EXPECTATIONS ABOUT CBDC IMPLEMENTATION IN KAZAKHSTAN

A thesis submitted in partial fulfillment of the requirements for
The Degree of Master of Public Policy, International Program

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ABSTRACT

National Bank of Kazakhstan (NBK) plans to fully implement digital tenge in 2025 and expects relatively high interest (60%) among population. However, these expectations are not supported by the survey results presented in our paper. Our survey on the willingness of adoption of digital tenge was conducted among individuals and shops in 2 major cities and 5 smaller towns from four geographical regions of Kazakhstan. We find that overall interest in digital tenge is around 29% and 24% among individuals and shops, respectively. Also, the logistic regression analysis has shown that mainly familiarity with digital tenge increases the likelihood of positive opinion on digital tenge among both focus groups. Therefore, we see the success of the digital tenge in the thorough explanation of digital tenge and a proper communication with the potential users.

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Also, I would like to highlight the invaluable support of my family, friends, and especially, my wife Zhansaya and my little daughter Balbibi. Last, but not the least I am thankful for NBK, JISPA and GRASPP for providing me an opportunity to have quality academic journey in Japan.

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1. Introduction

Central Bank's Digital Currency (CBDC) is one of the fast-developing areas of financial world in the last decade. The authorities of many countries expressed interest to third, digital, form of money, which is complementary to existing cash and non-cash money forms. As of June 2024, there are 134 countries that are under different stages of CBDC development according to the Atlantic Council (2024).

In Kazakhstan the project on the implementation of Kazakh CBDC, digital tenge, started in 2021 and is expected to be fully implemented in 2025. The developer of digital tenge - a subsidiary of National Bank of Kazakhstan (NBK), National Payment Corporation of Kazakhstan (NPCK), indicates three motivations behind the development of digital tenge: financial inclusion, enhancement of competition and innovation in the payments industry, and increase of Kazakh financial sector's competitiveness in the global market (NPCK, 2021).

Kazakh CBDC's technological and economic targets are to be interoperable (compatible with the existing payment infrastructure), secure (with reliable protection measures) and cost effective (reducing transaction costs and enhancing faster payments) (NPCK, 2023).

During the pilot stage NPCK tested different use-case scenarios: Digital vouchers scenario for school meals, CBDC Card scenario for transfers from legal entities accounts to individuals' accounts, Cross-border payments via SWIFT CBDC Connector scenario, and Issuance of stablecoins backed by digital tenge on the Binance platform scenario (NPCK, 2023).

Furthermore, NPCK conducted the country-wide pilot survey on the digital tenge among the population. According to the results of the survey, 60% of the respondents answered "Yes" to a question which asks their willingness to use digital tenge if it would be introduced the following day. In addition to it, people's interest in digital tenge among different groups was also significantly high. For example, for people with income over 500 thousand tenge per month it was 79%, for students - 68%, for business owners - 68%. The survey also covered other aspects like frequency of daily bank app use, preference on the features of digital tenge, digital tenge design (cash-like, interest earning like deposit) and others. At the same time NPCK takes into consideration that the success of digital tenge will depend on the wide acceptance of digital tenge in the country (NBK, 2022).

The similar research on CBDC implementation was made by Ueda & Hay (2024), where they study the Cambodian CBDC – the Bakong, which is offered in two currencies, the Khmer riel (KHR) and the US dollar (USD). The paper also covers survey results conducted two years later after the implementation of the Bakong. The results show that around 20% of respondents had an experience of using the Bakong for payment purposes and 25% for money transfer purposes. Ueda and Hay (2024) claim that USD denomination of Bakong pose risks of further elimination of local currency, Khmer riels, by USD, while the Cambodian economy is already highly dollarized. They argue that de facto the Bakong is an obligation of the central bank, while de jure the central bank do not bear legal liabilities for it. In comparison, NBK officially states digital tenge as its liabilities. The research methodology of a paper by Ueda and Hay (2024) was taken into consideration under the framework of this thesis paper.

In this research, we also assess the key issues on digital tenge implementation based on a survey, which is similar to Hay and Ueda (2024). We determine the factors that can increase the adoption of the Kazakh CBDC and identify the potential users of digital tenge. In the

following chapters, we discuss the methodology of data collection (survey) among individuals and shops, descriptive statistics of the survey and results of logistic regression analyses. Some recommendations to increase digital tenge adoption among both individuals and shops are discussed in the conclusion.

2. Methodology and Data

2.1 Survey design

The survey was held from mid-March to mid-April of 2024 in Astana, the capital of Kazakhstan, in Almaty, the largest city and former capital of the country, and in other 5 smaller towns that represent western (Maqat and Beyneu), northern (Fyodorovka), southern (Sekseuil), and eastern (Urzhar) regions of Kazakhstan. These towns were chosen due to availability of human resources to conduct a survey, however, in Kazakhstan there are 17 administrative regions on a country level. Population of Astana is more than 1 million people, while population of Almaty is more than 2 million people. Maqat, Fyodorovka, Urzhar and Sekseuil represent towns with population from 7 000 to 17 000 people. Beyneu is a relatively larger town with population almost 58 000 people[1].

The target of the survey were individuals between 18 and 70 years old and shops that agreed to participate in the interview. In Astana and Almaty all the administrative districts were covered by the interviewers: 5 districts in Astana and 8 districts in Almaty for both individuals and shops. In each of the districts of Astana and Almaty, and in each of the other small towns on average 50 individuals were randomly interviewed. In Astana and Almaty around 13 shops per district shops were interviewed, while the number of interviewed shops in each of Maqat, Fyodorovka and Sekseuil was around 10. In Beyneu and Urzhar the shops refused to participate in the survey. The respondents from shops were the owners, managers or people at the desk of the shops.

Interview locations were mainly markets (bazaars), shopping malls and a public service center (only in Sekseuil for a part of the individual respondents). Most of the time respondents were afraid to participate in the survey. Reluctance to survey participation can be explained by an increasing number cases of financial scams and frauds in Kazakhstan. To increase the response rate of the survey a chocolate and an opportunity of participation in a lottery were offered for individuals as intensives. Also, an additional chocolate was offered to individuals that provided their contact details. The contact details were requested to interview the same respondents after the full launch of digital tenge in 2025 and to find out whether their feelings about digital tenge would change or not.

Overall, 1024 and 271 responses were collected from the individuals and shops respectively (see *Table 1*). In both focus groups the share of women respondents exceeded by twice the share of men. 38% of individuals and 42% of shops were familiar about the digital tenge. Among the individuals 29% of the respondents were interested to use digital tenge (positive), more than half of the respondents (64%) replied that they were neutral to use digital tenge (neutral) and 14% of them were precautious (negative) about Kazakh CBDC. Among the shops the numbers are similar, but interest is lower (24%), neutrality and negativity are higher (60% and 17%, respectively). Also, individuals and shops prefer payments with digital tenge to be traceable than anonymous. The demand for offline digital tenge, which allows to send digital tenge without connection to the internet is relatively low, around 20%. Demand for using

[1] Population of the Republic of Kazakhstan by gender and type of locality (as of April 1, 2024). (n.d.). https://stat.gov.kz/en/industries/social-statistics/demography/publications/159623/

programmable digital tenge for personal purposes[2] is 65%, while this number is 46% for shops that were asked about their opinion on programmability of digital tenge for tax purposes[3].

Table 1. Short summary of the digital tenge survey results

	Individuals	**Shops**
Number of respondents	1024	271
Gender (man/woman)	36% / 64%	38% / 62%
Heard about Digital Tenge	38%	42%
First feelings about Digital Tenge		
Interested to use Do not know yet, neutral Precautious, try to avoid	29% 57% 14%	24% 60% 17%
Anonymity vs Traceability	33% vs 67%	23% vs 77%
Demand for offline	21%	25%
Demand for programming and controlling	65% (for personal use)	46% (for tax automation)

2.2. Detailed survey results for individuals

The individuals were asked 29 questions related to demographics, economics and feelings on digital tenge.

In the **rural** areas men and women were relatively less interested than the same counterparts from the **urban** areas. Share of the rural women interested in using digital tenge is only 18% of the rural women, while the similar share of the urban women is 33% (*see Table A1*).

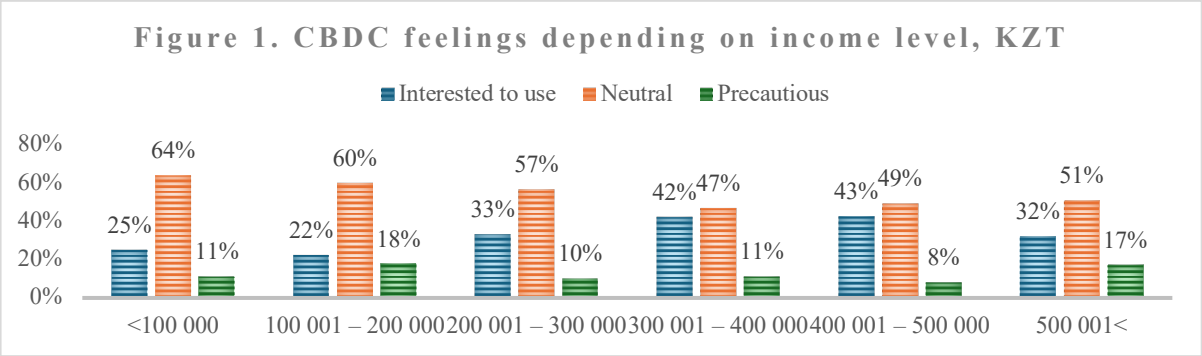
Among the **age** groups the highest interest in digital tenge was from the respondents younger than 40 years old (31-33%). Not surprisingly, the interest decreases and precautions increase as people get older which is observable among age groups older than 40 years old (*see Table A2*). Also, this number is supported by the retired people's negative opinion that comprise 40% of the retired respondents (*see Table A3*).

