The direct and indirect impacts of factors on the use of QR code payment during the Covid-19 pandemic: Empirical research in Ho Chi Minh City, Vietnam

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ABSTRACT

The QR code payment is a service that allows customers to use their smartphone's camera and mobile banking application to scan the QR code to quickly pay for many transactions by money being transferred from the account of the customer to the account of the point of sale. The objective paper is to identify factors influencing customers' use of QR code payment in Ho Chi Minh (HCM) City, Vietnam, during the Covid-19 pandemic. Our proposed model extended based on combining the TAM and UTAUT2. We had an online survey with the participation of 567 customers who used the QR code payment in HCM City from June 2020 to January 2021 and applied Structural Equation Modeling (SEM) to test hypotheses. The results were analyzed by SPSS 25 and AMOS 24 software, indicating that the total effect of perceived Covid-19 on the use of QR code payment was the strongest, with the second rank on the direct impact and the first rank on the indirect impact. Intention to use plays the strongest role in the direct effects of the use of QR code payment, while the effects of attitude, facilitating conditions, personal innovativeness, security, trust, and perceived ease of use on the use of QR code payment were indirect and positive. These results will help providers of QR code payment have some recommendations to increase the use of customers about the QR code payment to develop and exploit their potential market for this service.

1. Introduction

After WHO declared coronavirus Covid-19 to be a pandemic, it seriously affected people's health and the global economy (Golinelli et al., 2020). Up to September 20, 2021, it infected more than 229 million people and made the death of over 4.7 million people, particularly 687,063 and 17,090 Vietnamese infected and died respectively (Worldometer, 2021). But if you look at it from another perspective, the Covid-19 epidemic is an opportunity for strongly developing digital payments, as WHO indicated that avoiding physical contact and keeping social distance was one of the best preventive solutions (World Health Organization, 2020). According to the Payment Department of the State Bank of Vietnam, by the end of the first quarter of 2021, despite being affected by the epidemic, non-cash payments continued to record high growth: transactions through the Internet channel reached 8.1 million billion VND accounted for increasing 28.4%

compared with the same period in 2020; similarly, transactions via mobile phone channel reached more than 4.6 million billion VND accounted for increasing 103%; transactions via QR code channel reached nearly 4.5 billion VND accounted for increasing 146% (Phi Nhat, 2021). This means that despite strong growth, the total transaction value via the QR Code channel is the lowest among the non-cash payment methods mentioned. Moreover, the Internet and smartphones have become embedded in every aspect of Vietnamese day-to-day lives with 68.72 million people using the Internet, and 96.9% of Internet users aged 16 to 64 owed smartphones (We Are Social and Hootsuite, 2021). Therefore, it seems to have many chances for the development of QR code payment in the future.

Quick Response Code (QR Code) first appeared in Japan in 1994 to track vehicles during the production process. After that, many fields have applied it all over the world. In the context of payment, the QR code payment allows customers to use their smartphone's camera and mobile banking application to scan the QR code to quickly pay for many transactions by money being transferred from the account of the customer to the account of the point of sale. Nowadays, in Asian countries, QR code payment has become more popular and strongly developed as customers have changed their payment habits from cash to cashless by using new technology applications (Ngo & Nguyen, 2021).

In recent years, some researchers have been aware of the QR code payment service. Researchers based on every model, not combining models such as TAM (Hajazi, Chan, Ya'kob, Siali, & Latip, 2021; Liébana-Cabanillas, Ramos de Luna, & Montoro-Ríos, 2015; Ngo & Nguyen, 2021), UTAUT (Mai, Nguyen, & Le, 2019; Slade, Dwivedi, Piercy, & Williams, 2015), UTAUT2 (Dawi, 2019; Imani & Anggono, 2020), and MTAM (Yan, Tan, Loh, Hew, & Ooi, 2021). Our paper combined TAM and UTAUT2 to analyze factors affecting the use of QR code payment by customers. These authors focused on factors affecting the intention to adopt the QR code payment (Slade et al., 2015; Yan et al., 2021), intention to use the QR code payment (Dawi, 2019; Hajazi et al., 2021; Liébana-Cabanillas et al., 2015; Ngo & Nguyen, 2021) and actual use of the QR code payment (Imani & Anggono, 2020; Mai et al., 2019). Imani and Anggono (2020) showed that in the case of generation Z in Bandung, using QR code payment, habit, facilitating conditions, hedonic motivation, and performance expectancy positively impacted behavioral intention, and the influence of behavioral intention on actual usage was positive. Moreover, Mai et al. (2019) indicated that the decision to use QR code payment of individual customers in Danang City was affected by attitude, useful feeling, and convenient feeling.

