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An Empirical Insight into Adoption & Spending with Digital Payment System in Vietnam During Covid 19 Era

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Abstract

The outbreak of the Covid-19 pandemic has seriously affected the world economy, especially commercial activities. Due to the widespread adoption of social distancing standards, the Covid-19 pandemic has increased the number of contactless online payments and e-commerce worldwide. This study aims to clarify the impact of the COVID-19 pandemic on the adoption and use of digital payments in Vietnam. Both qualitative and quantitative methods were used in this study to focus on analyzing the increase in spending with digital payments. With a sample of 335 responses that matched the study's requirements, relevant information was gathered from the pre-pandemic period and during the pandemic. The findings obtained from the Structural Equation Model (CB-SEM) show the significant influence of factors such as performance expectations, ease of use, social influence, facilitation conditions, perceived technology security, and price expectations on digital payment adoption. And as a result, it also led to an increase in spending through this payment method during the Covid-19 pandemic. Furthermore, the study provided evidence of a markedly stronger impact of factors such as social influence, perceived technology security, and price expectancy on users' adoption of cashless payments during the pandemic. Based on the research results, a number of recommendations were proposed to maintain the promotion of digital payment activities in Vietnam.

Keywords: Adoption, Covid-19, Digital payments, UTAUT2, Vietnam.

JEL Classifications: G20, G21.

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1. Introduction

Ho Chi Minh City, also called Sai Gon, is the second-largest city in Vietnam. It is the most crowded city in the country, with an official population of approximately 9 million people in a total area of over 2,061 km^2. Currently, Ho Chi Minh City consists of 19 districts and 5 suburban districts. Today, Ho Chi Minh City has emerged as the center of commerce, economy, education, science and technology, health care, and tourism in Vietnam. The economy of Ho Chi Minh City now contributes one-fourth of the country's GDP. The city is fast in industrialization. Ho Chi Minh City has invested heavily in 4 key industries of the city, namely: mechanical; food processing (food); chemicals (plastic and rubber); and electronics (information technology). In 2020, Ho Chi Minh City held the leading position in the economy of the country, contributing more than 22% of GDP and about 27% of the total budget revenue of the country. In 2022, Ho Chi Minh City's GRDP is estimated at approximately VND1.479 trillion [1]. With a pioneering role in the application of digitization, the industries prioritized by Ho Chi Minh City for digital transformation are healthcare, education, transportation, travel, agriculture, logistics, environment, energy, training human resources, especially finance (banking in general and payment field in particular). Therefore, researching the adoption of digital payments in Ho Chi Minh City during the Covid-19 pandemic is necessary to serve as a fundamental reference for proposing appropriate policies when expanding the application form of digital payments at the provincial as well as national level. That is why our team chose Ho Chi Minh City as our research space.

Covid-19 began to draw attention from the whole world at the beginning of 2020. To prevent the impact of the coronavirus outbreak, several governments throughout the world are taking several measures to restrict human-to-human interaction, as this is a virus that spreads by direct contact, such as closing public venues and modes of transportation; social distancing; and asking the public to stay at home, maintain social distance and work from home. As a result, people have to use different methods to meet their needs in these activities through technology and the Internet: learning online, working from home, shopping online, etc.

A prime example of this is the rapid increase in people using digital payments. WHO and the state advised people to use digital payments instead of cash, as buyers are increasingly limited in spending cash amid the current health crisis. Social distancing and movement restrictions make people switch to online platforms, where they can shop, spend, and ensure safety. Application suppliers can create better services and new marketing strategies that meet the needs of almost all classes of customers. The impact of the fourth wave of the Covid-19 outbreak on the economy, which has affected all industries, is evident. In conclusion, the Covid-19 outbreak significantly boosts electronic payment systems in the banking industry, which is a healthy development.

According to Klein (2020), China has been successful in the digital payment revolution. China is a pioneer in the innovation of digital payment technology and is also a rare country that has succeeded in making the entire population adopt digital payments.

[1] https://en.wikipedia.org/wiki/Ho_Chi_Minh_City

Hoa, et al. (2021) research paper illustrated that all three factors in the Theory of Planned Behavior showed an influence on users online purchase behavior, including perceived behavioral control, attitude, and subjective norm, in which attitude played the most critical role, and the new element in the model, trust ,also showed an influence on online purchases. Singh & Rana (2017) showed that education was found to significantly influence digital payment adoption. It has also been found that in areas where the education level is high, like Delhi NCR and other metropolitan areas, the possibility of digital payment acceptance is much higher. The expansion of smartphone users and internet penetration in such areas also facilitated the adoption of digital payments. The study of Ahmad, et al. (2022) indicated that Covid-19 has promoted the development of digital payments in Malaysia, while traditional transactions such as cash and cheques have been on a downward trend since the pandemic outbreak. Tamang, et al. (2020) confirmed the elements like the perceived risk of Covid-19 and other independent variables like demography and literacy, perceived usefulness and convenience of digital payment to motivate the adoption of digital payment.

Previous studies have indicated that the trend of not using cash in the future is unavoidableand can help lower the risk of disease transmission throughout the Covid-19 period. Musyaffi, et al. (2021) said that the rapid development of information technology, also supported by an extensive internet network, makes it easy for people to carry out activities using smartphones. However, most of the studies mentioned above were undertaken in other countries, and there were relatively few studies on electronic payments in Vietnam during the period of social quarantine caused by Covid-19. We decided to perform a study based on the findings of the previous investigations into spending with digital payments during the Covid-19 quarantine period in Vietnam. Domestic and international studies show that the overspending on digital payment apps is remarkably focused. This study was carried out to determine the factors influencing Vietnamese people's spending via different payment methods during the Covid-19 era and whether such spending was excessive. Simultaneously, the paper will offer potential remedies to this problem.

2. Theoretical Framework

2.1 Research theories

The term "digital payment" refers to the technique of constructing a payment through electronic means. To transmit and receive money in digital payments, both the payer and the payee employ digital channels. Any variety of money transfers conducted through electronic devices is considered an electronic payment.