Business owners (33%), full-time students with paid-jobs (34%), and paid employees and workers (33%) are the most digital tenge interested ones if we group the respondents based on **occupation**. Unemployed people's positive and negative opinions on digital tenge are almost similar with 25% and 23%, respectively (*see Table A3*).

Possessing a **computer** increases probability of having a positive opinion on digital tenge by 16 percentage points from 20% to 36% and decreases probability of having a negative opinion by 11 percentage points from 20% to 9% (*see Table A4*).

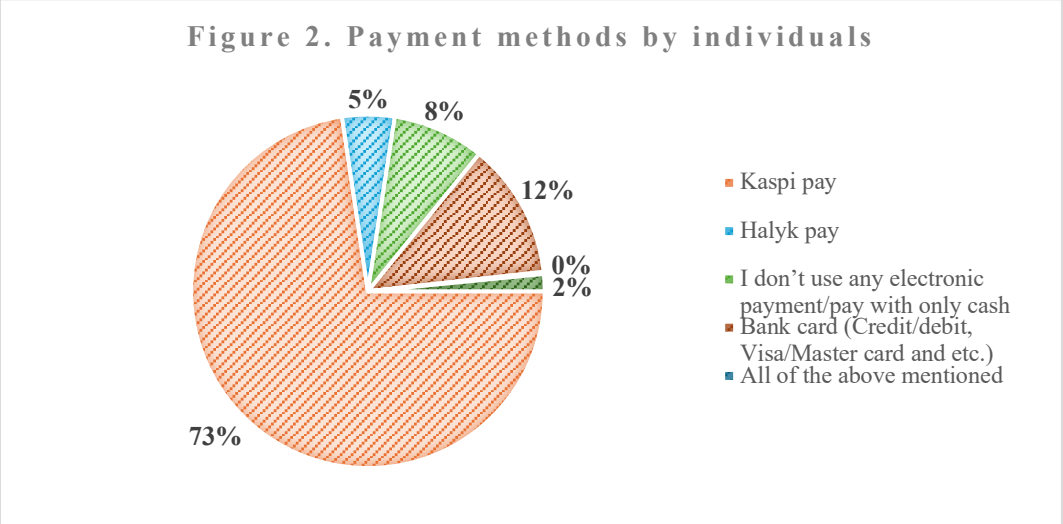
[2] The question was stated as follows: "It allows money to be programmed, so you could control the money you give to your child to be spent only for food not for the entertainment. Would you like to use it?"
[3] The question was stated as follows: "It allows money to be programmed, so that all the duly taxes related to the transaction to be paid to tax authorities. Would you prefer your tax liabilities to be paid instantly or later by accumulating for each period?".

Figure 1 demonstrates that as **income** increases interest in digital tenge increases also between lowest (less than 100 000 KZT per month) and highest (more than 500 000 KZT per month) income levels. However, more than 40% of people with monthly income between 300 000 KZT and 500 000 KZT showed interest in using digital tenge.



When people do some monthly **savings**, the probability of showing interest in digital tenge increases by 11 percentage points and probability of having negative feelings on digital tenge decreases by 8 percentage points.

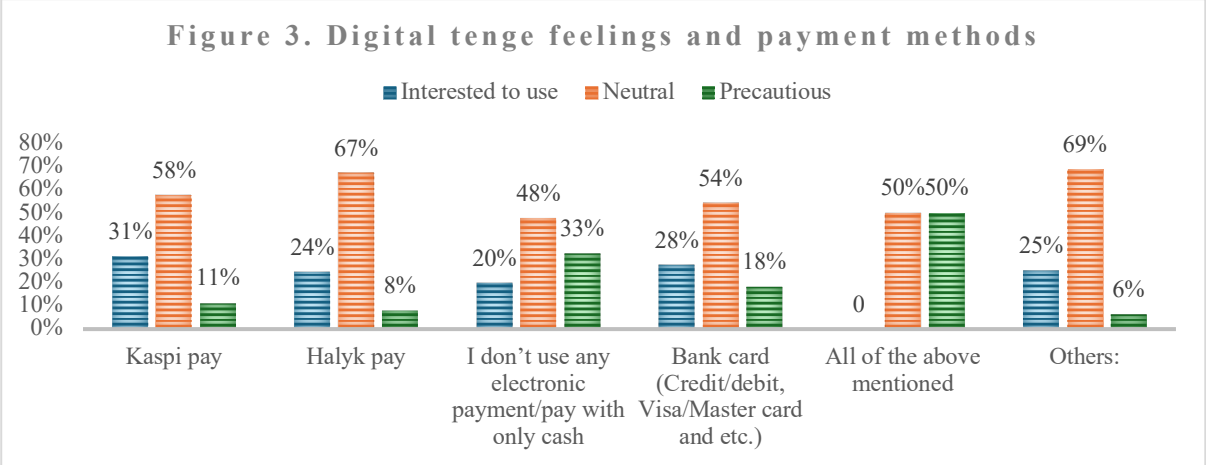
The responses of people on **methods of payment** for services and goods show that Kaspipay is used by 73% of the respondents, while only 5% use Halykpay and 12% use bank cards for the same purposes. 8% of the respondents represent very conservative people, that use only cash for payments and do not use any electronic means of payments (Figure 2). Interesting point is that people who use all the above-mentioned methods of payments are not interested in using digital tenge at all. However, their share among the respondents is insignificant.



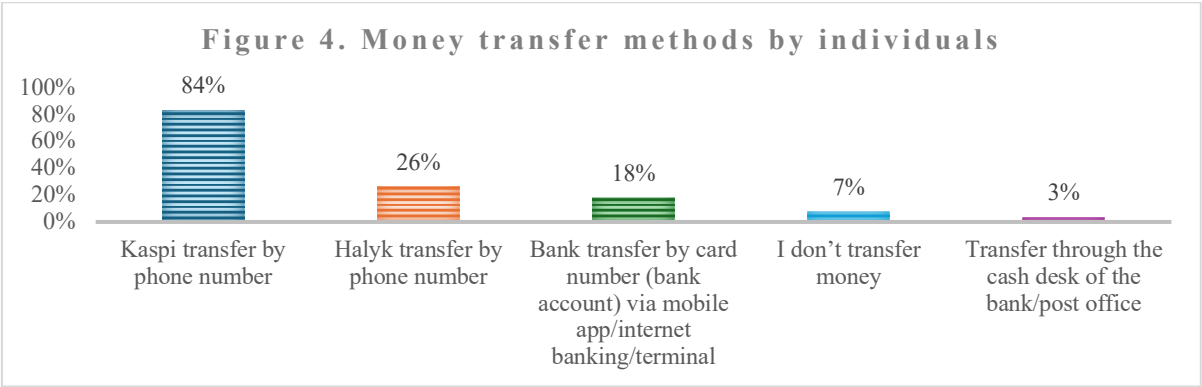
Overall, 31% of Kaspipay users are interested in using digital tenge, while 24%, 20% and 28% of Halykpay users, bank cards users and "only" cash users show positive interest in digital tenge respectively (*see Figure 3*).

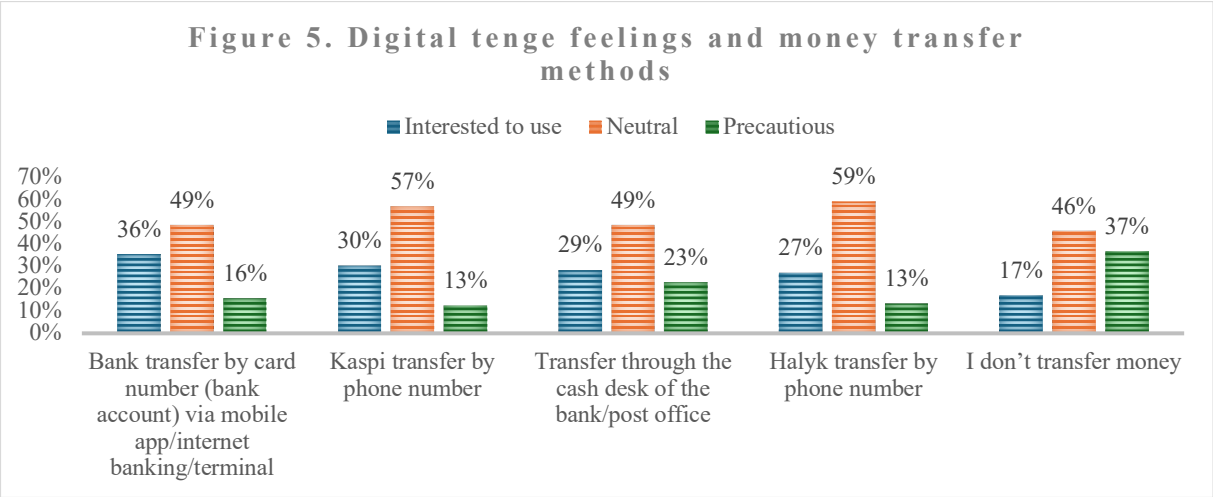
The question on the **methods of money transfer** allowed to choose multiple options for the respondents. Figure 4 shows that 84% of respondents consider Kaspipay transfer by phone number as a money transfer service among others. Also 26% of the respondents use optionally Halykpay transfer by phone number. People who use bank transfer by card number (bank account) via mobile app/internet banking/terminal comprise 18% of the respondents. 7% of

respondents answered that they do not transfer money at all. Transfer through the cash desk of the bank/post office accounts for only 3% of the responses.