Moreover, TAM and UTAUT2 don't include 02 factors: perceived security and customer trust in the system, and the effects of customer trust and perceived security on the QR code payment on attitude toward the QR code payment weren't studied in the past. Some researchers indicated that security positively impacted the adoption intention of mobile payment (Moorthy et al., 2020; Zhao & Bacao, 2021), and accepting mobile payment (Alabdan & Sulphey, 2020). Similarly, customer trust also had a positive correlation with usage intention mobile payment (Gao & Waechter, 2017; Zhao & Bacao, 2021), with the adoption of digital payment (Alkhowaiter, 2020), or with customer's intention to adopt mobile wallets (Chawla & Joshi, 2019), or with attitude towards adoption mobile wallet (Alswaigh & Aloud; 2021; Chawla & Joshi, 2019). Particularly, the impact of the Covid-19 pandemic on cashless payment was studied in some research (Srivastava, Mahendar, & Vandana, 2021; Wisniewski, Polasik, Kotkowski, & Moro, 2021). Toh and Tran (2020) stated that because of the Covid-19 pandemic, consumers likely tend

to adopt digital payments. However, the impact of Covid-19 on QR code payment didn't study in the past. Despite the Covid-19 pandemic mentioned by Zhao and Bacao (2021), they didn't put the impact of Covid-19 as a variable. In Vietnam, in the context of the Covid-19 pandemic and the development trend of QR code payment as above, there was still rarely research about QR code payment, with only 02 studies not having perceived Covid-19 and customer trust as variables (Mai et al., 2019; Ngo & Nguyen, 2021). Therefore, we integrated the TAM and UTAUT2 to analyze factors affecting the use of QR code payment by customers and added perceived security, customer trust, and perceived Covid-19 in our proposed model to fill these gaps above.

In this paper, we first proposed a new theoretical model for the use of the QR code payment by extending based on combining the TAM and UTAUT2 as well as some research in the same fields. Secondly, based on the collected data, we analyzed and evaluated the determinants, directly and indirectly, impacting the use of QR code payment by customers in HCM City, Vietnam, particularly the effects of customers' perceived Covid-19 on the use of QR code payment. Finally, we have some theoretical and practical contributions for the development of the QR code payment in the future, especially for providers of the QR code payment to increase the use of customers about the QR code payment to develop and exploit their potential market for this service.

2. Literature review

2.1. The Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) was built by Davis (1989) for the acceptance of users of information systems. This model consists of two primary factors: perceived ease of use and perceived usefulness. The attitude of users is significantly impacted by these two factors. Moreover, users' attitude affects their behavioral intention to accept new technology, and behavioral intention to use impacts actual use.

2.2. The Unified Theory of Acceptance and Use of Technology 2 model (UTAUT2)

Based on the UTAUT, Venkatesh, Thong, and Xu (2012) proposed UTAUT2. The difference between the UTAUT and the UTAUT2 was that the UTAUT focused on both organizational and non-organizational while the UTAUT2 focused on the use of customers (Venkatesh et al., 2012). There were 05 new variables added in the UTAUT2, as follows: hedonic motivation, price value, and habit, while voluntariness of use was deleted. The UTAUT2 was more complex than UTAUT because of the new five constructed relationships. Firstly, the effects of facilitating conditions on behavioral intention and use behavior were moderated by gender, age, and experience. Secondly, the effect of hedonic motivation on behavioral intention was moderated by gender, age, and experience. Thirdly, the effect of price value on behavioral intention was moderated by gender, age, and experience. Fourthly, the effect of habit was moderated by gender, age, and experience. Finally, the effect of behavioral intention was moderated by experience.