Furthermore, in accordance with The Payment and Settlement Act of 2007 (PSS Act, 2007), "Digital Payments" defined an "electronic funds transfer" as any transfer of funds initiated by an individual through an instruction, authorization, or order to a bank to debit or credit an account maintained thereon through electronic means, and includes point-of-sale transfers, ATM transactions, direct deposits or withdrawals of funds, transfers initiated by telephone, internet, and card payment.

2.1.1 Theory of Reasoned Action (TRA)

There are many theories involved, the first of which is the TRA theory. The Theory of Reasoned Action (TRA) was developed by Adjzen & Fishbein (1980) and adjusted and expanded over time. In Ajzen & Fishbein (1975), the TRA model shows that consumption tendency is the best predictor of consumption behavior. To be more interested in the factors that contribute to the buying trend, consider two factors: customer attitudes and subjective standards.

TRA suggests that stronger intentions increase the motivation to perform the behavior, increasing the possibility that the behavior will be performed.

2.1.2 Theory of Planned Behavior (TPB)

The Theory of Planned Behavior demonstrates the relationship between beliefs and someone's behavior, in which beliefs are divided into three categories: behavioral beliefs, subjective norms, and perceived behavioral control.

This concept was initiated by Ajzen (1991) , aiming to improve the predictive power of the Theory of Reasoned Action (TRA), offering many advantages in predicting and explaining an individual's behavior in a given context.

Ajzen (1991) developed the Theory of Planned Behavior by adding a new perceived behavioral control factor. He extended the theory of rational behavior to include non-rational factors to increase the accuracy of the behavioral prediction model.

2.1.3 Technology Acceptance Model (TAM)

The TAM is a model developed by Davis based on the previous theory – TRA Davis (1989). TAM replaced and developed many of TRA's attitude measures with the two variables developed by Davis: perceived usefulness and perceived ease-of-use. Perceived usefulness (PU): If using that technology brings benefits and improves work performance for themselves, they will be willing to access and use that technology. Perceived ease-of-use (PEOU): If it is not easy to use and the interface is complicated, no one will have a positive attitude towards it.

2.1.4 Unified Theory of Acceptance and Use of Technology (UTAUT & UTAUT2)

Venkatesh, et al. (2012) developed the UTAUT2 Model from the extended technology acceptance model – UTAUT1 Venkatesh, et al. (2003). The goal of the UTAUT2 Model is to predict the adoption and use behavior of technology by an organization or individual. Venkatesh et al. (2012) proposed UTAUT2 with the combination of three more factors into UTAUT, including (1) hedonic motivation, (2) values, and (3) habit, compared to the old model UTAUT1.

Researchers apply the original model or add extra variables to suit each country's cultural characteristics and technological development level.

2.2 Research hypotheses

2.2.1 Performance expectation

According to Venkatesh, et al. (2003), the performance expectation in UTAUT is intended primarily to measure the extent to which consumers believe that a system like a brand-new mobile technology will benefit their daily lives. They found that performance expectations were the strongest predictor of intention to use within the original model. It

is almost like the perceived utility construct in TAM. The mobile payment system offers consumers the flexibility to create payments without location or time restrictions. It is an alternate method for convenient transactions as all payments may be made via smartphone with no other restrictions. Hence, it has become prevalent in recent years, especially in the Covid-19 epidemic. People must ensure that they keep a safe distance from close contact to prevent the spread of the virus. Therefore, this paper proposes the following assumption: *H1. Performance expectancy has a positive and significant influence on consumers' adoption of digital payments.*

2.2.2 Ease of use

Effort Expectation (EE): This refers to the "easiness involved in using the system" Venkatesh, et al. (2003). Everyone who comes into contact with technology for the first time hopes that they will be able to absorb information quickly and use that technology easily. That is reflected in the "effort expectancy" at UTAUT. When a technology, in particular digital payment, is optimized for operations and usage to suit all types of users, users are more likely to have access to that technology . They do not want to learn how to use a new digital payment method software when there are countless suppliers in the market capable of providing their users with the fastest support and instructions, most specifically in the process. So, solutions that can increase the ease of using a digital payment method can be a 24/7 customer care hotline, brief instructional web/video clips, specific instructions at every stage of the transaction process, etc. Therefore, this paper proposes the following assumption:

H2. Ease of use has a positive and significant impact on consumers' adoption of digital payments.

2.2.3 Social influence

Social influence in UTAUT2 is defined as the degree to which an individual perceives that crucial others trust him or her to use the new system Venkatesh, et al. (2003).

In research by Verkijika (2018), he pointed out that the adoption and use of m-commerce were greatly influenced by social influence. Along with that result, he also said it was similar to other research done on e-commerce. Research by Lee, et al. (2019) pointed out that social influence was one factor that positively influences the intention to continue using the food delivery app in Korea. Like e-commerce, digital payments are also closely related to social influence. Therefore, this paper proposes the following assumption:

H3. Social influence has a positive and significant impact on consumers' adoption of digital payments.

2.2.4 Facilitating conditions

Facilitating conditions are considered a direct determinant of user behavior in the UTAUT model studied by Venkatesh, et al. (2003), defined as "the degree of ease associated with the use of systems".

In this study, we use facilitating conditions to measure users' level of trust about the influence of their facilities' conditions and knowledge on the adoption of digital

payments. Several prior studies have found a link between favorable conditions and technological adoption, particularly in the payments sector. Peñarroja, et al. (2019) highlighted that facilitating conditions for consumers are essential for cashless payment system acceptability. Therefore, this paper proposes the following assumption:

H4. Facilitating conditions has a positive and significant impact on consumers' adoption of digital payments.

2.2.5 Perceived technology security

Technological security is concerned with identifying security flaws and developing appropriate remedies to mitigate the risk of technology failure or consumer data hacking, Andreu (2020). Perceived technology security is essential when transactions are made over the Internet. When making payments through the Internet, all risks related to the Internet, such as personal information disclosure, security issues, virus transmission to technological devices, etc., also become risks for customers. Several studies have shown that customer trust is also crucial for accepting and using e-commerce services. Therefore, this paper proposes the following assumption:

H5. Perceived technology security has a positive and significant impact on consumers' adoption of digital payments.

