On the other hand, decentralized DFS has no single point of failure as the transaction records are replicated and distributed. Information in a decentralized DFS is immutable. However, the architecture of decentralized DFS is hard to understand and implement [12]. Thus, we can see that both types of DFSs have their pros and cons.

Now, many questions arise on how users of these systems see these differences. For example, i) how much differences do the users experience between the two types of systems? ii) how differently do they perceive the security aspect of DFS based on their types? iii) does it matter to the users which type of DFS they are using? More precisely, we try to answer the following questions in this study:

- **RQ1:** How do users of centralized and decentralized DFSs perceive the differences in terms of usability?
- **RQ2:** How do users of centralized and decentralized DFSs perceive the differences in terms of security?
- **RQ3:** What are the leading factors that influence an user for choosing a DFS?

To answer these questions, we conducted a survey with two distinct groups of people. Each group had 30 participants. One group were asked to use bKash and perform some tasks. Another group was asked to use Upay to do the same. The tasks were planned with the goal of making the users interact with different usability and security features of their respective DFS.

This study contributes to our understanding of whether using blockchain technology is beneficial from the perspective of Bangladeshi users' perceptions of usability and security. Moreover, the DFS industry in Bangladesh, both domestic and foreign investors, can utilize this study as a basis and expand upon it to gain a deeper comprehension of the advantages (such as increased user volume) associated with the integration of blockchain technology in DFS.

## 2 Related Literature

Blockchain is a relatively new technology that has been widely adopted in different fields around the world. For its decentralized nature and transparency, it is being used in healthcare [13]. For its traceability, it is being used in supply chain management [14] and media rights protection [15]. Finally, for its immutability [16], blockchain is considered to be an important technology to be added to the fintech industry. Fintech is where blockchain is being used the most [17]. Our study also focuses on the use of blockchain in fintech. However, it is important to assess the user perception of a new technology before it should be adopted [7]. Hence, our research focuses on evaluating the perception of blockchain usage in DFS. For this purpose, we have divided our literature review into the following sections.

## 2.1 Blockchain Adoption and its Perception Studies Outside Bangladesh

Blockchain is incorporated into various fields in the developed countries [13–15, 17]. The user perception towards the use of blockchain is generally positive [18, 19]. However, in developing countries, blockchain is still in its infancy [20]. Some studies have been conducted to find out the possibilities of blockchain adoption on the African continent [8]. Because the use of blockchain is limited in the least developed countries, the study of their perception is also quite limited. A recent study in Pakistan found out that blockchain is not nicely accepted by the public and its practical application is still limited [21]. Further research is necessary to form a generalized opinion of users' perceptions of blockchain for the least developed countries.

## 2.2 Blockchain Adoption and its Perception Studies in Bangladesh

The adoption of blockchain technology in banking in Bangladesh is a hot topic for research. Many banks in the country are considering switching to a blockchain-based infrastructure due to the international trend, cost-effectiveness, and transparency of blockchain technology [22]. However, the degree to which blockchain is actually used in a developing country like Bangladesh is very limited. Hence, the search for possible avenues for use of blockchain technology cannot be conducted using conventional method. A secondary data collection process (e.g., TV, journals, articles) was used to find potential avenues to employ blockchain technology in Bangladesh [23]. It should also be noted that because Bangladesh is a developing country, the main technology trend of the country is still very flexible. So, it might be a good idea to integrate blockchain technology early. However, the perception and feasibility of blockchain implementation in a field needs to be investigated [24]. Currently, there is no existing research on the general perception of blockchain adoption in Bangladesh.

## 2.3 Research Gap in Existing Literature

For the least developed countries, there is not significant amount of research to assess how blockchain is perceived by the users in fintech. Moreover, the trade-off between security and usability of blockchain technology is also something that needs to be investigated [25]. Often, blockchain-based software is not usable by the general public. For this reason, both usability and security aspects are factors that should be considered by the designers of such applications [26]. No existing research addresses the general perception of blockchain adoption in Bangladesh. Also, no existing research portrays the perception on security and usability aspects together. In this study, our goal is to address these research gaps.