2.3. The hypotheses and research model

Perceived ease of use (PE):

Davis (1989) defined perceived ease of use (PE) as the degree of customers' perception that of using a particular technology without effort. It means that if people think that new technology is easy to use without their efforts, their attitude towards it would be worth trying and adopting. By contrast, if they think that the use of new technology is complex and difficult, they would reject trying and adopting it (Hajazi et al., 2021). In this paper, perceived ease of use is the

degree to which customers use the QR code payment with free effort (Yan et al., 2021). Venkatesh (2000) proved that PE is an important factor affecting attitude towards the use of information technologies. Ngo and Nguyen (2021) stressed that PE significantly and positively affected the attitude towards intention to use QR code payment when Vietnamese customers went shopping in Vietnam. Moreover, Alswaigh and Aloud (2021) illustrated that PE significantly and positively impacted users' attitudes toward adopting mobile wallet services in Saudi Arabia. Therefore, we hypothesize:

H1: Perceived ease of use has a positive relationship with attitude toward adopting QR code payment

Perceived Usefulness (PU):

Customers' perceived usefulness (PU) refers to customers' belief that new and particular technology brings benefits for them (Davis, 1989), and PU plays a vital role in attitude toward intended use (Liébana-Cabanillas, Sánchez-Fernández, & Muñoz-Leiva, 2014). Liébana-Cabanillas et al. (2015) also indicated that PU had a significant positive relationship with attitude towards the use of the QR mobile payment system. Yan et al. (2021) stated that the effect of PU on the intention to adopt the QR code payment was significant and positive, and the more benefits being brought by providers of the QR code payment led to the more increasing intention to adopt it. Similarly, Hajazi et al. (2021) also reported that PU had a positive correlation with the intention to use QR code payment in Malaysia. Chawla and Joshi (2019) showed that the effects of PU on attitude and intention to adopt mobile wallet services in India were positive and significant. Alswaigh and Aloud (2021) found that PU significantly and positively impacted user attitudes toward adopting mobile wallet services. Thus, we hypothesize:

H2: Perceived usefulness has a positive relationship with attitude toward QR code payment

H3: Perceived usefulness has a positive relationship with the intention to use QR code payment

Facilitating Conditions (FC):

Facilitating Conditions (FC) are defined as the degree of technical and organizational infrastructure that supports customers in using the system (Venkatesh, Morris, Davis, & Davis, 2003). By extending the UTAUT2, Imani and Anggono (2020) showed that more access to one facilitation led to a higher customer's intention to use one new technology. Hence, there were links of FC to both the behavioral intention and the actual use. Similarly, it is said that FC leads customers to have the intention to adopt the QR code payment (Imani & Anggono, 2020). Alswaigh and Aloud (2021), Chawla and Joshi (2019) indicated that FC significantly and positively impacted user attitudes toward adopting mobile wallet services. Moreover, Alkhowaiter (2020) stated that FC and use behavior had a positive relationship in his proposed model for the adoption of digital payment and banking in Gulf countries. Thus, the hypothesis is as follows:

H4: Facilitating conditions have a positive relationship with attitude toward QR code payment

H5: Facilitating conditions have a positive relationship with the intention to use QR code payment

H6: Facilitating conditions have a positive relationship with the use of QR code payment

Personal Innovativeness (PI):

Agarwal and Prasad (1998) indicated that PI concerns personal willingness to explore new technology. Slade et al. (2015), Liébana-Cabanillas et al. (2015) confirmed that PI has a positive correlation with customer's intention to use QR code payment or mobile payment services.

Although Yan et al. (2021) hypothesized that PI positively impacted the intention to use the QR code payment, they didn't prove this hypothesis. Thus, the hypothesis is as follows:

H7: Personal innovativeness has a positive relationship with customer intention to use QR code payment

Trust (TR):

Benamati, Fuller, Serva, and Baroudi (2010) stated that trust occurred when customers believed in the three dimensions of providers, including ability, integrity, and benevolence. Some research indicated that there was a positive relationship between trust and attitude (Agag & El-Masry, 2016; Alswaigh & Aloud, 2021; Chawla & Joshi, 2019; etc). Customer trust also had a significant and positive correlation with usage intention in mobile payments (Gao & Waechter, 2017; Zhao & Bacao, 2021). Similarly, Alkhowaiter (2020) hypothesized that TR and intention behavior had a positive relationship in his proposed model for the adoption of digital payment and banking in Gulf countries. With empirical research in India, Chawla and Joshi (2019) proved that TR significantly and positively impacted both attitude and intention toward mobile wallets. Hence, we hypothesize:

H8: Customer trust has a positive relationship with attitude toward QR code payment

H9: Customer trust has a positive relationship with the intention to use QR code payment

Perceived Covid-19:

In our research, perceived Covid-19 concerns the customers' perception of the risk effects of Covid-19 on them. Some authors stated that perceived risk negatively impacted customer intention to use mobile payment services (Abidin, Rivera, Maarop, & Hassan, 2017; Dawi, 2019; Humbani & Wiese, 2018; Slade et al., 2015). However, because of the Covid-19 pandemic, many countries limited community activities, and citizens were required to maintain social distancing, recommend citizens stay at home as well as apply technologies to daily activities (Musyaffi, Sari, & Respati, 2021). As a result, the sudden increase in digital payments was reported on a global scale (Benni, 2021) and the use of QR code payment in Vietnam showed a growth of 164% in the first quarter of 2021 compared to the same period in 2020 (Phi Nhat, 2021). Aji, Berakon, and Md Husin (2020) proved that perceived Covid-19 risk positively affected the intention to use e-wallets. Moreover, Srivastava et al. (2021) proved that perceived vulnerability and perceived severity during the Covid-19 pandemic significantly and positively impacted the intention to use cashless payments. According to the argument, we would like to test the new variable of whether perceived Covid-19 has effects on the attitude, intention to use, and the use of the QR code payment. Therefore, the hypothesis is as follows:

H10: Perceived Covid-19 has a positive relationship with attitude toward QR code payment

H11: Perceived Covid-19 has a positive relationship with the intention to use QR code payment

H12: Perceived Covid-19 has a positive relationship with the use of QR code payment

Security (SE):

Chawla and Joshi (2019) indicated that security concerns customers' belief that they will be safe when they make online payments. Although Chawla and Joshi (2019) hypothesized that SE positively impacted the intention to use the mobile wallet, they didn't prove this hypothesis. However, some authors successfully proved this hypothesis. Zhao and Bacao (2021), Moorthy et al. (2020) stressed that the intention to adopt mobile payment was significantly positively impacted

by SE. Moreover, Alabdan and Sulphey (2020) also confirmed that SE has a positive relationship with accepting mobile payment services. Therefore, the hypothesis is as follows:

H13: security has a positive relationship with the intention to use the QR code payment

Attitude (AT):

Attitude (AT) concerns customers' positive or negative emotions and feelings when they adopt new technology (Davis, 1989), and customer intention concerns customers tending to adopt and use the latest technology (Venkatesh et al., 2003). Chawla and Joshi (2019) indicated that attitude significantly and positively affected customer intention to adopt mobile wallets in India. Similarly, Alswaigh and Aloud (2021) proved that customer attitude toward adopting mobile payment services significantly positively impacted customer intention to adopt mobile payment services in Saudi Arabia. Moreover, Liébana-Cabanillas et al. (2015), Ngo and Nguyen (2021) also found that intention to use QR code mobile payment and attitude had a significant and positive correlation. Hence, we hypothesize:

H14: Attitude has a positive relationship with the intention to use the QR code payment

Intention to use (IN):

Venkatesh et al. (2012) proposed in the UTAUT2 that intention behavior impacted the actual use of customers. Some empirical studies were done to prove this. Imani and Anggono (2020) indicated that the actual use of QR code payment and intention behavior had a positively significant relationship for generation Z in Indonesia. Moreover, Musyaffi et al. (2021) confirmed that behavior intention to use digital payments and use behavior had a significant positive correlation during the Covid-19 pandemic in Indonesia. Therefore, the hypothesis is as follows:

H15: Intention to use has a positive relationship with the use of the QR code payment