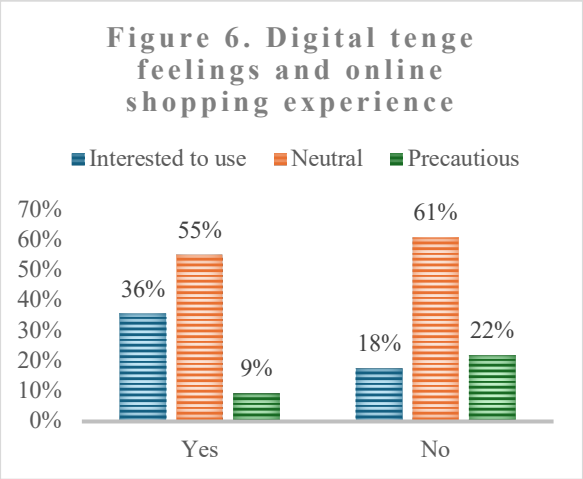
Interest in digital tenge was shown from 30% of Kaspipay users and 27% of Halykpay users that use these financial products for money transfer purposes (see Figure 5). For people that use mobile apps/internet banking/terminal to transfer money by card number or bank account number probability of positive response is 36%. For people that prefer transfer through the cash desk of the bank/post office this rate is 29%.

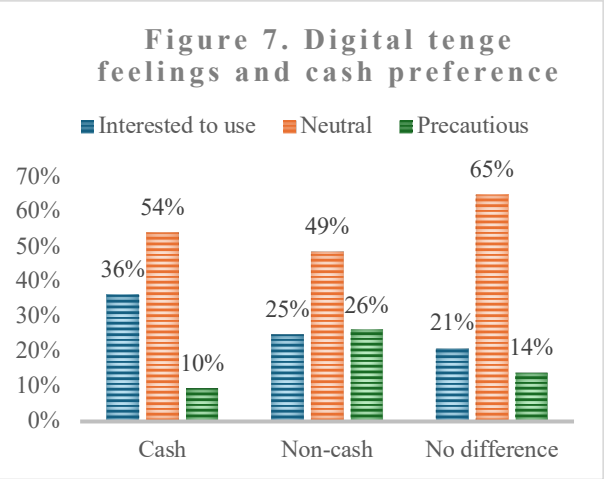




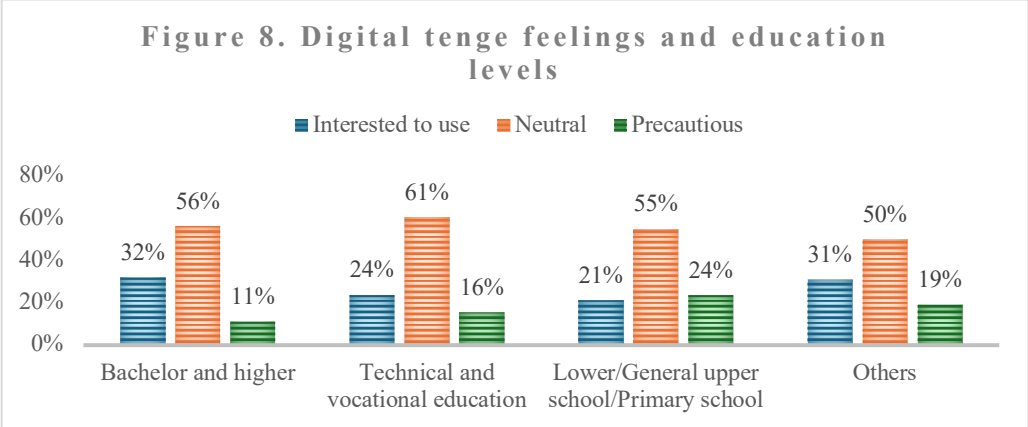
According to Figure 6, probability of positive opinion on digital tenge are twice higher with a previous **experience of online shopping** than for those who have never shopped online (36% vs 18%). Also, the probability of negative feelings on digital tenge decreases from 22% to 9% once an individual has shopped online before.

Surprisingly, Figure 7 demonstrates that people with **cash preference**, i.e. interested to use more cash money in transactions than non-cash money, have higher probability of having a positive opinion than people with non-cash preference (11 percentage point difference).

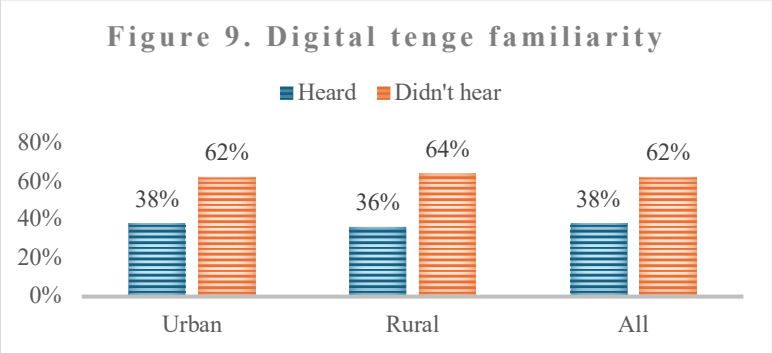


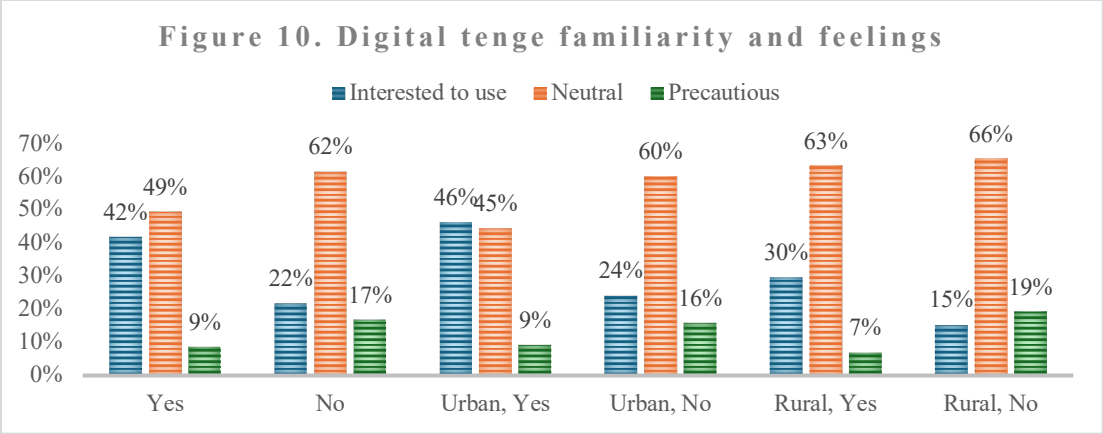


Also, people's **education** make a difference in defining their attitude towards digital tenge. As Figure 8 demonstrates education at the level of university or higher have 32% probability of having positive opinion on digital tenge. Education at the level of vocational school gives a probability of 24% positive attitude on digital tenge. School level education (primary/lower/general upper) indicates that 21% probability of good attitude towards digital tenge. Thus, we observe a declining interest in digital tenge and increase of the negative attitude when the education level also moves from high to low.

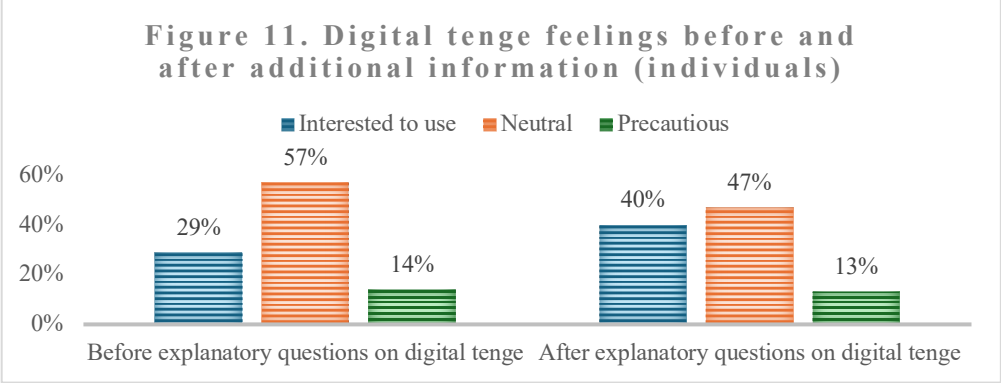


As it was mentioned earlier **familiarity with digital tenge** increases the probability of interest in using it. Numbers from Figure 9 show that familiarity rate with digital tenge is similar both in urban and rural areas. However, as it is demonstrated in Figure 10 among people that know about digital tenge urban people are more interested in using it than rural people (46% vs 30%).





The question about the feelings on digital tenge was repeated for the respondents after they were asked some questions that describe some features of digital tenge. The additional information on digital tenge significantly improved the welcomeness of digital tenge by the individuals as we observe it from Figure 11. Interest for digital tenge increased from 29% to 40%. Neutral and negative opinions on digital tenge decreased from 57% and 14% to 47% and 13%, respectively. Appendix A shows more descriptive statistics on individuals' survey.



2.3 Detailed survey results for shops

During the survey 271 shops from 2 cities and 3 towns were asked 24 questions related to their economic activity, sales volume, payment methods preference and others. Overall, urban shops comprise the main part of the interviewed shops (89%). Both interest and precautions on digital tenge are also higher in **urban** shops than in shops from **rural** areas (see Figure 12) for 9 and 12 percentage points respectively.

69% of the interviewed shops were **located** separately on the street, while 7% of shops were from bazaars and 24% of the shops were from shopping malls. Classification of shops by **economic sector** shows that almost half of the shops (47%) were from the sector of "Wholesale

and retail trade; repair of motor vehicles and motorcycles", 14% from "Accommodation and food service activities" sector and 18% from the sector of "Other service activities" (see Figure A-2). Figure 13 shows that the highest level of interest in digital tenge was shown among the shops from the "Accommodation and food service activities" sector. "Wholesale and retail trade; repair of motor vehicles and motorcycles" sector mostly represented by grocery stores and clothes shops show relatively lower interest in digital tenge (21%).