2.2.6 Price expectancy

Price expectation is understood as the user's expectation of the benefits in terms of costs and prices before using digital payment services. Many theories and previous studies show that consumers perceived price has a very significant impact on their adoption of technology Luarn & Lin (2005) and Tobin (2012) indicated that customers are more likely to use mobile money services if they feel satisfied with the cost. In the context of Covid-19 in Vietnam, digital payments have become a popular payment trend, and consumers are also more concerned about saving costs. Therefore, we found that price expectancy and adoption of digital payments have a close relationship in the Vietnamese market, so we added price expectancy as a factor to the research model and the factors of the original UTAUT model. Therefore, this paper proposes the following assumption:

H6. Price expectancy has a positive and significant impact on consumers' adoption of digital payments.

2.2.7 Spending

On the contrary, the Covid-19 pandemic has encouraged the adoption of digital payment options. People's shopping habits have had to alter to connect with e-commerce and digital payments due to the pandemic. As a result, we recognize that greater adoption of digital payment methods can lead to an increase in expenditure via e-payments during the Covid-19 epidemic. The Adoption factor is an intermediate variable that directly shows the effects of the independent variables on the Spending factor. The Spending factor is the dependent variable and the final result of the correlations and effects of those independent variables mentioned before. Therefore, this paper proposes the following assumption:

H7. Adoption of digital payments has a positive and significant impact on spending on digital payments.

3. Research Method

3.1. Research design

The methodology employs a five-point Likert scale (1 completely disagrees and 5 strongly agrees), allowing the individual to express how strongly they agree or disagree with a statement. The scale was developed based on attributes measuring the relationship and impact of Covid-19 on overspending during the quarantine period in Ho Chi Minh City.

3.2. Overall study sample

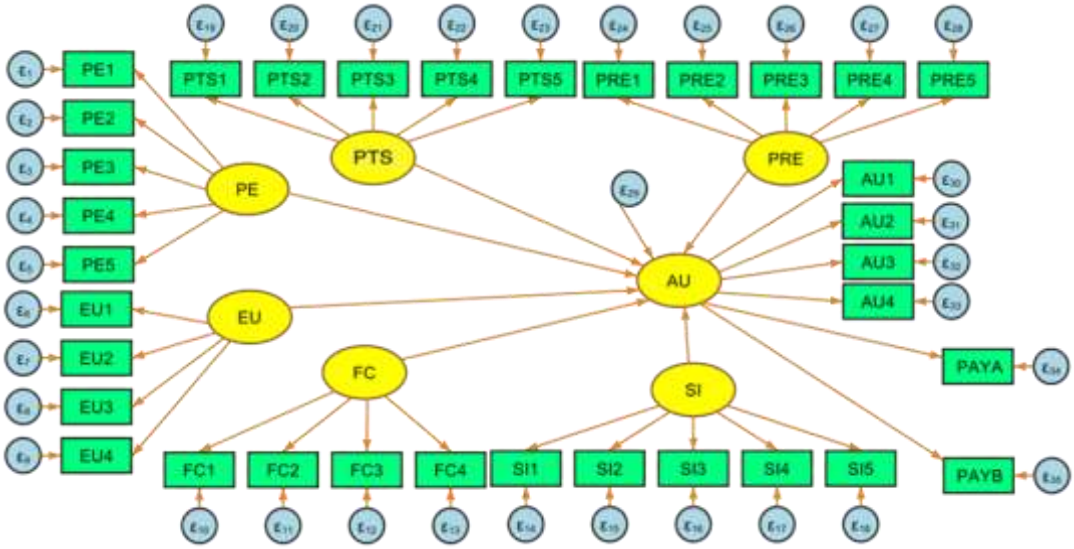
Regarding the sample size of the study, the overall sample was identified as Vietnamese consumers who used online banking, cashless transactions, and other online transactions to purchase products and services. The research sample size was selected according to the rules for factor analysis methods. The sample size's determination to ensure the study's reliability is currently not consistent among researchers. According to Hair, et al. (2006), the minimum number for studies using factor analysis is 100. Comrey & Lee (1992) provide sample sizes with respective opinions: 100 is bad, 200 is good, 300 is good, 500 is very good, and 1000 or so is excellent.

The data collection method was a survey questionnaire. We chose the HCMC area in Vietnam because it has the best access to the various payment services available in the country. Besides, it is also a place that has been heavily affected by the epidemic and has had the longest quarantine. Therefore, their views will be essential to understanding how the pandemic- era distancing measures affect consumers' overspending through electronic payments in Vietnam. The research team designed a questionnaire and sent it to potential candidates on the friends' list via email, Facebook, or text message. Out of 500 distributed questionnaires, 335 usable questionnaires were used for data analysis, and the response rate was 72.8%.

3.3 Research model

Based on theory, research overview, and inherited values from previous studies, the research model is built as shown in Figure 1 .

Figure 1: Research Model



Source: Prepared by the authors.

4. Results and discussion

4.1 Results

4.1.1. Descriptive statistics

The researchers surveyed for nearly three months and received more than 400 responses from participants, of which 335 met the survey's requirements. Regarding gender, the distribution of survey samples by sex included 75.7% female, 23.7% male, and 0.6% of another gender.