### 3 Methodology

We chose bKash as the centralized DFS, as it is widely used in the country. On the other hand, Upay was chosen as the decentralized DFS because it is the first DFS that incorporated blockchain technology to DFS in the country. In [27], the researches evaluated the perceived usability and security of bitcoin. In [28], the authors conducted a study to find out the existence of any difference in usability between two groups of people when it comes to interacting with mobile applications. Our research area and target demographic are similar to these studies. Hence, they served as inspiration for the perception evaluation of our study. We designed a survey to find out if there is any perceived difference in terms of usability and security between Upay and bKash. We conducted a survey with two distinct groups of people. Each group had 30 participants. The participants agreed to provide some basic information, and we made sure not to reveal additional information through the survey and maintain data privacy guidelines. Because we conducted a usability test based on Nielsen's usability aspects, 30 participants from both groups is good enough to get a sense of the trend [29]. We designed a task-based questionnaire and customized it for Upay and bKash. The participants had to do similar tasks in their respective DFS. Participants were asked to share screenshots after completing each of the tasks to ensure that the tasks were completed by them. Afterwards, they had to fill up the questionnaire that had similar questions for both groups. We distributed the questionnaire for bKash among one group and the questionnaire for Upay among another group. The following subsections present the design, execution, response evaluation procedures of our survey in details.

#### 3.1 Null Hypotheses Declaration

We declared seven hypotheses as null hypotheses. These hypotheses are listed in Table 1.

**Table 1.** Null Hypotheses

#	Research Hypothesis
H1	Upay and bKash users perceive no significant difference in terms of learnability
H2	Upay and bKash users perceive no significant difference in terms of efficiency
H3	Upay and bKash users perceive no significant difference in terms of memorability
H4	Upay and bKash users perceive no significant difference in terms of error and recoverability
H5	Upay and bKash users perceive no significant difference in terms of help and documentation
H6	Upay and bKash users perceive no significant difference in terms of security
H7	Upay and bKash users perceive no significant difference in terms of satisfaction

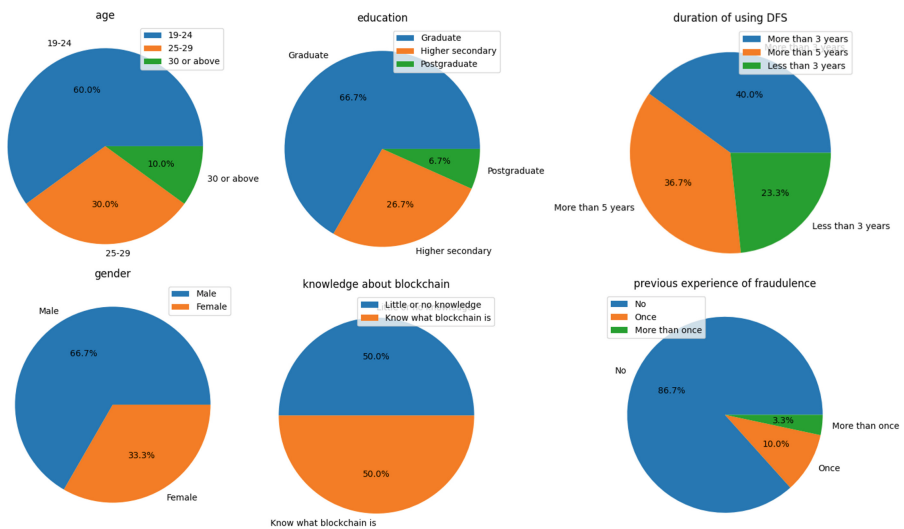


Fig. 1. Upay demographic

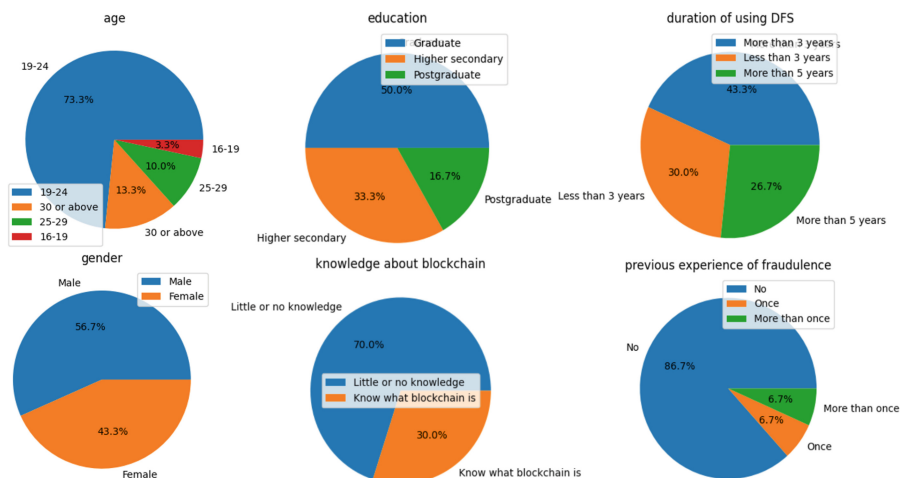


Fig. 2. bKash demographic

### 3.2 Divisions of the Survey Questionnaire

Most of the questions were multiple choice questions that were designed to measure their responses using the 5 point Likert scale [30] as follows.