Figure 12. Digital tenge feelings among shops: urban vs rural

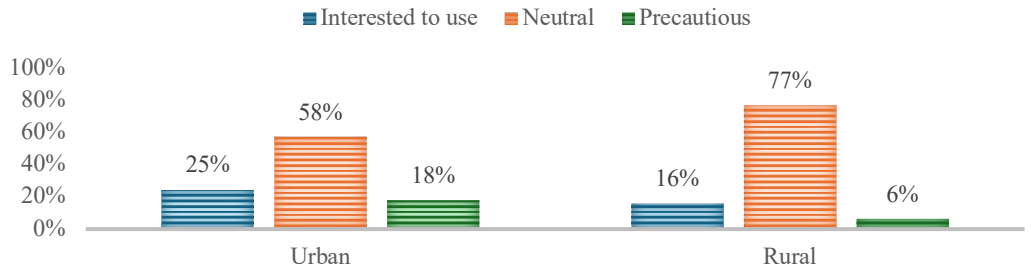
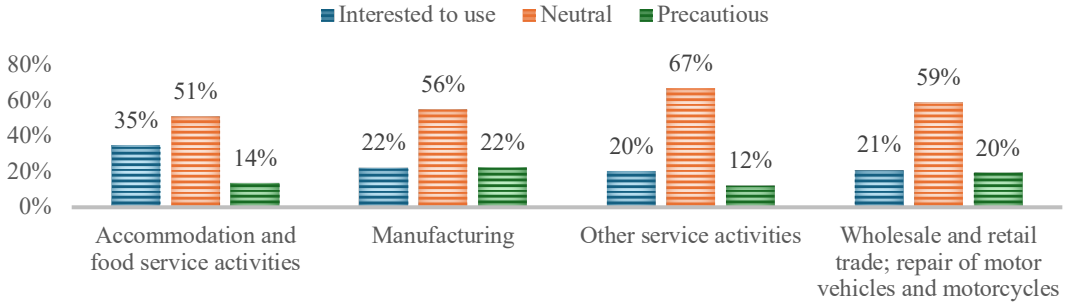


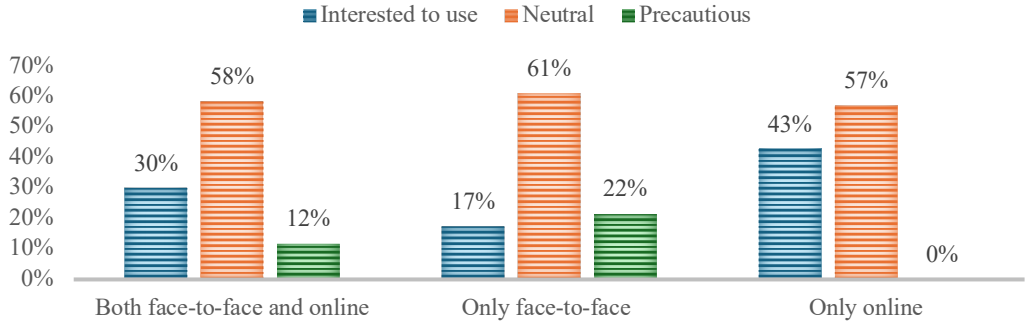
Figure 13. Digital tenge feelings by economic sector



When a shop provides an option of **online** purchase for customers, the probabilities of greater interest in digital tenge increases significantly. For example, only 17% of shops that sell only face-to-face showed interest in digital tenge, while this number was 43% for shops that sell only online and 30% for shops that sell both online and face-to-face (see Figure 14).

The answers of the shops on **the methods of payments** they accept shows that 87% of the shops accept Kaspipay among others, 37% accept Halykpay, and 47% accept bank cards (Figure 15).

Figure 14. Digital tenge feelings by online sellers and shops that don't sell online



Two thirds of the shops prefer **electronic** means of **payments** to cash, but interest in digital tenge does not differ significantly between the two preference groups. However, cash users are more reluctant to use digital tenge than shops that prefer electronic means of payments (25% vs 12% respectively).

Figure 15. Most accepted payment methods

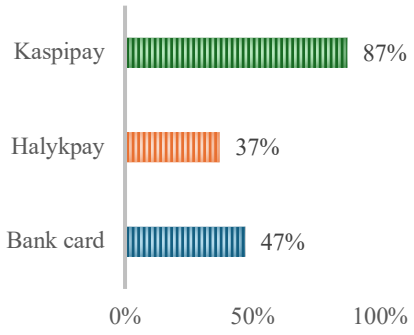
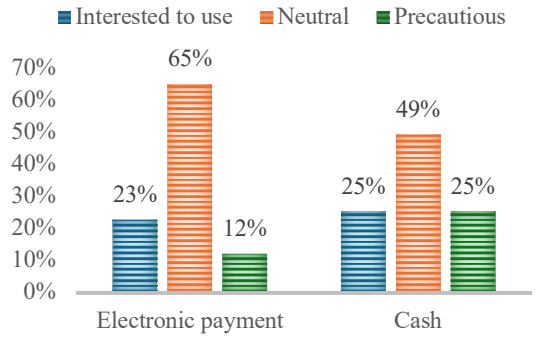


Figure 16. Digital tenge feelings and payment method preferences



Unsurprisingly, digital tenge **familiarity** among shops increased interest in digital tenge from 14% to 37% by 23 percentage points and decreased negative opinions from 21% to 10% (Figure 17).

Programmability of digital tenge in terms of value added tax (VAT) divided the shops into for[4] and against[5] response groups. Former group comprises 46% of shops and the latter 54% of shops. Shops that voted for automated VAT payments with digital tenge are 6 percentage points more interested in using it and their negative response rate decreases by 22 percentage points from 27% to 5% in comparison with shops that were against automated VAT payment with digital tenge according to Figure 18.

Figure 17. Digital tenge: familiarity and feelings

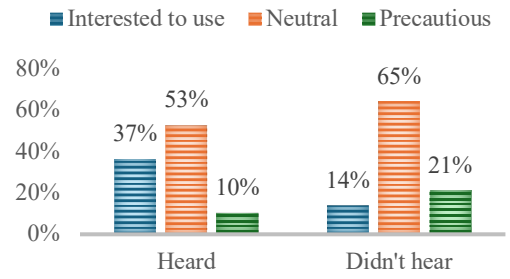
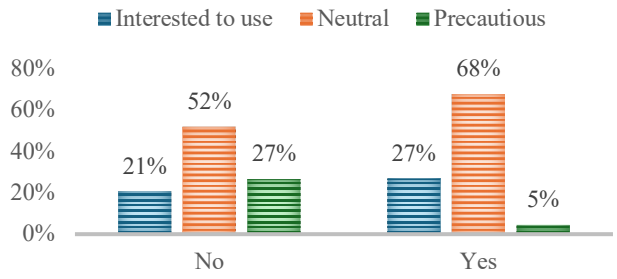
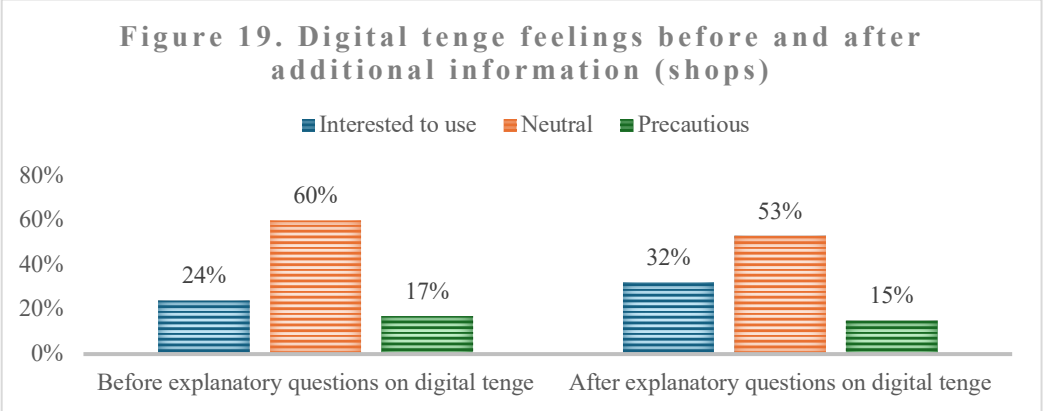


Figure 18. Automated VAT payment with digital tenge



Similar to individuals' survey, the question about the **feelings** on digital tenge was repeated for shops after they had been asked some questions that describe some features of digital tenge. The additional information on digital tenge significantly improved the welcomeness of digital tenge among the shops. Thus, interest for digital tenge increases from 24% to 32%. Neutral and negative opinions on the digital tenge decreases from 60% and 17% to 53% and 15%, respectively. Appendix A provides more information on survey data on shops.

[4] "Yes, I would like to have my taxes to be automated with instant payments to tax authorities. It frees me from an additional work".
[5] "No, I don't want my taxes to be transferred to the authorities immediately".



3 Logistic regression

3.1 Prediction of the change of the people's opinion on digital tenge

The binary logistic regression (or logit) and ordinal logistic regression (or ordered logit) were conducted to answer to our research question. We utilized the binary logistic regression because it is useful for categorized data unlike the linear regression models that are usually used for continuous data. Thus, logit allows to predict the outcome of dichotomous response as Yes/No, Positive/Negative or Success/Failure and others. Benefits of ordered logit are indispensable in finding the likelihood of output variable changing from lower ranks to the higher ranks.

While the probability of having a positive, negative, or neutral attitude on digital tenge depends on the share of respective responses among the survey participants, the odds ratio is calculated by comparing the probability of one event against the probability of another event, i.e. by dividing them.

The formula of logit is presented in (1), which allows to calculate for the logged odds of being interested in digital tenge (individuals saying "Interested to use" in a base scenario) to being neutral or negative on digital tenge (answers "Do not know yet, neutral" or "Precautious, try not to use"). The similar approach was used for a model where baseline scenario was a negative feeling versus neutral and positive feelings towards digital tenge.

$$\begin{gathered}\text{logit} = \log\left(\frac{\text{P(Positive)}}{1-\text{P(Positive)}}\right) = \\ \beta_0 + \beta_1\text{Location} + \beta_2\text{Sex} + \beta_3\text{Age} + \beta_4\text{Education} + \beta_5\text{Occupation} + \\ \beta_6\text{Experience} + \beta_7\text{Institution} + \beta_8\text{Income} + \beta_9\text{Industry} + \beta_{10}\text{Savings} + \\ \beta_{11}\text{Computer} + \beta_{12}\text{Payment} + \beta_{13}\text{OnlineShopping} + \beta_{14}\text{Cashpreference} + \\ \beta_{15}\text{CBDCfamiliarity} + \beta_{16}\text{Anonymity}\end{gathered} \quad (1)$$

where:

$logit$ is the log odds of showing interest in digital tenge, i.e. positive opinion, and $P(Positive)$ is the probability of showing interest in digital tenge, i.e. positive opinion.