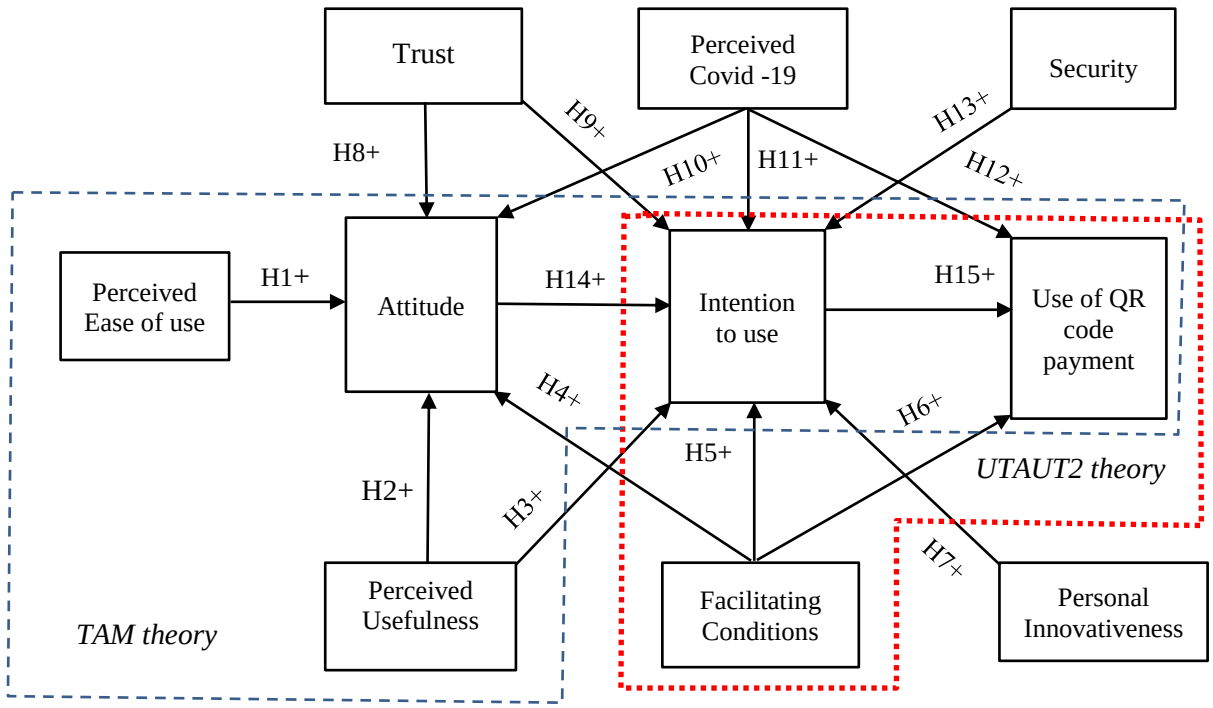

Figure 1. The proposed research model

Source: Research findings

3. Research methodology

3.1. Sample and data collection

This paper used a quantitative method and the main target respondents were users of the QR code payment in HCM City, Vietnam with different age groups. We applied the convenience method and online survey via Facebook social network and Zalo application to collect data from June 2020 to January 2021 when the sure of the Covid-19 pandemic in HCM City. Because of the sample's requirement about the filtering level to ensure all participants have enough experience or understanding of the research's subject (Yan et al., 2021), the first requirement for participants was that they have used the QR code payment, and then they will be only given the questionnaire if they agree to participate. The questionnaire was collected when the participant answered completely all questions in 2 sections. The first section is to collect respondents' profiles regarding gender, age, education level, and income. The second section contained the measurement items with 43 questions being based on scales of previous research.

According to Hair, Anderson, Babin, and Black (2010), the minimum sample size for analyzing the structural equation modeling (SEM) with over 07 factors is 500. Therefore, with 10 factors in the research model, our sample size applied must be at least 500. Although 800 the google form link of the questionnaire was sent, we received only 567 respondents, with a response rate of 70.86% of the distributed survey, and met the minimum sample requirements.

Table 1

Profile of respondents in the sample size

Respondents' profile	Categories	Frequency	Percentage
Gender	Female	334	58.91
	Male	233	41.09
Age	18 - 25	174	30.69
	26 - 35	231	40.74
	36 - 45	131	23.10
	46 - 55	31	5.47
Education level	High school	13	2.29
	Intermediate school	41	7.23
	College	140	24.69
	University	351	61.91
	Over university	22	3.88
Income	Under 05 million VND	45	7.94
	05 - 10 million VND	278	49.03
	11 - 15 million VND	175	30.86
	Over 15 million VND	69	12.17
Frequency of using QR code payment per month	01 - 10 times	266	46.91
	11 - 20 times	215	37.92
	21 - 30 times	75	13.23
	Over 30 times	11	1.94

Source: The study results

Table 1 shows our sample description. The total number of respondents was 567 with 334 females. The respondents were predominantly young from 18 to 35 years old as the majority of them were in 02 age groups: 26 - 35 (40.74%) and 18 - 25 (30.69%). Most respondents graduated from university (61.91%) and college (24.69%), and the smallest percentage of them obtained high school level (2.29%). The majority income was from 5 to 10 million VND (49.03%) and the minority income was under 5 million VND (7.94%). It is seen to be that QR code payments are very popular payment forms for use from 1 to 10 times per month (46.91%) and from 11 to 20 times per month (37.92%).