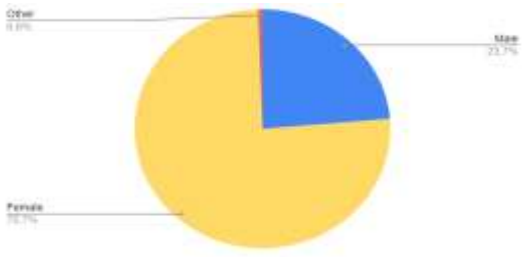


Figure 2: Distribution by gender

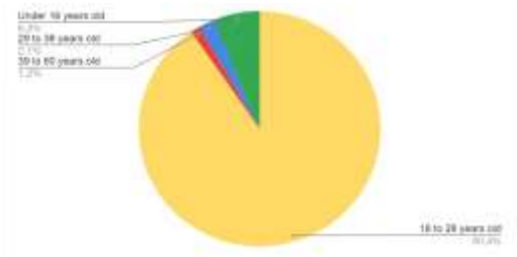


Figure 3: Distribution by age group

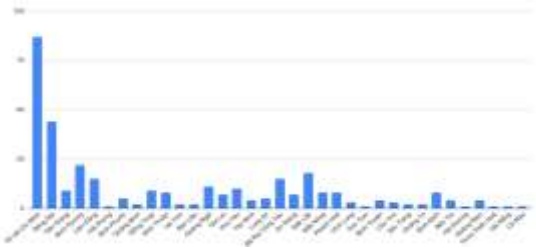


Figure 4: City chart

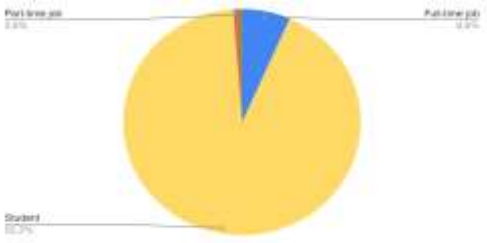


Figure 5: Career chart

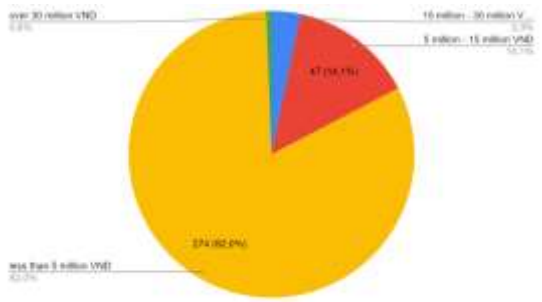


Figure 6: Income before Covid-19

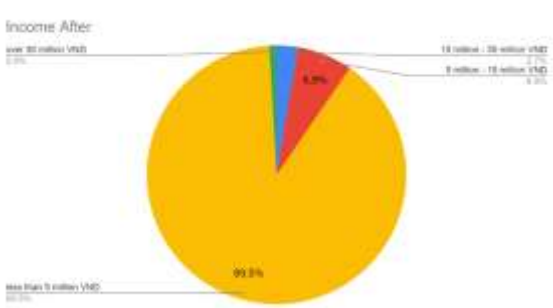


Figure 7: Income during Covid-19

Source: Outputs of data processing.

In terms of age, we separate many different age groups. Specifically, those under 18 years old accounted for about 6.3%. The age range of 18 to 28 accounts for a sizable proportion, accounting for around 90.4 percent. Next, the age group 29 to 38 has about 2.1%, and finally, 39 to 60 accounts for about 1.2%.

In terms of geography, the group's research includes many samples from many provinces in Vietnam. The most is in Ho Chi Minh City, with more than 75 samples, followed by neighboring areas such as Dong Nai and Binh Duong.

The percentage of students taking this survey is exceptionally high (92.2%). Followed by the group of people with full-time jobs with 6.6%. The remaining three groups have part-time jobs, are students working part-time, and are unemployed.

Regarding income before the Covid-19 pandemic, the number of people with incomes over VND 30 million – what currency? accounted for about 0.6%. The income level of VND 15 million to VND 30 million accounts for 3.3 percent at a slightly higher rate. Moreover, the income level of VND 5 million to VND 15 million accounted for 14.1% of our total survey. Furthermore, the highest income level is less than VND 5 million, with 82%.

Regarding income during the Covid-19 pandemic, the number of people with incomes over VND 30 million tends to increase and accounts for 0.9%. The income level of VND 15 million to VND 30 million reversed, falling to 2.7%. Along with that trend, the income level from VND 5 million to VDN 15 million is only 6.9%. Moreover, finally, the income level below VND 5 million remained stable when it increased to 89.5%.

4.1.2 Cronbach's Alpha reliability analysis

The reliability analysis of the scales was conducted based on the test for Cronbach's Alpha coefficient. This is a statistical test of the correlation of a set of observed variables. This test is conducted with the aim of removing unreliable variables before conducting factor analysis. Reliability analysis of Cronbach's alpha scale is used for latent variables such as Performance expectations, Ease of use, Facilitation conditions, Social influence, Perceived technology security, Price expectations, and adoption of digital payments.

Cronbach's Alpha on all scales is higher than 0.7 (see APPENDIX 2). The correlation coefficients of the total variables of the observed variables on the scale are all

greater than 0.4. There is no case where removing the observed variable can make the Cronbach's Alpha of every scale greater than the Cronbach's Alpha overall. Therefore, all observed variables are accepted and will be used in the subsequent factor analysis.

4.2.3. Confirmatory factor analysis (CFA)

After performing the CFA model using STATA 16 software, we found that the p-values of all observed variables used to measure latent variables such as PE, EU, FC, SI, PRE, and PTS all had a value of 0. Therefore, this result helps to confirm that all observed variables can explain and measure all of the latent variables in the model.