For a better interpretation of the coefficients of logit, the odds ratios are calculated, which is an exponentiation of the logit coefficients as shown in the formula (2). Thus, depending on the values of logit coefficients and odds ratio we will be able to claim that among

the two group of people one category is more interested or less interested in using CBDC than the other part.

$$P = \frac{e^{\beta_0+\beta_1 \text{Location}+\beta_2 \text{Sex}+\beta_3 \text{Age}+\ldots+\beta_{16}\text{Anonymity}}}{1+e^{\beta_0+\beta_1 \text{Location}+\beta_2 \text{Sex}+\beta_3 \text{Age}+\ldots+\beta_{16}\text{Anonymity}}} \quad (2)$$

In an ordered logit model, we try to predict the likelihood of people changing their opinions on using CBDCs in an ascending (improving) order, i.e. from negative to neutral or from neutral to positive.

In our models we tried to find a link between the feelings of people and shops on digital tenge and their demographic, economic and other characteristics. For the calculation of the logit and ordered logit results R packages as "lessR" and "MASS" were utilized respectively. Overall, we used two logit and one ordered logit models for each of the focus groups: individuals and shops. In the following sections the models set up and their results are presented.

3.2 Logit for individuals

In all three models of logit and ordered logit, 14 predictors (independent variables) were categorized into a binary class. Predictors as Age and Income (logged) were not categorized as they represent continuous data.

The values of *Feelings,* a dependent variable, were assigned with the following values:

1) "Binary logit 1 for individuals" – a model with a positive baseline scenario: 1 for a positive response and 0 for neutral and negative responses.
2) "Binary logit 2 for individuals" – a model with a negative baseline scenario: 1 for positive and neutral responses and 0 for a negative response.
3) "Ordinal logit for individuals": 0 for a negative response, 1 for a neutral response and 2 for a positive response.

The detailed classification of the variables is shown in the Table 2.

Table 2. Categorization of variables' values for individuals

Variables			**Classification**		
			0	**1**	**2**
Dependent variable					
1.	Feelings	Binary logit 1	Do not know yet, neutral Precautious, try to avoid	Interested to use	-
		Binary logit 2	Precautious, try to avoid	Interested to use Do not know yet, neutral	-
		Ordinal logit	Precautious, try to avoid	Do not know yet, neutral	Interested to use
Independent variables					
2.	Location		Rural	Urban	-
3.	Sex		Woman	Man	-
4.	Age		Numeric		
5.	Education		Others	University degree	-
6.	Occupation		Unemployed	Employed	-

7.	Experience	Less than 5 years	More than 5 years	-
8.	Institution	Non-private	Private	-
9.	Industry	Sectors with values less than Industry average	Sectors with values more than Industry average	-
10.	Income (log)	Numeric		
11.	Savings	Cannot save	Can save	-
12.	Computer	Don't have	Have	-
13.	Payment	Others than Kaspipay/Halykpay	Kaspipay/Halykpay	-
14.	OnlineShopping	No, didn't shop online	Yes, shopped online	-
15.	Cashpreference	Non-cash / No difference	Cash	-
16.	CBDCfamiliarity	Haven't heard about digital tenge	Heard about digital tenge	-
17.	Anonymity	Traceability	Anonymity	-

3.2.1 Model "Binary logit 1 for individuals"

Estimation of *"Binary logit 1 for individuals"* model has shown that only 4 variables were statistically significant for the purposes of the model with *p-values<0.05 (*see Table B1 in Appendix B*)*. They are Computer, Cashpreference, CBDCfamiliarity and Anonymity (see Table 3). Further exponentiation of coefficients provide odds ratio between the odds of showing interest in using digital tenge and being neutral or negative about it (see Table 4).

Table 3. Estimation of the coefficients of the *model "Binary logit 1 for individuals"*

Variable	**Estimate**	**Std Err**	**Z value**	**p value**	**Lower 95**	**Upper 95**
Computer1	0.424	0.198	2.133	0.033*	0.034	0.813
Cashpreference1	0.556	0.192	2.897	0.004**	0.180	0.933
CBDCfamiliarity1	0.635	0.176	3.601	0.000***	0.289	0.981
Anonymity1	-0.631	0.191	-3.294	0.001**	-1.006	-0.255
Note : * p<0.05,** p<0.01,*** p<0.001						

Table 4. Odds ratio and confidence interval the *model "Binary logit 1 for individuals"*

Variable	**Odds Ratio**	**Lower 95**	**Upper 95**
Computer1	1.528	1.034	2.256
Cashpreference1	1.745	1.197	2.543
CBDCfamiliarity1	1.888	1.336	2.669
Anonymity1	0.532	0.365	0.774

By interpreting the results, we can claim that **owning a computer** increases the odds of positive attitude on digital tenge by a factor of 1.5283 or in other words the people who own a computer are **52.83% more likely** to use digital tenge than those who don't have a computer.

Being a person who prefers cash to non-cash or indifferent between them increases the odds of positive attitude on digital tenge by a factor of 1.7451. In other words, the people who prefer cash are **74.51% more likely** to use digital tenge than those who prefer non-cash or indifferent between them.

Familiarity with digital tenge plays an important role in having a positive feeling on it. For people who have heard about digital tenge the likelihood of positive acceptance of digital tenge increases by a factor of 1.8885. In other words, people who have heard about digital tenge are **88.5% more likely** to use it.

However, as it may seem interesting, for **people who prefer anonymity** odds of positive interest **to use** digital tenge decrease by **46.8%** ((0.532-1)*100%). In the opposite, **people who prefer digital tenge being traceable** are **87.96%** ((1/0.532-1)*100%) **more likely** to use it.

3.2.2 Model "Binary logit 2 for individuals"

In the model *"Binary logit 2 for individuals"* there are only 2 statistically significant independent variables (*p-values<0.05*): *Age* and *Cashpreference (see Table B2 in Appendix B)*. The coefficients in *Table 5* and odds ratio in *Table 6* allow us to interpret the results of this model as follows.

Age's odds ratio of 0.9724 suggests that for every one year increase in Age the odds of being neutral or positive decrease by 2.76% ((0.9724-1)*100%). In other words, as Age increases, the likelihood of the negative attitude towards digital tenge increases by 2.83% ((1/0.9724-1)*100%).

Cashpreference's odds ratio of 1.8541 indicates that for people who prefer cash the likelihood of the being positive or neutral on digital tenge increases by a factor of 1.8541 or by 85.41%. In terms of people who do not prefer cash but prefer non-cash or indifferent between them the odds of the being positive or neutral on digital tenge decreases by 46% ((1/1.8541-1)*100%).

Table 5. Estimation of the coefficients of the model "Binary logit 2 for individuals"

Variable	Estimate	Std Err	Z value	p value	Lower 95	Upper 95
Age	-0.028	0.013	-2.114	0.034*	-0.053	-0.002
Cashpreference1	0.617	0.260	2.369	0.018*	0.106	1.128
Note : * p<0.05,** p<0.01,*** p<0.001						

Table 6. Estimation of the odds ratio of the model "Binary logit 2 for individuals"

Variable	Odds Ratio	Lower 95	Upper 95
Age	0.972	0.947	0.998
Cashpreference1	1.854	1.112	3.090

Collinearity and accuracy of the simple logit models for individuals

The collinearity tests has shown that the simple logit models' tolerance values are more than 0.25 and VIF values are less than 3. The specified confusion matrices have shown that model accuracy were 71.74% for *"Binary logit 1"* and 87.08% for *"Binary logit 2" (see Tables B3, B4, B5 in Appendix B).*

3.2.3 Ordered logit model for individuals

In the ordered logit model statistical significance (p values < 0.05) was found for variables such as Age, Computer, Cashpreference, CBDCfamiliarity and Anonymity (*see Table B6* in Appendix B). Therefore, the ordered logit model was re-estimated with the above-mentioned statistically significant independent variables only (see Table 7). Following the odds ratio values from Table 8, we can claim that once a person **owns a computer or prefers to pay with cash or is familiar with digital tenge the likelihood of changing opinion** on digital tenge from negative to neutral or from neutral to positive **increases by 61.3%, 86% and 93.2% respectively**.

Increase in the **age** of the individuals by one year **decreases odds** of a person changing his/her opinion from negative to neutral or from neutral to positive **by 1.93% ((0.9807-1)*100%)**. In other words, as age increases a person is 98.07% more likely to change his opinion from positive to neutral or from neutral to negative on using digital tenge. For people that value **anonymity of digital tenge** likelihood of changing opinion from negative to neutral or from neutral to positive **decreases by 33.13% ((0.6687-1)*100)**.

Table 7. Coefficients of re-estimated ordered logit model for individuals

Variable	**Value**	**Std Err**	**t value**	**p value**
Age	-0.019	0.006	-2.870	0.004**
Computer1	0.478	0.156	3.057	0.002**
Cashpreference1	0.620	0.153	4.049	0.513***
CBDCfamiliarity1	0.658	0.154	4.256	0.207***
Anonymity1	-0.402	0.157	-2.552	0.010*
0|1	-1.967	0.289	-6.795	0.108***
1|2	1.013	0.278	3.633	0.028***
Note : * p<0.05,** p<0.01,*** p<0.001				

Table 8. Odds ratio of re-estimated ordered logit model for individuals

Variable	**Odds ratio**
Age	0.980
Computer1	1.613
Cashpreference1	1.860
CBDCfamiliarity1	1.932
Anonymity1	0.668

Collinearity and accuracy of the models

The collinearity tests has shown that the ordered logit model's tolerance and VIF values were close to 1 (see Table B7).