**1** - Strongly Disagree, **2** - Disagree, **3** - Neutral, **4** - Agree, **5** - Strongly Agree.

Each survey questionnaire had four sections as described in the subsequent parts.

**Personal Information.** The first section of the survey was dedicated to personal information about the participants. We were interested to analyze some survey questions for different user groups. We used the following attributes to group the users: Age, Gender, Educational Qualification, Knowledge regarding blockchain technology, Exposure to fraudulent attacks.

**Usability.** Based on [31] and Nielsen's Usability guidelines, the following 5 factors are chosen to be determinants of usability.

- Learnability: How easy it is to learn to use the system.
- Efficiency: How fast and easily can the users use the features repeatedly.
- Memorability: How easy it is to memorize the steps to using different features
- Error and recovery: How easy it is to understand errors and quickly redo the tasks properly.
- Help and training: How much does the system facilitate novice users with useful information.

**Security.** This is one of the most important sections for our research, as we are interested to know how users perceive the use of blockchain in DFS. This section was detailed and contained the following subsections.

- Preferences for 2FA (2-Factor Authentication): focuses on which activity should require 2FA, how 2FA should be done.
- Logging into user account from a different device: focuses on how safe users think they are from third party access.
- Transaction Security: focuses on how secure users feel their transaction activities are
- Sharing information with third party: focuses on how safe and private users think their information the platform are.

**Satisfaction.** This section focuses on how good or satisfied the users felt using the features of their respective DFS. This is a subjective metric and can vary from user to user. However, given a large population size, the results of this part (combined with other factors) can help us determine which system the users are more comfortable with.

### 3.3 Survey Execution

We set a target of 30 participants from each of the two groups. Participants were asked to do the following tasks.

- T1.** Register and create a new Account for their respective DFS: participants were asked to create a new DFS account

**T2.** Login to your newly created account: using the credentials, the participants were asked to log in to their account.

**T3.** Cash in to your account: participants were asked to perform a small cash in operation at a nearby DFS merchant.

**T4.** Send money to an account: participants were asked to send a small amount of money to another DFS account.

**T5.** Perform a recharge to a mobile number: participants were asked to perform a recharge to a known mobile number.

**T6.** Try to login to your account from a different mobile device: participants were asked to check if they could access their account using a different mobile phone without their SIM card.

**T7.** Cash out at a merchant: just like cash in, participants were asked to perform a cash out operation.

**T8.** Make a payment (vending machine, online payment etc.): participants were asked to use the service to perform a payment operation at a nearby vending machine or for online shopping.

**T9.** Visit the help and documentation pages as you use the features.

After going through the tasks, they were given the questionnaire and their responses were recorded. Each participant was rewarded with 200 BDT for taking part in this task-based survey.

### 3.4 Response Evaluation

For the quantitative aspect of our survey, we used the Mann-Whitney U test for evaluating the responses for both groups. This test is applicable when the data is ordinal and the sample size is relatively small [32]. The steps for evaluating a hypothesis are as follows.

- Combine all the responses from both groups and rank them.
- Calculate the rank sum for each group separately (T1 for Upay, T2 for bKash).
- take  $n1$  = population of Upay group and  $n2$  = population of bKash group
- $u1 = n1.n2 + \frac{n1(n1+1)}{2} - T1$
- $u2 = n1.n2 + \frac{n2(n2+1)}{2} - T2$
- $u = \min(u1, u2)$
- $\mu = \frac{n1.n2}{2}$
- $\sigma = \sqrt{\frac{n1.n2(n1+n2+1)}{12}}$
- $Z = \frac{u-\mu}{\sigma}$
- From normal distribution table, find  $p$  – value for  $Z$
- If  $p < 0.05$ , there is a significant difference between the two groups. The hypotheses is rejected.
- Otherwise, there is no significant difference and the hypotheses is true.
- Effect size ( $r$ ) can be used to determine if the perceived difference is small or not.