Table 1: CFA Analysis After Modification Indices

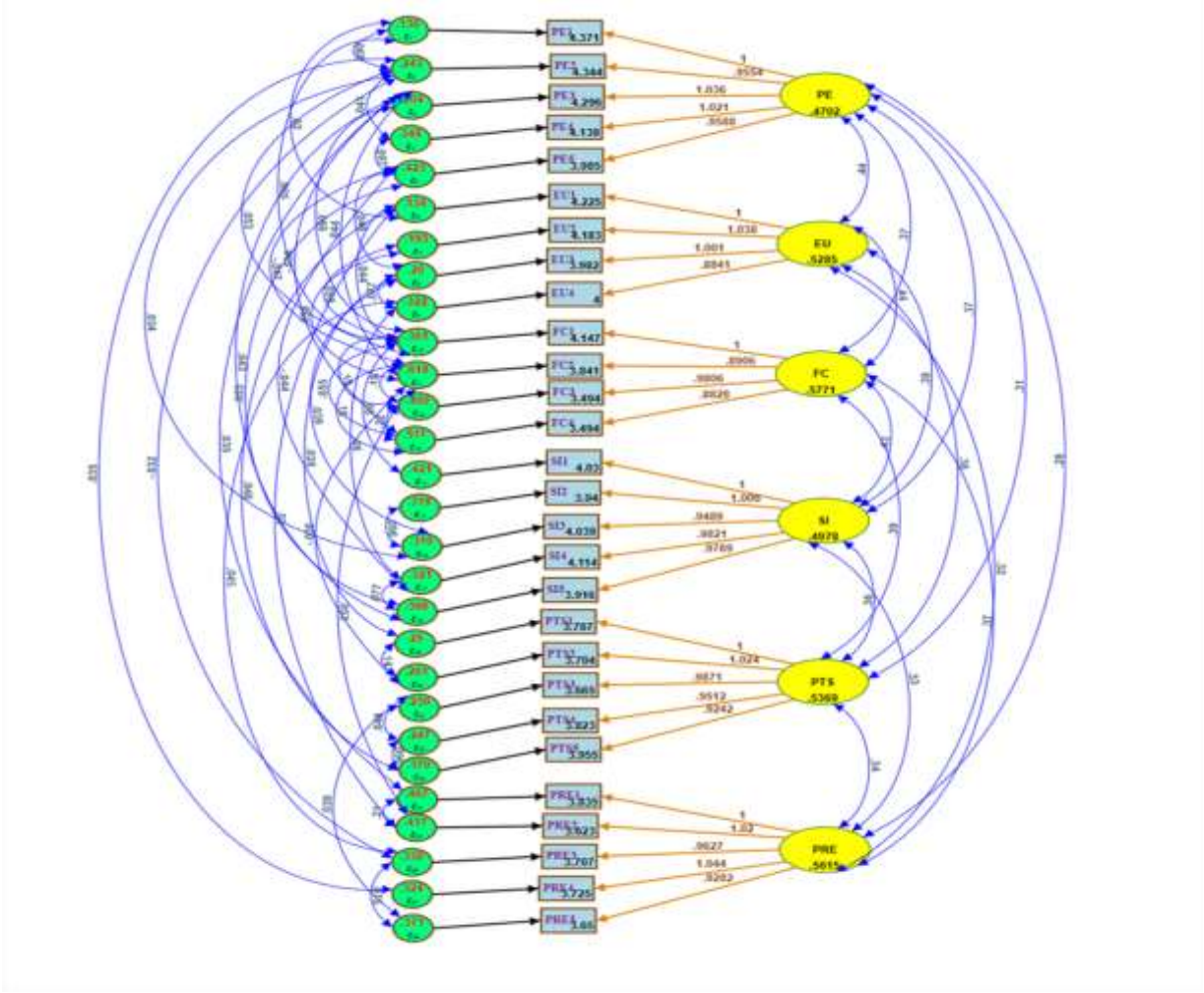
Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(267)	294.182	model vs. saturated
p > chi2	0.122	
chi2_bs(378)	7570.592	baseline vs. saturated
p > chi2	0.000	
Population error		
RMSEA	0.017	Root mean squared error of approximation
90% CI, lower bound	0.000	
upper bound	0.029	
pclose	1.000	Probability RMSEA <= 0.05
Information criteria		
AIC	17857.814	Akaike's information criterion
BIC	18494.275	Bayesian information criterion
Baseline comparison		
CFI	0.996	Comparative fit index
TLI	0.995	Tucker-Lewis index
Size of residuals		
SRMR	0.032	Standardized root mean squared residual
CD	1.000	Coefficient of determination

Source. Outputs of data processing.

The chi-square goodness of fit test was significant. The Chi-square = 294.182, p > 0.1. This indicates that the model fits the data very well. The RMSEA = 0.017, which is a close fit with the data. The p-close test = 1, which means the model is well fitted to the data. The CFI (0.996) and TLI (0.995) indicate a well-fitting model. Moreover, the SRMR (0.032) suggests a good-fitting model.

Due to the very good fit of the model, we can indicate that the measurement of latent variables through the observed variables identified in the study is entirely appropriate and reliable. Then, the linear structural model to show the relationship between latent variables and observed variables in the model can be drawn as Figure 7 below:

Figure 7: CFA Model of Latent Variables and Observed Variables.



Source. Outputs of data processing.

According to the estimation results of the CFA model in the figure above, the estimated coefficients of all the observed variables are approximately 1 and have statistical significance at the 5% level. With this result, the observed variables identified to measure latent variables in the study are completely consistent.

In addition, from the value of the variance as well as the covariance of the latent variables in the CFA model, we can see that the correlation coefficient between the latent variables is less than 0.5 (the correlation coefficient is calculated by the formulas). Hence, there is no correlation between these variables. Thus, the CFA model also satisfies the discriminant property.

4.1.4. Structural Equation Modeling (SEM) analysis

a. *SEM model estimation results on all observations*

The results of the estimated model indicate that all latent variables, including PE, EU, FC, SI, PTS, PRE,and AU, are explained by observed variables due to all variables having a correlation relationship in the model. This is demonstrated by the index of the covariance values between the latent variables that are all equal to 0.

At a meaningful level of 5%, the model has only two out of five latent variables, including PTS and PRE, that can explain AU due to having a p-value<0.05; on the

contrary, the remaining variables including PE, EU, FC and SI all have $p - value > 0.05$, so they are impossible to explain AU at a meaningful level of 5%. Despite this, the observed variables of PE, EU, FC, SI, and AU still show a correlation relationship due to the p-value of the covariance between these variables being less than 0.05. This shows that, although only PTS and PRE have an effect in the model, the statistical results indicate that between the observed variables belonging to PE, FC, EU, SI, and AU, there is still the possibility of influencing the model.

Table 2: Results of Goodness of Fit Test of the Model

Fit statistic	Value	Description
Likelihood ratio		
chi2_ms(418)	455.098	model vs. saturated
p > chi2	0.102	
chi2_bs(561)	9111.947	baseline vs. saturated
p > chi2	0.000	
Population error		
RMSEA	0.016	Root mean squared error of approximation
90% CI, lower bound	0.000	
upper bound	0.026	
pclose	1.000	Probability RMSEA <= 0.05
Information criteria		
AIC	26237.368	Akaike's information criterion
BIC	27041.518	Bayesian information criterion
Baseline comparison		
CFI	0.996	Comparative fit index
TLI	0.994	Tucker-Lewis index
Size of residuals		
SRMR	0.033	Standardized root mean squared residual
CD	1.000	Coefficient of determination

Source. Outputs of data processing.