To find the accuracy of the ordered logit model the data was divided into train and test model with 75% and 25% share. The results show that for both train and test data the prediction accuracy levels were 58.51% and 58.1% respectively (*see Table B8 in Appendix B)*.

3.3 Logit for shops

The same models were used to find a significant relationship between the opinions of shops on digital tenge and their different characteristics. While the dependent variables are kept the same, the independent variables are different due to the nature of questions asked during the interview. 12 independent variables were categorized into binary mode, while *Sales* (logged) was kept numeric as it represents continuous data.

The values of *Feelings,* a dependent variable, were assigned with the following values:

1) "Binary logit 1 for shops" – a model with a positive baseline scenario: 1 for a positive response and 0 for neutral or negative responses.

2) "Binary logit 2 for shops" – a model with a negative baseline scenario: 1 for positive or neutral responses and 0 for a negative response.

3) "Ordinal logit for shops": 0 for a negative response, 1 for a neutral response and 2 for a positive response.

The detailed classification of the variables is shown on the Table 9.

Table 9. Categorization of variables' values for shops

Variables			**Classification**		
			0	**1**	**2**
Dependent variable					
1.	Feelings	Binary logit 1	Do not know yet, neutral Precautious, try to avoid	Interested to use	-
		Binary logit 2	Precautious, try to avoid	Interested to use Do not know yet, neutral	-
		Ordinal logit	Precautious, try to avoid	Do not know yet, neutral	Interested to use
Independent variables					
2.	Urban		Rural	Urban	-
3.	Location		In a mall/ a bazaar	Separately on the street	-
4.	Sales (logged)		Numeric		
5.	Employees		More than 2	1-2	-
6.	SellsOnline		Yes	No	-
7.	PaymentAcceptance		Other than Kaspipay	Kaspipay	-

8.	Industry	Sectors with values less than Industry average	Sectors with values more than Industry average	-
9.	PaymentPreference	Electronic	Cash	-
10.	Familiarity	Haven't heard about digital tenge	Heard about digital tenge	-
11.	Taxautomation	No	Yes	-
12.	SmartContract	Will use digital tenge as a part of smart contract or sees no difference in using digital tenge and traditional bank account	Will not use digital tenge as a part of smart contract, but a traditional bank account	-
13.	Traceability	Anonymity	Traceability	-

3.3.1 Model "Binary logit 1 for shops"

Estimation of the model *"Binary logit 1 for shops"* shows that only 2 variables are statistically significant for the purposes of the model with *p-values<0.05 (see Table B9 in Appendix B)*. They are *Familiarity* and *SmartContract* (see Table 10). So, the focus of the model is the shops' familiarity with digital tenge and their willingness to use digital tenge in smart contracts.

Table 10. Estimation of the coefficients of the *model "Binary logit 1 for shops"*

Variable	**Estimate**	**Std Err**	**z value**	**p value**	**Lower 95**	**Upper 95**
Familiarity1	0.883	0.413	2.134	0.033*	0.071	1.694
SmartContract1	-1.826	0.490	-3.724	0.000***	-2.787	-0.865
Note : * p<0.05,** p<0.01,*** p<0.001						

Also, exponentiation of the log-odds provides odds ratio between the odds of interest in using digital tenge and odds of a pair of neutral and negative opinion about it (see Table 11).

Table 11. Odds ratio and confidence interval of the *model "Binary logit 1 for shops"*

Variable	**Odds Ratio**	**Lower 95**	**Upper 95**
Familiarity1	2.418	1.074	5.442
SmartContract1	0.161	0.061	0.421

Based on the values of the odds ratios we can claim that **familiarity with digital tenge** increases the likelihood positive attitude on digital tenge by a factor of 2.4184 or in other words the shops that have heard about digital tenge are **141.84% more likely** to use digital tenge than those who haven't heard about it.

However, if a **shop** expresses **willingness** to use a traditional **bank account in smart contracts** rather than using digital tenge, then it **decreases** the likelihood of having a **positive**

opinion on digital tenge **by 83.9%** ((0.161-1)*100%). So, shops with **interest in smart contracts with digital tenge or indifferent** (using the digital tenge or traditional bank accounts) **in smart contracts** are **521%** ((1/0.161-1)*100%) more likely to have positive opinion on digital tenge.

3.3.2 Model "Binary logit 2 for shops"

In the model "Binary logit 2 for shops" there are only 2 statistically significant independent variables (*p-values<0.05*): *PaymentPreference* and *Taxautomation (see Table B10 in Appendix B)*. The coefficients in *Table 12* and odds ratio in *Table 13* allow us to interpret the results of this model as follows.

Odds ratio of ***PaymentPreference*** suggests that shops that prefer receiving payment by cash to electronic payments are 443% ((5.4312-1)*100%) more likely to be interested in using digital tenge or be neutral about it. Also it allows to conclude that shops that prefer electronic payments are 82% ((1/5.4312-1)*100%) more likely to have negative feelings on using digital tenge.

Interest on the **automation of taxes** by using digital tenge decreases the likelihood of positive or neutral feelings on digital tenge by 80.16% ((0.1984-1)*100).

Table 12. Estimation of the coefficients of the model "Binary logit 2 for shops"

Variable	**Estimate**	**Std Err**	**z value**	**p value**	**Lower 95**	**Upper 95**
PaymentPreference1	1.692	0.576	2.936	0.003**	0.562	2.821
Taxautomation1	-1.617	0.645	-2.506	0.012*	-2.882	-0.352
Note : * p<0.05,** p<0.01,*** p<0.001						

Further exponentiation of the coefficients provide odds ratio between the odds of showing interest in using digital tenge and a pair of neutral and negative opinions about it (see Table 13.)

Table 13. Estimation of the odds ratio of the model "Binary logit 2 for shops"

Variable	**Odds Ratio**	**Lower 95**	**Upper 95**
PaymentPreference1	5.431	1.754	16.808
Taxautomation1	0.198	0.056	0.703

Collinearity and accuracy of the simple logit models for individuals

The collinearity tests has shown that the simple logit models' tolerance values are more than 0.7 and VIF values are less than 1.3. The specified confusion matrices have shown that model accuracy were 81.1% for *"Binary logit 1 for shops"* and 90% for *"Binary logit 2 for shops" (see Tables B11, B12, B13 in Appendix B).*

3.3.3 Ordered logit model for shops

In the ordered logit model for shops statistical significance (p values < 0.05) was found for only two variables *Familiarity* and *SmartContract* (*see Table B14 in Appendix B*). Therefore, the model of ordered logit for shops was re-estimated with the above-mentioned statistically significant independent variables (see Table 14). Following the odds ratio values from Table

15, we can claim that **familiarity** of shops with digital tenge increases **the likelihood** of changing opinion from negative to neutral or from neutral to **positive by 194%** ((2.9481-1)*100%). However, similar to the previous model of Binary logit 2 for shops, preference of using bank account rather than digital tenge in smart contracts decreases the same ratio by 75.66% ((0.2436 – 1)*100%).

Table 14. Coefficients of re-estimated ordered logit model for shops

Variable	**Value**	**Std Err**	**t value**	**p value**
Familiarity1	0.901	0.339	2.657	0.007**
SmartContract1	-1.470	0.364	-4.035	0.005***
0|1	-2.289	1.726	-1.326	0.184
1|2	1.547	1.723	0.898	0.369
Note : * p<0.05,** p<0.01,*** p<0.001				

Table 15. Odds ratio of re-estimated ordered logit model for shops

Variable	**Odds ratio**
Familiarity1	2.948
SmartContract1	0.243

Collinearity and accuracy of the models

The collinearity tests has shown that the ordered logit model's tolerance and VIF values were close to 1 (*see Table B15 in Appendix B*).

To find the accuracy of the ordered logit model the shops data was also divided into train and test model with 75% and 25% share. The results show that for train and test data the prediction accuracy levels were 61.68% and 75% respectively (*see Table B16 in Appendix B*).

4. Conclusion

We conducted a survey on the expectations of people and shops on the implementation of digital tenge in Kazakhstan. First, we provided a brief information on CBDC development in Kazakhstan and looked at a similar paper by Ueda & Hay (2024) about CBDC in Cambodia. In the next section we described the methodology of data collection, descriptive statistics of the survey results and feelings of people based on different group categories. Also, the collected data allowed to run logit and ordered logit regressions, suitable for categorical data.

Descriptive statistics of the survey results showed that 29% of the individuals and 25% of shops positively evaluated the implementation of digital tenge in Kazakhstan which is significantly lower than the results of the study conducted by the NBK, where 60% of the respondents answered "Yes" to a question "If tomorrow the digital tenge was implemented in Kazakhstan, would you use it?". Neutral response rate by the individuals was 57% against 31% from the survey result of NBK. Negative responses also differ between the two surveys: 14% according to our survey and 9% according to the survey of NBK.

We have found that business owners, part-time working students and paid employees and workers showed highest interest (31-33%) in digital tenge. Factors such as owning a computer, higher education, experience of online shopping, cash preference, and income between of 300 000 KZT and 500 000 KZT played an important role in increasing interest in digital tenge among population. Factors that decrease the people's interest in using digital tenge include non-cash preference, education levels lower than university degree. The most effect on higher levels of welcomeness was the familiarity with digital tenge.

Overall, the shops' positive responses are relatively lower than individuals' responses. Online shopping options for clients (at least by 13 percentage points), operations in accommodation and food services sector (35% of the specific sector respondents) and interest in VAT automation with digital tenge (27% of the specific sector respondents) increase interest in digital tenge among shops. Also, preference for cash serves as a factor that increase a negative opinion on digital tenge among shops (by 13 percentage points). However, the interest between cash and non-cash preference groups are almost similar (23% vs 25%).