This method was used in [27,28], where the data was similar to our survey and population size was also similar. We also tried to find any bias between the two groups based on their gender, age, educational qualification, experience with DFS and knowledge about blockchain by drawing bar diagrams and examining them.

## 4 Data Analysis

### 4.1 Demographic

For each DFS, 30 participants were able to complete the survey. The two sets of people are not overlapping. Figure 1 and Fig. 2 respectively show the demographic information for bKash and Upay.

### 4.2 Usability

Analytical results for mean, median and standard deviation are summarized in Table 2. A higher standard deviation indicates that the responses were more varied. The mean and median were used to calculate p-value and correlate them to the effect size ( $r$ ). U value, p-value and effect size are shown in Table 3.

**Learnability.** From Table 3, we can see that Mann-Whitney U value for learnability was 437.5, p-value was  $0.849 > 0.05$  and effect size  $r = -0.03$  is small ( $|r| < 0.1$ ), so we cannot reject H1. So, there was no significant difference between the two groups in terms of learnability. The standard deviation was lower for bKash, which means that the responses were more consistent.

**Efficiency.** From Table 3, we can see that the Mann-Whitney U value for efficiency was 383.5, p-value was  $0.287 > 0.05$  and effect size  $r = -0.16$  is small ( $|r| \simeq 0.1$ ), so we cannot reject H2. So, there is no significant difference between the two groups in terms of efficiency. The standard deviation was lower for bKash, which means that the responses were more consistent.

**Memorability.** From Table 3, we can see that the Mann-Whitney U value for memorability was 427.5, p-value was  $0.738 > 0.05$  and effect size  $r = -0.06$  is small ( $|r| < 0.1$ ) so we cannot reject H3. So, there is no difference between the two groups in terms of memorability. The standard deviation was lower for Upay, which means that the responses were more consistent.

**Error and Recovery.** From Table 3, we can see that the Mann-Whitney U value for error and recoverability was 505.0, p-value was  $0.414 > 0.05$  and effect size  $r = 0.13$  is small ( $|r| \simeq 0.1$ ), so we cannot reject H4. So, there is no perceived significant difference between the two groups in terms of error and recoverability. The standard deviation was quite high for both, which means that the responses were not very consistent.

**Help and Documentation.** From Table 3, we can see that the Mann-Whitney U value for help and documentation was 561.0, p-value was  $0.097 > 0.05$  and effect size  $r = 0.18$  is small ( $|r| \simeq 0.1$ ), so we cannot reject H5. So, there was no significant difference in terms of help and documentation. The standard deviation was quite high for both, which means that the responses were not very consistent.

**Subjective Satisfaction.** From Table 3, we can see that the Mann-Whitney U value for satisfaction was 431.5, p-value was  $0.788 > 0.05$  and effect size  $r = -0.045$  is small ( $|r| < 0.1$ ), so we cannot reject H7. So, there was no significant difference in terms of satisfaction. The standard deviation was quite high for both, which means that the responses were not very consistent.

4.3 Security

From Table 3, we can see that the Mann-Whitney U value for security was 431.5, p-value was  $0.001 < 0.05$  and effect size  $r = 0.51$  is large ( $|r| \simeq 0.5$ ), so we reject H6. The positive sign of effect size indicates that Upay was perceived to be more secure than bKash.

Table 2. Mean, Median and Standard Deviation for Upay and bKash

Factor	Mean		Median		Std. Deviation	
	Upay	bKash	Upay	bKash	Upay	bKash
Learnability	4.622	4.655	5	5	.6249	.498
Efficiency	4.544	4.711	5	5	.685	.521
Memorability	4.388	4.411	4	5	.627	.773
Error Recoverability	4	3.788	4	4	.918	.983
Help	4.055	3.777	4	4	.848	.853
Security	4.07	3.595	4	4	.881	1.092
Satisfaction	4.133	4.175	4	4	.815	.813