The results of the goodness of fit test of the model show that the model fits very well. The likelihood ratio shows that the Chi-squared goodness of fit test gives the results and indicates that the model has a very good fit. However, this indicator is affected by the sample size, so researchers in general also test other metrics such as RMSEA, CFI, TLI, and SRMR to prove the goodness of fit. Accordingly, the RMSEA = 0.016 (less than 0.05) and the probability that the index is less than or equal to 0.05 is $p - close = 1$, which proves that the model is perfectly fit to the data. The $CFI = 0.996$ and $TLI = 0.994$, both indicators are greater than 0.95, indicating a very good fit of the model to the data. The SRMR = 0.033 indicating a perfect fit of the model to the data.

Direct and indirect effects

Due to the model's very good fit, we evaluate the direct and indirect effects of the AU variable on PAYA and PAYB.

The analysis results indicate that AU has a direct impact on PAYA and PAYB. However, comparing the level of impact, the impact of AU on PAYA is more significant than the impact of AU on PAYB because the AU's coefficient index in the case of PAYA is greater than the AU's index in the case of PAYB ($10.5452 > 7.0777$). The latent PTS and PRE variables directly impact AU due to a $p - value < 0.05$.

Particularly, SI effects on PAYB and PAYA are $0.19 * 7.07$ and $0.19 * 10.54$,respectively, so SI affects PAYA more, showing that the impact of society has directly affected the need to accept digital payments for people after the pandemic. Digital payment service providers have also implemented brand promotion campaigns, so the number of people accessing digital payments has increased. Along with the lockdown period due to Covid-19, the daily habit of using Digital payment means has also become more popular. Regarding PTS, we have the same result; PTS effects on PAYB and PAYA are $0.13 * 7.07$ and $0.13 * 10.54$,respectively, so PTS affects PAYA more. Payment applications are gradually being perfected as demand increases, especially security methods that are more tightly consolidated. Since then, users have increased their trust in payment applications, so PTS has had a high influence on the demand for digital payments during and after Covid-19. Similarly, PRE effects on PAYB and PAYA are $0.4 * 7.07$ and $0.4 * 10.54$,respectively, so PRE affects PAYA more than it affects PAYB. The pandemic has changed people's consumption habits a lot. People tend to use digital services more thanks to programs like free transactions, cashback when shopping, and many other incentives, to save money and reduce costs in difficult epidemic situations.

By analyzing the indirect effect, similar to the case of direct effect evaluation, the results showed that PTS and PRE had indirect effects on PAYA and PAYB in both cases. In the indirect effect evaluation on PAYA, the coefficients of PTS and PRE were 1.3957 and 4.3794, respectively. Meanwhile, the coefficients of PTS and PRE in the indirect effect evaluation on PAYB were 0.9368 and 2.9394, respectively. Comparing each pair of PTS indicators in PAYA with PTS in PAYB, and PRE in PAYA with PRE in PAYB shows that the coefficient of PTS and PRE in the case of assessing the indirect effect on PAYA is always greater than the indicators in the other case.

b. SEM model estimation with categorical variables

Observations classification

To compare the ratio of spending during Covid-19 and spending before Covid-19. We have the formula for the form:

$$k = \frac{PAYA}{PAYB}$$

Classifying all observations into two classes, where, if an observation that has $0 \leq k \leq 1$, it will be clustered into class "Overspending = 0", which means there is no increase in spending by digital payments during Covid-19; if an observation has k>1, it will be clustered into class "Overspending = 1", which means there is an increase in spending by digital payments during Covid-19.

With CB-SEM model estimation using the maximum likelihood method, for the "Overspending = 0" group, model estimates show that the AU variable is affected by PE, PTS, and PRE due to their p-value ≤ 0.05, the AU variable also affects PAYA and PAYB

at a meaningful 5%. For the "Overspending = 1" group, the SEM model estimation results indicate that the EU, SI, and PRE have an effect on the AU variable in the model at a meaningful level of 5%. AU is also the variable that has an effect on PAYA and PAYB at the same meaningful level as the above variables. In the estimated results of both groups, the impact of AU on PAYA and PAYB was the same.

Goodness of fit test.

The test results give the overall value of 1.0000. This means that all variables included in the test model can thoroughly explain AU, in which the goodness of fit of EU1 reached 87.45% (R-squared = 0.8745478), and that of PTS5 reached 86.35% (R-squared = 0.8635303), both of which are also the two variables with the highest fit in this model.

For the model of group "Overspending =1", the goodness of fit test result reached 0.9999, approximately 1. Therefore, concluding that all the variables included in the model can explain AU, of which PE1 and EU1 are the two variables with the highest fit of the model, PE1 has a goodness of fit of 81.03% and EU1 reaches 75.24%.

Stability analysis of the structural equation model

For the group "Overspending = 0", the stability index has a result of 0, inferring that all individual values are in the unit circle, and the SEM model satisfies stable conditions. Similarly, for the "Overspending = 1" group, the stability index is 0, concluding that all individual values are in the unit circle. This SEM model also satisfies stable conditions.

Direct and indirect effect

For the group "Overspending = 0", PE, PTS, and PRE directly affect AU. For the group "Overspending = 1", EU, SI, and PRE directly influence AU. In particular, the coefficient of the PRE variable in the group "Overspending = 0" has a more significant effect than the coefficient of the PRE variable in the other group.

For the "Overspending = 0" group, only PE, PTS, and PRE have an indirect effect on PAYA and PAYB, where the effect on PAYA is greater than the effect on PAYB. For the "Overspending = 1" group, EU, SI, and PRE indirectly affect PAYA and PAYB. Similar to the above group, the effect of these variables on PAYA is greater than the effect on PAYB. In summary, the results have clearly illustrated that these variants, EU, SI, and PRE, have a positive impact on digital payment adoption (AU), result in an upswing in customers' spending needs through digital payments post-Covid-19 (PAYA).