Shops familiarity significantly increases positive opinion on digital tenge from 14% to 37% and decreases negativity from 21% to 10%. Also, information provided during interview moderately increased positivity on digital tenge by 8 percentage points from 24% to 32%.

Results of logistic regressions shows that preference for cash, computer ownership, familiarity can serve as factors that increase the likelihood of people having positive opinion and interest in using digital tenge. However, demand for anonymity decreases the likelihood of positive response on digital tenge according to the binary logistic regression. As it was suggested by survey results, the age increase served as a factor that can lower interest in digital for individuals. The similar results were received by the ordered logit model that describes the change of responses from negative and/or neutral to neutral and/or positive.

Logistic regression results for shops showed that familiarity with digital tenge and cash preference increase the likelihood of welcomeness among shops. However, programmability of digital tenge in smart contracts and in tax automation decrease the odds ratio for positive attitude among shops. The similar results were received by ordered logit model for shops.

The results allow us to conclude that the adoption of digital tenge would be defined mainly by the familiarity of people with digital tenge. Both survey statistics and logit results support this opinion. Also, as it may sound interesting, the cash preference is mostly associated with interest of using digital tenge among two response groups. In addition to that developers of digital tenge should consider that relatively lower interest in anonymous digital tenge, but higher interest in programmable digital tenge among people and shops. Overall, the key policy implication for the National Bank of Kazakhstan, also for the National payment corporation of Kazakhstan, is the importance of proper communication regarding the procs and cons of the digital tenge to both consumers and entrepreneurs.

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Appendix A. Additional descriptive statistics: tables and figures

Table A1. Digital tenge feelings by gender

Gender	# respondents	% share	Interested to use	Neutral	Precautious
Man	372	36%	31%	55%	15%
Woman	652	64%	29%	58%	13%
Urban					
Man	285	38%	32%	54%	14%
Woman	461	62%	33%	54%	13%
Rural					
Man	87	31%	25%	57%	17%
Woman	191	69%	18%	68%	14%

Table A2. Digital tenge feelings by age groups

Age groups	# respondents	% share	Interested to use	Neutral	Precautious
<=20	170	17%	**31%**	61%	8%
<=25	238	23%	**32%**	58%	10%
<=30	156	15%	**33%**	58%	10%
<=35	142	14%	**32%**	57%	11%
<=40	103	10%	**33%**	48%	**19%**
<=45	76	7%	26%	62%	12%
<=50	51	5%	18%	59%	**24%**
<=55	39	4%	15%	49%	**36%**
<=60	28	3%	18%	50%	**32%**
>60	21	2%	10%	52%	**38%**

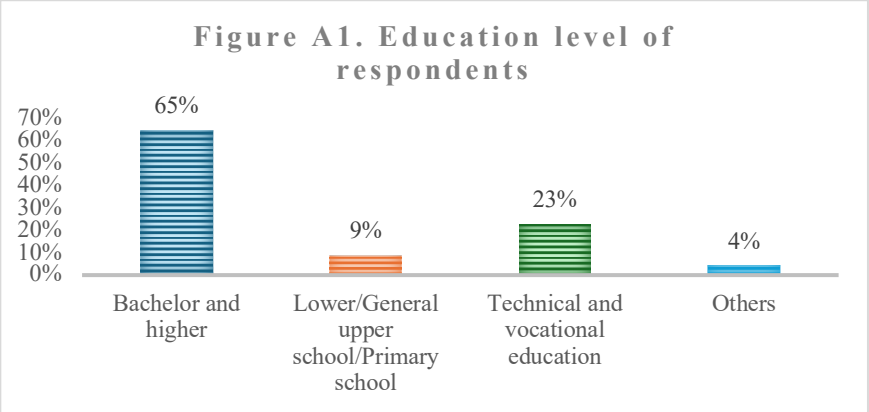
Table A3. Digital tenge feelings by occupation

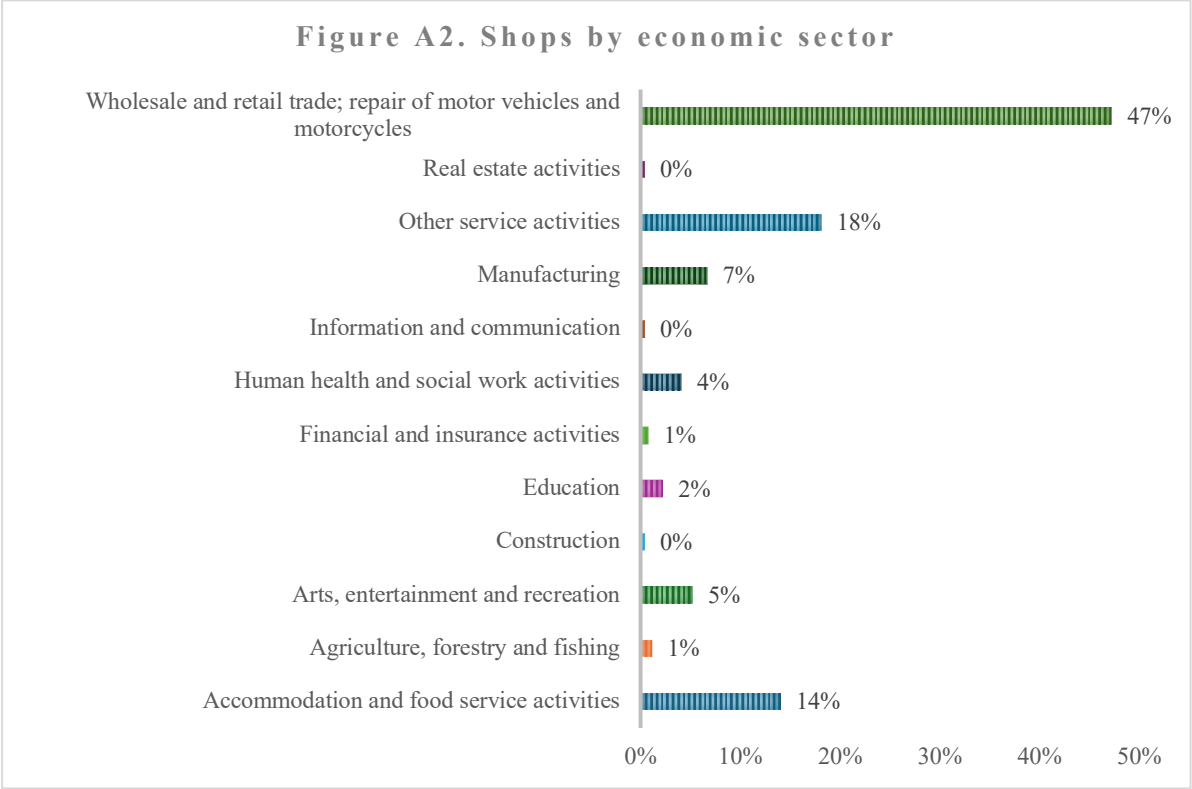
Occupation	# respondents	% share	Interested to use	Neutral	Precautious
Business owner	67	7%	**33%**	60%	7%
Employee of budgetary organization	146	14%	29%	55%	16%
Full time student with paid job	95	9%	29%	60%	11%
Full time student without paid job	88	9%	**34%**	60%	6%
Homemaker (sewing, handcrafting)	44	4%	18%	66%	16%

Paid employee or worker	392	38%	**33%**	55%	12%
Retired	26	3%	0%	58%	**42%**
Self-employed (taxi, delivery)	46	4%	24%	59%	17%
Unemployed	104	10%	25%	52%	23%

Table A4. Digital tenge feelings and computer ownership

	# respondents	**% share**	**Interested to use**	**Neutral**	**Precautious**
Possesses a computer	581	57%	36%	55%	9%
Doesn't possess a computer	443	43%	20%	60%	20%





Appendix B. Logistic regression results

Individuals

Table B1. Binary logit 1 for individuals.

Variable	Estimate	Std_Err	z_value	p_value	Lower_95	Upper_95
(Intercept)	-2.836	1.832	-1.548	0.122	-6.428	0.755
Location1	-0.014	0.237	-0.061	0.952	-0.480	0.451
Sex1	0.222	0.188	1.179	0.238	-0.147	0.591
Age	-0.015	0.011	-1.289	0.197	-0.038	0.007
Education1	-0.021	0.199	-0.105	0.916	-0.411	0.369
Occupation1	-0.240	0.278	-0.867	0.386	-0.785	0.303
Experience1	0.206	0.242	0.852	0.394	-0.268	0.682
Institution1	0.084	0.184	0.459	0.646	-0.276	0.446
Industry1	0.101	0.185	0.545	0.586	-0.262	0.465
Income	0.125	0.166	0.752	0.452	-0.201	0.452
Savings1	0.127	0.184	0.691	0.490	-0.234	0.489
Computer1	0.424	0.198	2.133	0.033*	0.034	0.813
Payment1	-0.053	0.217	-0.248	0.804	-0.479	0.371
OnlineShopping1	0.323	0.215	1.499	0.134	-0.099	0.745
Cashpreference1	0.556	0.192	2.897	0.004**	0.180	0.933
CBDCfamiliarity1	0.635	0.176	3.601	0.000***	0.289	0.981
Anonymity1	-0.631	0.191	-3.294	0.001**	-1.006	-0.255
Note : * p<0.05,** p<0.01,*** p<0.001						

Table B2. Binary logit 2 for individuals

Variable	Estimate	Std Err	z value	p value	Lower 95	Upper 95
(Intercept)	2.972	2.544	1.168	0.243	- 2.015	7.960
Location1	- 0.551	0.312	- 1.766	0.077	- 1.162	0.060
Sex1	0.058	0.256	0.228	0.820	- 0.444	0.561
Age	- 0.028	0.013	- 2.114	0.034*	- 0.053	- 0.002
Education1	0.061	0.261	0.235	0.815	- 0.450	0.573
Occupation1	- 0.145	0.371	- 0.392	0.695	- 0.872	0.582
Experience1	0.055	0.318	0.174	0.862	- 0.568	0.679
Industry1	- 0.001	0.251	- 0.003	0.997	- 0.494	0.493
Income	- 0.081	0.228	- 0.359	0.720	- 0.528	0.365