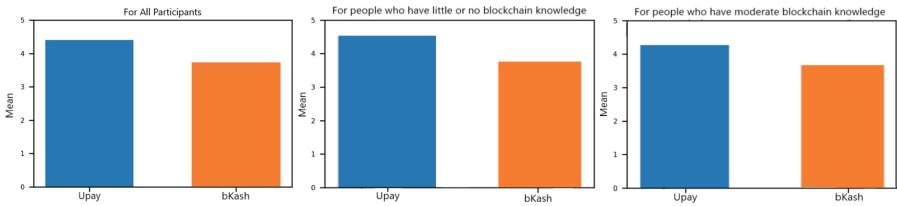
Table 3. Mann Whitney-U test values

Test Metric	Learnability	Efficiency	Memorability	Error	Help	Security	Satisfaction
Mann Whitney-U	437.5	383.5	427.5	505.0	561.0	671.0	431.5
p-value (2-tailed)	0.849	0.287	0.738	0.414	.097	0.001	0.788
effect size (r)	−0.03	−0.16	−0.06	0.13	0.18	0.51	−0.045

Now, we will evaluate the security aspects more deeply.

**Transaction and Personal Information Safety.** (Security section, Question no. 8 of bKash survey and Question no. 10 of Upay survey).

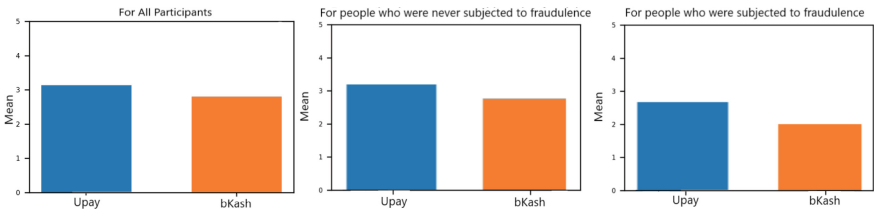
Figure 3 shows that people feel their information and transactions are more safe and immutable when using Upay. When we consider people’s knowledge about blockchain, we can see that Upay is perceived to be better in both cases.



**Fig. 3.** Perception of personal info safety. Upay was perceived to be more reliable than bKash. Left: For all participants. Middle: Participants with little or no blockchain knowledge. Right: Participants who are knowledgeable in blockchain.

**Trust in the DFS’s Ability to Block Access from Outside.** (Question no. 3 of the security section of both surveys)

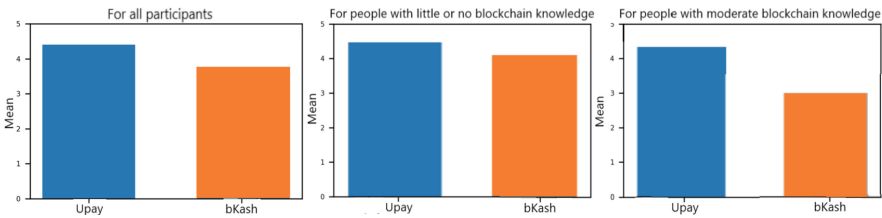
This part focuses on how safe people feel against unwanted access to their accounts from outsiders. Figure 4 shows that people feel their accounts are safer from unauthorized access when using Upay. When we consider people’s past experience with fraudulent activities on their account, we can see that Upay is perceived to be better in both cases. People who experienced fraud were more skeptical when it came to trusting bKash.



**Fig. 4.** Trust in the DFS’s ability to block access from outside. Upay is perceived to be more reliable than bKash. Left: For all participants. Middle: For participants who were never subjected to fraud in the past. Right: For participants who were subjected to fraud in the past.

**Trust in the DFS to not Reveal Any Sensitive Personal Info During Transaction Activities.** (Question no. 5 of the security section of both surveys)

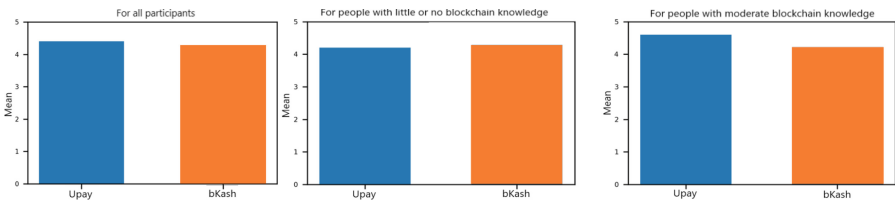
Figure 5 shows that people feel that their personal information is safer to share when using Upay. When we consider people’s knowledge about blockchain, we can see that Upay is perceived to be better in both cases.



**Fig. 5.** Trust in the DFS to not reveal any sensitive personal info during transaction activities. Upay is perceived to be more reliable than bKash. Left: For all participants. Middle: For participants with little or no blockchain knowledge. Right: For participants with moderate blockchain knowledge.