With the aim of controlling for the impact of Age, Gender, and Job variables on electronic payment spending throughout the pandemic, cost-square tests were performed in this study. The results showed that the p-values were vastly larger than the 5% (or even 10%) significance level. Therefore, we could confirm that these demographic factors did not have a significant impact on the digital payment spending behavior of observed individuals during the Covid-19 pandemic.

4.2 Discussion

Perceived technology security and Price expectancy significantly impact the adoption of digital payments by consumers, while some factors belonging to

Performance expectancy, Ease-of-use, Facilitating conditions, and Social influence show specific associations with them. The adoption of digital payments is the direct factor driving consumers to make digital payments, especially during Covid-19. All the impacts of Covid-19 are more remarkable than before.

Divided the data group into two groups: (1) people with an increase in digital payment spending due to Covid-19 and (2) those who did not have an increase in digital payment spending due to Covid-19. The impact of the adoption of digital payments on consumers' spending behavior in both groups was the same.

In group 1, "Overspending = 0", Perceived technology security, Price expectancy, and Performance expectancy directly influence the adoption of digital payments. Consumers in this category are pretty common in Vietnam. Although they are aware of the advantages that digital payments bring, their spending on digital payments during Covid-19 has not increased, possibly due to many reasons such as lack of conditions of use, not knowing how to use it (common among middle-aged and older people), reduced income, or those whose spending needs are unchanged between before and during the pandemic.

In group 2, "Overspending = 1", the direct factors influencing the adoption of digital payments are Ease-of-use, Social influence, and Price expectancy. This group of people is often found at a relatively young age. They can easily learn to use digital payments and be affected by social networks, especially in times of epidemics. They are also very attracted to price incentives because most of their income is not high. In the time of Covid-19, thanks to many favorable conditions and restrictions to prevent the pandemic, this group of people quickly tended to increase spending through digital payments.

Price expectancy is the determining factor in the adoption of digital payments by all consumers, both before and during Covid-19. In contrast, facilitating conditions are not at all a factor affecting the behavior of the group of people surveyed. The remaining factors show their influence on each customer differently.

Therefore, we propose some recommendations to develop digital payments in the context of Covid-19. First, it is necessary to upgrade and optimize the digital payment app interface so that people of all ages can easily use it. Second, to limit the risk of losing money in customer accounts, always having an authentication code, pin code, or password is necessary when making electronic payment transactions. Finally, to promote the habit of non-cash payment, it is necessary to increase the features and utilities of the service to ensure that it is fast, low-cost, and safe.

The present study has some limitations. Firstly, the methods and sample collection are not highly representative; the survey respondents are mainly concentrated in Ho Chi Minh City. Second, a small sample size of 407 people was used, and the age of the surveyed people was mostly 18 to 28. The survey participants are mainly students and working people who are often exposed to internet media. The factors that influence overspending can always change over time and according to consumer needs. Therefore, the solutions and contributions to the topic are for reference only and are consistent with the actual situation at present.

5. Conclusion

Theoretically, our findings broaden the literature on the adoption of electronic payments in emerging Asian countries. These regions are characterized by disruptive technology, which has fueled large populations with technology generation, while the policies or regulatory frameworks for non-cash payments have not been entirely efficient. Legally, the regulatory framework and related vendors maintain limitations that need to be improved as soon as possible to increase scale and value for users. The research has gradually proven that non-cash payments have become necessary as well as close to people's daily transactions.

This study is even more special because it is a study on the Vietnamese market during the Covid-19 period to determine users' acceptance of using electronic payments. According to the study results, acceptance of using electronic payments depends on performance expectations, ease of use, social influence, facilitating conditions, perceived technology security, and price expectations. All independent variables show both a positive correlation and statistical significance with the adoption of digital payments. However, only perceived technology security and price expectancy positively influence users' adoption of cashless payment. Besides, the study also shows that the group of variables ease of use, social influence, and price expectancy positively influence the acceptance of using digital payments, leading to an increase in spending through digital payments by users during Covid-19. In addition, this study also found that demographic factors did not affect the change in spending behavior of individuals through electronic payments during the Covid-19 pandemic. This is a consistent result. Because, during this research period, social distancing was strictly implemented in Vietnam, everyone, regardless of age, job, or gender, was required to be confined at home. Thus, the personal necessities were similar.

With the above findings, the study has both scientific and practical significance. In particular, the research results on the topic help to suggest some recommendations to improve the existing advantages and disadvantages. Digital payment service providers need to provide clear and detailed instructions and optimize the interface of digital payment applications so that they can be easily used by all ages. Besides low service costs, many promotions should be applied throughout the year to encourage customers to use digital payment services. Furthermore, it is necessary to develop and complete legal provisions on information security, including regulations on sharing information data between relationships: individuals - providers, providers - partners, within providers, and providers - regulatory agencies. Finally, in order to limit the risk of losing money in customer accounts, it is necessary to have an authentication code, pin, or password every single time making online transactions to verify the identity of the user, allow monitoring of all transactions, and locate mobile subscribers making transactions.

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Appendix 1
Questionnaire Survey

Table A1: Content of the question observed variables

Variable and Sources	Items
Performance expectancy Boonsiritomachai, W., & Pitchayadejanant, K. (2019).	[PE1] I find digital payment very convenient.
	[PE2] Digital payment is useful to save time.
	[PE3] I can track account balance fluctuations faster.
	[PE4] Buying and selling can be done at any time and from any location.
	[PE5] E-commerce services' registration and maintenance costs of e-commerce services are more economical than traditional banking services.
Ease of Use Moore and Benbasat, (1991), Rogers (1983), Slyke et. al., (2004), Davis (1989), Monsuwe' et. al., (2004), Slyke et. al., (2005).	[EU1] It is easy to perform transactions using e-commerce.
	[EU2] It is easy to learn how to trade using e-commerce.
	[EU3] The interface of e-commerces media is easy to understand
	[EU4] There are always specific instructions at each payment step interface of e-commerces media is easy to understand.
Facilitating condition Adler (2004), Jih, W.J.K and S.F. Lee. (2002).	[FC1] I have the electronic devices necessary to use digital payment
	[FC2] I am eligible for internet/3G/4G to use e-mail.
	[FC3] I receive dedicated support from an e-commerce service provider.
	[FC4] Internet connection quality is always guaranteed to implement e-commerce.
Social influence Boonsiritomachai and Pitchayadejanant (2019), Lee, Dean, and Jung (2008), Sun et al. (2013), Sair and Danish (2018)	[SIS1] Family/Friends/colleagues use digital payment.
	[SIS2] There are many places to buy and sell that accept e-commerce.
	[SIS3] I see e-commerce is widely used.
	[SIS4] Social media is widely advertised on social networks.
	[SIS5] I can easily find reviews of e-commerce facilities.
Perceived technology security Boonsiritomachai, W., & Pitchayadejanant, K. (2017).	[PTS1] All transaction information is confidential.
	[PTS2] My personal information is kept confidential.