Institution1	- 0.096	0.255	- 0.376	0.707	- 0.597	0.405
Savings1	0.264	0.255	1.036	0.300	- 0.235	0.764
Computer1	0.243	0.269	0.903	0.366	- 0.284	0.771
Payment1	0.512	0.270	1.892	0.059	- 0.018	1.042
OnlineShopping1	0.474	0.268	1.768	0.077	- 0.051	1.001
Cashpreference1	0.617	0.260	2.369	0.018*	0.106	1.128
CBDCfamiliarity1	0.477	0.274	1.737	0.082	- 0.061	1.015
Anonymity1	0.028	0.260	0.110	0.912	- 0.481	0.538
Note : * p<0.05,** p<0.01,*** p<0.001						

Table B3. Collinearity test of models on individuals data

Variables	**Tolerance**	**VIF**
Location1	0.727	1.375
Sex1	0.836	1.197
Age	0.467	2.141
Education1	0.826	1.210
Occupation1	0.707	1.414
Experience1	0.492	2.032
Institution1	0.837	1.194
Industry1	0.927	1.079
Income	0.545	1.836
Savings1	0.822	1.216
Computer1	0.747	1.338
Payment1	0.911	1.098
OnlineShopping1	0.751	1.332
Cashpreference1	0.772	1.295
CBDCfamiliarity1	0.888	1.126
Anonymity1	0.948	1.055

Table B4. Specified confusion matrices for model Binary logit 1 for individuals

Probability threshold for predicting 1: 0.5						
		Baseline		Predicted		
		Total	%Tot	0	1	%Correct
Feelings	1	231	31.1	170	61	26.4
	0	512	68.9	472	40	92.2
	Total	743				71.7

Accuracy: 71.74 Sensitivity: 26.41 Precision: 60.40

Table B5. Specified confusion matrices for model Binary logit 2 for individuals

Probability threshold for predicting 1: 0.5						
		Baseline		Predicted		
		Total	%Tot	0	1	%Correct
Feelings	1	649	87.3	4	645	99.4
	0	94	12.7	2	92	2.1
	Total	743				87.1
Accuracy: 87.08 Sensitivity: 99.38 Precision: 87.52						

Table B6. Ordered logit for individuals

Variable	**Value**	**Std. Error**	**t value**	**p value**
Location1	- 0,213	0,197	- 1,084	0,278
Sex1	0,186	0,165	1,128	0,260
Age	- 0,023	0,010	- 2,392	0,017*
Education1	- 0,001	0,171	- 0,005	0,996
Occupation1	- 0,129	0,239	- 0,544	0,587
Experience1	0,209	0,210	0,995	0,320
Institution1	0,039	0,163	0,243	0,808
Income	0,081	0,145	0,556	0,578
Industry1	0,087	0,162	0,536	0,592
Savings1	0,189	0,161	1,177	0,239
Computer1	0,359	0,172	2,086	0,037**
Payment1	0,184	0,190	0,968	0,333
OnlineShopping1	0,413	0,181	2,286	0,022**
Cashpreference1	0,585	0,169	3,458	0,001**
CBDCfamiliarity1	0,603	0,159	3,796	0,001***
Anonymity1	- 0,401	0,162	- 2,484	0,013*
0|1	- 0,746	1,594	- 0,468	0,640
1|2	2,277	1,597	1,426	0,154

Note : * p<0.05,** p<0.01,*** p<0.001

Table B7. Collinearity test of the ordered logit model on individuals data

Variables	**Tolerance**	**VIF**
Age	0.947	1.056
Computer1	0.904	1.106
Cashpreference1	0.936	1.068
CBDCfamiliarity1	0.937	1.067
Anonymity1	0.985	1.015

Table B8. Confusion matrix for training and testing data of the ordered logit model

Training	0 (74)		1 (321)		2 (169)	
0	0	0	0	0	0	0
1	72	22.42%	290	90.34%	129	40.18%
2	2	01.18%	31	18.34%	40	23.66%
Prediction accuracy: 58.51%						
Testing	0 (20)		1 (97)		2 (62)	
0	0	0	0	0	0	0
1	17	17.52%	82	84.53%	40	41.23%
2	3	4.83%	15	24.19%	22	35.48%
Prediction accuracy: 58.10%						

Shops

Table B9. Binary logit 1 for shops

Variable	**Estimate**	**Std Err**	**Z value**	**p value**	**Lower 95**	**Upper 95**
Intercept	-1.406	2.235	-0.630	0.529	-5.786	2.973
Urban1	0.533	0.653	0.817	0.414	-0.746	1.812
Location1	-0.431	0.455	-0.946	0.344	-1.322	0.461
Industry1	-0.387	0.473	-0.819	0.413	-1.314	0.539
Employees1	-0.168	0.425	-0.394	0.693	-0.999	0.665
SellsOnline1	-0.346	0.405	-0.854	0.393	-1.139	0.448
PaymentAcceptance1	0.676	0.750	0.901	0.368	-0.794	2.144
Sales	0.049	0.149	0.327	0.743	-0.244	0.342
PaymentPreference1	-0.030	0.442	-0.068	0.946	-0.897	0.836
Familiarity1	0.883	0.414	2.134	0.033*	0.072	1.694
Taxautomation1	-0.278	0.413	-0.673	0.501	-1.087	0.531
SmartContract1	-1.827	0.491	-3.724	0.000***	-2.788	-0.865

Traceability1	-0.523	0.456	-1.146	0.252	-1.417	0.371
Note : * p<0.05,** p<0.01,*** p<0.001						

Table B10. Binary logit 2 for shops

Variable	Estimate	Std Err	z value	p value	Lower 95	Upper 95
(Intercept)	-15.909	1131.8650	-0.014	0.989	-2234.3236	2202.5056
Urban1	17.126	1131.862	0.015	0.988	-2201.284	2235.535
Location1	0.413	0.648	0.637	0.524	-0.857	1.683
Industry1	-0.082	0.768	-0.106	0.916	-1.586	1.423
Employees1	0.153	0.517	0.297	0.767	-0.860	1.166
SellsOnline1	0.166	0.538	0.309	0.757	-0.887	1.220
PaymentAcceptance1	-0.877	0.962	-0.912	0.362	-2.763	1.009
Sales	-0.281	0.184	-1.528	0.126	-0.642	0.080
PaymentPreference1	1.692	0.576	2.936	0.003**	0.562	2.822
Familiarity1	-1.093	0.595	-1.837	0.066	-2.259	0.073
Taxautomation1	-1.617	0.645	-2.506	0.012*	-2.882	-0.352
SmartContract1	0.849	0.544	1.559	0.119	-0.218	1.916
Traceability1	0.718	0.697	1.030	0.303	-0.649	2.085
Note : * p<0.05,** p<0.01,*** p<0.001						

Table B11. Collinearity test of models on shops data

Variables	Tolerance	VIF
Urban1	0.815	1.228
Location1	0.953	1.049
Industry1	0.917	1.090
Employees1	0.831	1.204
SellsOnline1	0.905	1.105
PaymentAcceptance1	0.797	1.254
Sales	0.799	1.251
PaymentPreference1	0.878	1.138
Familiarity1	0.882	1.134
Taxautomation1	0.866	1.155
SmartContract1	0.866	1.155
Traceability1	0.857	1.167

Table B12. Specified confusion matrices for Binary logit 1 model

Probability threshold for predicting 1: 0.5						
		Baseline		Predicted		
		Total	%Tot	0	1	%Correct
Feelings	1	41	21.6	31	10	24.4
	0	149	78.4	144	5	96.6
	Total	190				81.1
Accuracy: 81.05						

Sensitivity: 24.39 Precision: 66.67

Table B13. Specified confusion matrices for Binary logit 2 model

Probability threshold for predicting 1: 0.5						
		Baseline		Predicted		
		Total	%Tot	0	1	%Correct
Feelings	1	27	14.2	17	10	37.0
	0	163	85.8	2161	2	98.8
	Total	743				90.0
Accuracy: 90.00 Sensitivity: 37.04 Precision: 83.33						

Table B14. Ordered logit for shops

Variable	Value	Std. Error	t value	p value
Urban1	-0,340	0,486	-0,699	0,485
Location1	-0,522	0,371	-1,406	0,160
Industry1	-0,409	0,407	-1,003	0,316
Employees1	-0,142	0,338	-0,420	0,674
SellsOnline1	-0,387	0,322	-1,204	0,229
PaymentAcceptance1	0,716	0,531	1,348	0,178
Sales	0,100	0,118	0,848	0,397
PaymentPreference1	-0,547	0,347	-1,575	0,115
Familiarity1	0,902	0,339	2,657	0,008**
Taxautomation1	0,343	0,334	1,027	0,304
SmartContract1	-1,470	0,364	-4,036	0.005***
Traceability1	-0,462	0,388	-1,190	0,234
0|1	-2,290	1,727	-1,326	0,185
1|2	1,548	1,723	0,898	0,369
Note : * p<0.05,** p<0.01,*** p<0.001				

Table B15. Collinearity test of the ordered logit model on shops data

Variables	Tolerance	VIF
Familiarity	0.985	1.015
SmartContract	0.985	1.015

Table B16. Confusion matrix for training and testing data of the ordered logit model on shops data

Training	0 (24)		1 (95)		2 (35)	
0	0	0	0	0	0	0
1	24	25.26%	95	100%	35	36.84%
2	0	0	0	0	0	0
Prediction accuracy: 61.68%						
Testing	0 (3)		1 (27)		2 (6)	

0	0	0	0	0	0	0
1	3	11%	27	100%	6	22%
2	0	0	0	0	0	0
Prediction accuracy: 75%						