**Conviction that the Transaction Messages from the DFS Provide a High Sense of Security.** (Question no. 6 of the security section of both surveys)

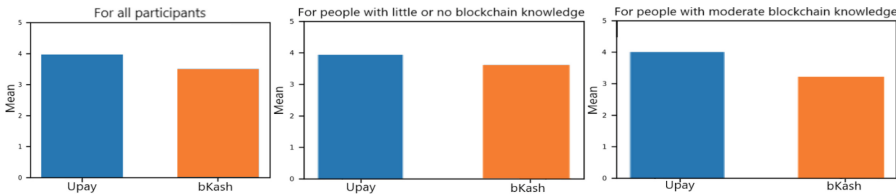
Figure 6 shows that people feel that transaction messages give them a slightly stronger sense of security when using Upay. When we consider people’s knowledge about blockchain, we can see that people who have no knowledge about blockchain perceived no difference, but people who are knowledgeable in blockchain perceived Upay to be better.



**Fig. 6.** Comparison between the two groups based on how much sense of security they get from the transaction messages. Upay is perceived to be slightly more reliable than bKash. Left: For all participants. Middle: For participants with little or no blockchain knowledge. Right: For participants with moderate blockchain knowledge.

**Participants' Satisfaction with the Security Measures of the DFS.**  
(Question no. 7 of the security section of both surveys)

Figure 7 shows that people are more satisfied with the storage system when using Upay. When we consider people's knowledge about blockchain, we can see that Upay is perceived to be better in both cases. However, the difference is greater in case of people with blockchain knowledge.



**Fig. 7.** Participants' satisfaction with the security measures of the DFS. Upay is perceived to be more reliable than bKash. Left: For all participants. Middle: For participants with little or no blockchain knowledge. Right: For participants with moderate blockchain knowledge.

**4.4 Qualitative Analysis**

We invited the participants to provide additional comments about their respective system. Some of the most common comments include:

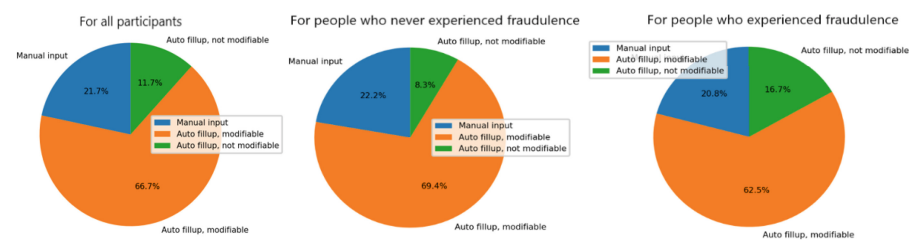
1. bKash users were satisfied with the system because the vendors for bKash were available in every part of their cities, Upay users expressed their dissatisfaction in this regard.
2. bKash users were satisfied with the system because their acquaintances had access to bKash as well. Upay users expressed that most of their acquaintances were not familiar with Upay.
3. Upay users said that they felt safer knowing that immutable blockchain is being used for securing their data and their transactions are associated with unique hash (even participants who did not initially know much about blockchain).

**4.5 User Preference Analysis**

We have asked the participants some questions regarding their preferred Digital Financial Service (DFS). The objective of setting these questions is to identify the leading factors that instigate the choice of a DFS.

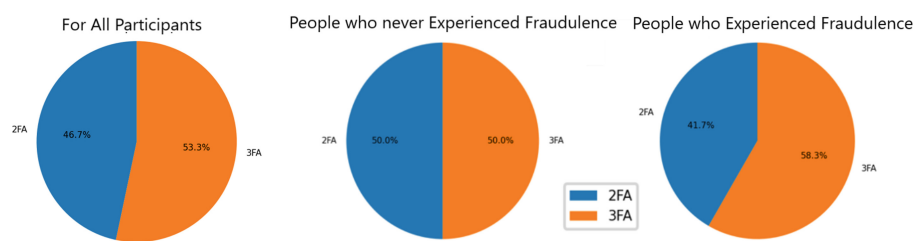
**Preference for Method of Filling up OTP:** In Fig. 8, we can see that people prefer OTP (One Time Password) to be automatically filled, which is convenient. But they also prefer to be in control, for example, they prefer the OTP to be

modifiable. When we consider their experience with previous fraudulent attacks, we can see that people who had experienced fraudulent activities in the past were more in favor of having the OTP not modifiable. This is because modifiable OTP used to be the main source of fraudulent attacks in the past.