Variable and Sources	Items
	[PTS3] I trust the service provider's rules and policies.
	[PTS4] Authentication steps when making digital payments are strictly controlled.
	[PTS5] There is a variety of account authentication (via e-mail, phone number, fingerprint.).
Price expectancy	[PRE1] I always pay attention to promotions when using.
	[PRE2] I always use promotions on digital payment.
	[PRE3] The form of digital payment I am using has been/been doing large promotion campaigns (big sales).
	[PRE4] I believe digital payment promotions help me save money.
	[PRE5] Promotions through e-commerce sites take place regularly.
Adoption of using digital payment	[AU1] I will increase the use of e-commerce in my daily life
Ozturk (2016), Sun et al. (2013).	[AU2] I will introduce people around to use e-commerce.
	[AU3] I will continue to use e-commerce with more forms (ATM card, internet banking, e-wallet,...).
	[AU4] I always use e-commerce (when possible) to make transactions.
Overspending in Covid-19	[PAYB] Before the gap (before 05/2021), what percentage (%) of your total monthly spending is spent by e-payment?
	[PAYA] During the gap (from May 5, 2021, to present), the amount of money spent by electronic payment accounts for how much percentage (%) of your total monthly spending?

Source: Prepared by the authors.

Appendix 2
Tables of quantity research results from Stata 16 software

Table A2: The results of the Cronbach's Alpha test of the "Performance expectancy" scale

Cronbach's Alpha: 0.9086			Number of variables: 5	
item	**Item-test correlation**	**Item-rest correlation**	**Interitem covariance**	**Alpha**
Pe1	0.8952	0.8368	0.5105788	0.876
Pe2	0.8663	0.7887	0.5138127	0.8845
Pe3	0.8658	0.7858	0.5095957	0.8849
Pe4	0.8627	0.7721	0.4948268	0.8881
Pe5	0.8032	0.681	0.5287157	0.9082

Source: Outputs of data processing.

Table A3: The results of the Cronbach's Alpha test of the "Ease of use" scale

Cronbach's Alpha: 0.9063			Number of variables: 4	
item	**Item-test correlation**	**Item-rest correlation**	**Interitem covariance**	**Alpha**
Eu1	0.9034	0.8283	0.5488992	0.8658
Eu2	0.8874	0.7937	0.5454077	0.8771
Eu3	0.8925	0.7972	0.5296392	0.8763
Eu4	0.8531	0.7402	0.5838591	0.8958

Source: Outputs of data processing.

Table A4: The results of the Cronbach's Alpha test of the "Facilitating condition" scale

Cronbach's Alpha: 0.8766			Number of variables: 4	
item	**Item-test correlation**	**Item-rest correlation**	**Interitem covariance**	**Alpha**
Fc1	0.8232	0.6883	0.6908035	0.8594
Fc2	0.8724	0.7596	0.616692	0.8317
Fc3	0.8615	0.7446	0.6362827	0.8377
Fc4	0.8594	0.7446	0.6452647	0.8378

Source: Outputs of data processing.

Table A5: The results of the Cronbach's Alpha test of the "Social influence" scale

Cronbach's Alpha: 0.8831			Number of variables: 5	
item	**Item-test correlation**	**Item-rest correlation**	**Interitem covariance**	**Alpha**
Si1	0.7912	0.6595	0.5374654	0.8755
Si2	0.8521	0.7606	0.5029638	0.8485
Si3	0.8375	0.7428	0.518647	0.8533
Si4	0.8433	0.7482	0.5100106	0.8517
Si5	0.8209	0.71	0.5163	0.8605

Source: Outputs of data processing.

Table A6: The results of the Cronbach's Alpha test of the "Perceived technology security" scale

Cronbach's Alpha: 0.9182			Number of variables: 5	
item	**Item-test correlation**	**Item-rest correlation**	**Interitem covariance**	**Alpha**
Pts1	0.8878	0.8191	0.5488188	0.8937
Pts2	0.8883	0.8178	0.5434787	0.8939
Pts3	0.8716	0.7963	0.5629279	0.8984
Pts4	0.8815	0.8128	0.5615843	0.8953
Pts5	0.8137	0.7047	0.5874222	0.9171

Source: Outputs of data processing.

Table A7: The results of the Cronbach's Alpha test of the "Price Expectancy" scale

Cronbach's Alpha: 0.8938			Number of variables: 5	
item	**Item-test correlation**	**Item-rest correlation**	**Interitem covariance**	**Alpha**
Pre1	0.8448	0.7436	0.5850627	0.87
Pre2	0.8619	0.772	0.5770653	0.8632
Pre3	0.8382	0.7446	0.6095913	0.8697
Pre4	0.8352	0.7352	0.6023565	0.8716
Pre5	0.8093	0.7032	0.6295484	0.8786

Source: Outputs of data processing.

Table A8: The results of the Cronbach's Alpha test of the "Adoption of Using Digital Payment" scale

Cronbach's Alpha: 0.8925			Number of variables: 4	
item	**Item-test correlation**	**Item-rest correlation**	**Interitem covariance**	**Alpha**
Au1	0.8854	0.7931	0.5678285	0.8506
Au2	0.877	0.7757	0.5694551	0.8567
Au3	0.8613	0.7576	0.6005422	0.8641
Au4	0.8598	0.7323	0.5644651	0.8755

Source. Outputs of data processing.