**Fig. 8.** Preference for method of filling up OTP. People are mostly in favor of having their OTP be filled up automatically. But they also want to be able to modify the OTP. Left: For all participants. Middle: never experienced fraud. Right: have experienced fraud. People who never experienced frauds are in favor of being able to modify their OTP. People who experienced fraud before are less attracted to modifiable OTP.

**Preference Between 2FA and 3FA:** We define 3FA (3-Factor Authentication) as having your SIM card on the device in addition to filling up your PIN and OTP. In Fig. 9, we can see that most users were in favor of 3FA which Upay uses. When we consider their experience with previous fraudulent attacks, we can see that people who had experienced fraudulent activities in the past were more in favor of having 3FA.



**Fig. 9.** Preference between 2FA and 3FA. Majority of people are in favor of 3FA. Left: For all participants. Middle: People who never experienced fraud. Right: People who experienced fraud

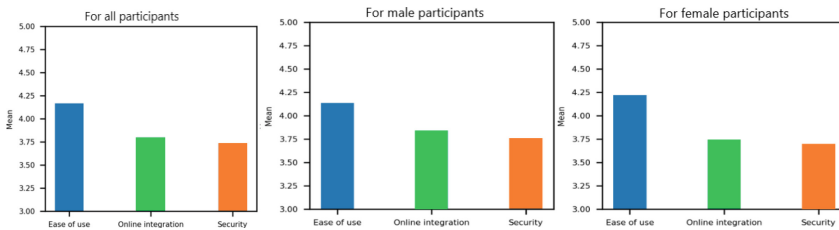
**Preference Between Centralized and Decentralized Storage System:** In Fig. 10, we can see that people prefer decentralized storage system by a significant margin. When we consider their experience with previous fraudulent attacks, we can see that people who had experienced fraudulent activities in the past



**Fig. 10.** Preference between centralized and decentralized storage system. People are mostly in favor of decentralized storage system. Left: For all participants. Middle: For participants who never experienced fraud. Right: For participants who have experienced fraud. People who had experienced frauds are more in favor of decentralized storage compared to people who had never been subjected to frauds.

were more in favor of a decentralized storage system than people who did not experience fraudulence.

**Factors that Influence Users the Most When Selecting a DFS:** In Fig. 11, we can see that people consider ease of using DFS to be the most important factor (mean: 4.167), followed by integration with online platforms (mean: 3.8). Security is the least important factor (mean: 3.73) to people when it comes to choosing a DFS. When we divide the population based on gender, we can see that the same overall sentiment is reflected in both genders. However, female participants consider ease of use to be more important than male participants. On the other hand, men consider security to be more important than female participants.



**Fig. 11.** Factors that influence users the most when selecting DFS. People were mostly concerned with ease of use, followed by integration with other online platforms and finally security. Left: For all participants. Middle: For male participants. Right: For female participants. Female participants put more importance on ease of use than male participants.

## 5 Result Summary

The decisions regarding the hypotheses are summarized in Table 4. We summarize our observations in the following subsections.

**Table 4.** Hypotheses Results Summary

Hypotheses Number	Verdict	Comment
H1 (Learnability)- Accepted	no significant difference	Although there was no significant difference between the two groups, negative effect sizes indicate that bKash was perceived to be slightly better in almost all categories here. So, we can say that bKash is slightly better than Upay in terms of usability
H2 (Efficiency)- Accepted	no significant difference	
H3 (Memorability)- Accepted	no significant difference	
H4 (Error and recoverability)- Accepted	no significant difference	
H5 (Help and documentation)- Accepted	no significant difference	
H7 (Satisfaction)- Accepted	no significant difference	
H6 (Security)- Rejected	There exists significant difference	Positive Effect size indicates that Upay is significantly better than bKash in terms of security

5.1 Usability

**bKash is perceived to be slightly better than Upay in terms of usability.**

The leading factors that contribute to the usability of bKash being slightly better than Upay are as follows.

- **Sequence of operations in bKash is easier to conduct and understand** (refer to the learnability question 2 and efficiency question 2): for sending money, checking balance, etc., bKash lets the user execute other smaller actions in the meantime. The operations also take fewer steps to execute when using bKash.
- **Information are more compact and summarized** (Refer to the memorability question 2 and 3): bkash represents the information in a more compact and summarized form, so users can remember it more easily. Hence, they find it easier to memorize the steps of transactions.
- **Availability of merchants:** One of the main reasons of using bKash is the abundance of merchants in every area. People find it easy to use the services thanks to their availability compared to Upay (refer to efficiency question 3 and satisfaction question 1).
- **Amount of customers using DFS:** bKash is the most used DFS in Bangladesh. According to [33], there were 2,989,058 Upay users and 53,968,418 bKash users in 2022. Because of the large user base, using bKash for transactions with users' acquaintances is much easier compared to Upay.



## 5.2 Security

### Upay is perceived to be significantly better in terms of security.

The leading factors that contribute to the security of Upay being significantly better than bKash are as follows.

- **Must have SIM card to input OTP:** Upay does not allow manual OTP input by the user. OTP is filled up by the system automatically and cannot be modified by user. bKash allows manual OTP input, which could be exploited by fraudsters. Manual OTP input had been the reason of naive people falling victim to fraudulent attacks (refer to question 3 of security section).
- **Promotion of blockchain technology and using unique hash with each message:** customers were drawn to the advertisement of Upay’s “Secure Blockchain technology.” The use of unique hash with each message also gave them a better sense of security (refer to security section, question 6 of bKash survey and question 6 and 9 of Upay survey).
- **Past experiences of people being subjected to fraudulent attacks:** people who experienced fraudulent attacks in the past were mostly centralized DFS users. So the aspect of a DFS that uses “secure blockchain technology” sounds more appealing and secure to those people (refer to security section, question 7 of the survey).

Now a question can arise: which factor is more important to people when it comes to selecting a DFS? The responses to our question 1 in the last section of the survey (Fig. 11) shows that among the 3 factors, people prefer them in the following order.

**1. Ease of Use, 2. Integration with other online platforms, 3. Security.**

This finding aligns with [34], where ease of use was determined to be the most important factor when choosing a DFS. People consider bKash to be easier to use and adopt. So, even if people perceive Upay to be more secure, it is not the primary factor to consider while choosing a DFS for most people.

## 6 Concluding Remarks

Our survey results show significant difference between Upay and bKash in only one case: security. Upay was perceived to be significantly better than bKash in terms of security. The same trend across different types of participants strengthen this claim. This indicates that Upay’s use of blockchain and promotion of blockchain-based security had a positive impact on the perceptions of it being more secure than bKash. On the other hand, even though there were no significant difference between bKash and Upay in other categories, bKash was perceived to be slightly better in terms of learnability, efficiency, memorability and satisfaction. Again, the same trend was noticed when we analyzed the responses based on different demographics, which strengthens this claim. Thus, bKash is perceived to be slightly ahead of Upay in terms of usability.

Even though Upay is considered to be significantly better in terms of security, it’s not enough to make users switch to it. People in Bangladesh prefer ease of use

over security while choosing a DFS. bKash is more available and more usable, and as a result, its user-base continues to increase rapidly compared to Upay. These findings open the door for future research problems, which will require survey conduction on the DFS users from all over the world. 1) How does a country's security campaign relate to user's perception on blockchain based DFS? 2) How does a country's economic standing relate to the dominating factors for choosing a DFS platform?

The limitation of this study lies in its scope. This study is confined to the DFS users of Bangladesh. Also, this study uses only two DFS platforms for the survey. The reason for that is that there is only one blockchain based DFS operating in Bangladesh. So, we chose one blockchain-based DFS platform and another most popular DFS platform. The DFS companies in Bangladesh or the foreign investors in Fintech in the least developed countries can refer to this survey to get a rough estimation and then conduct a larger study for predicting the feasibility of adopting newer technology or to find out different factors to improve their systems. The study should also provide valuable insight for considering the security-usability trade-off for advancing Fintech industry.

### Survey Questionnaire with Summary of Responses

- Upay survey response summary can be found here:  
<https://docs.google.com/document/d/1hjJy148gFhKZbUOTtG-rbq-G51uaEpd5RIA2AiZ0Vf0/edit?usp=sharing>
- bKash survey response summary can be found here:  
<https://docs.google.com/document/d/1Yh-7C6TMv8hGSnACvSLFRe2uvjyIa0DvYS4nwq8EgTk/edit?usp=sharing>

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