3.2. Scale measures

All scales in this study are multivariate scales and were developed regarding previous research as indicators to explain perceived ease of use, facilitating conditions, perceived usefulness, security, trust, personal innovativeness, attitude, intention to use, and the use of the QR code payment with the items adopting from previous authors in Table 2. We use a 5-point Likert: 1 being completely disagreed, up to 5 completely agreed, with 3 being neutral.

Table 2

Sources of measurement items

Variables	Items	Sources
Perceived ease of use (PE)	PE1, PE2, PE3, PE4, PE5	Yan et al. (2021), Alswaigh and Aloud (2021)
Facilitating Conditions (FC)	FC1, FC2, FC3, FC4	Chawla and Joshi (2019), Alswaigh and Aloud (2021)
Perceived Usefulness (PU)	PU1, PU2, PU3, PU4	Liébana-Cabanillas et al. (2015), Yan et al. (2021), Chawla and Joshi (2019), Alswaigh and Aloud (2021)
Security (SE)	SE1, SE2, SE3, SE4, SE5	Chawla and Joshi (2019), Zhao and Bacao (2021)
Trust (TR)	TR1, TR2, TR3, TR4, TR5	Zhao and Bacao (2021), Alswaigh and Aloud (2021), Chawla and Joshi (2019)
Personal Innovativeness (PI)	PI1, PI2, PI3, PI4	Slade et al. (2015), Liébana-Cabanillas et al. (2015), Yan et al. (2021)
Attitude (AT)	AT2, AT2, AT3, AT4	Chawla and Joshi (2019), Alswaigh and Aloud (2021), Liébana-Cabanillas et al. (2015)
Intention (IN)	IN1, IN2, IN3, IN4	Chawla and Joshi (2019)
Perceived Covid-19 (PC)	PC1, PC2, PC3, PC4	Aji et al. (2020), Srivastava et al. (2021)
Use of QR code payment (US)	US1, US2, US3, US4	Imani and Anggono (2020)

Source: The study results

3.3. Data analysis

All collected data were coded and analyzed data using SPSS 25.0 and AMOS 24.0 software in this study. The main analytical methods used in this study are analysis in the form of reliability assessment of the scale by Cronbach's Alpha, Exploratory Factor Analyses (EFA), Confirmatory Factor Analyses (CFA), and Structural Equation Modeling (SEM). In the analysis of Cronbach's

Alpha, to ensure high reliability of the scale, the coefficient of Cronbach's Alpha is ≥ 0.6 and the correlation coefficient of the total variable is ≥ 0.3 (Tabachnick & Fidell, 2013). Hair et al. (2010) indicated that to ensure the reliability and practicality of the scale, the Promax rotation method was applied and the EFA analysis must have as follows: a factor loading factor > 0.5, Bartlett test's sig. < 0.05, extracted variance ≥ 50%, KMO > 0.5, and eigenvalue > 1. For CFA and SEM analyses, the research model is suitable and good when p < 0.05; Chi-square/df (CMIN/df) ≤ 2; CFI ≥ 0.9; GFI ≥ 0.9; TLI ≥ 0.9; RMSEA ≤ 0.08 (Hair et al., 2010), and the PCLOSE ≥ 0.05 (Hu & Bentler, 1999).

4. Results and discussion

4.1. Cronbach's Alpha test for reliability of the scale

The scales met reliability requirements with the value of Cronbach's Alpha from 0.886 to 0.949 (> 0.6) and Corrected item-total Correlation greater than 0.5 (at least 0.708). After eliminating PE1, SE5, and TR5, 40 observed variables were consistently measured as specific, statistically, and analytically significant. Moreover, the results also showed that customers agreed with statements related to perceived ease of use, facilitating conditions, perceived usefulness, security, trust, personal innovativeness, attitude, intention to use, perceived Covid-19, and use of QR code payment because all mean values were from 3.45 to 3.58. Customer trust had the highest mean value while facilitating conditions and use of QR code payment had the smallest one.

4.2. The Exploratory Factors Analysis (EFA)

The results of EFA with the Promax rotation satisfied the suggested thresholds by Hair et al. (2010). All 40 items loaded on ten factors with Eigenvalues > 1; the cumulative percent of 76.263% and KMO values = 0.956 > 0.5. Bartlett's test is significant at p = 0.000 < 0.05 for the variables measuring ten factors, including perceived usefulness, personal innovativeness, use of QR code payment, perceived ease of use, perceived Covid-19, trust, facilitating conditions, attitude, security, and intention to use. The observed variables of factors were strongly correlated.

4.3. Confirmatory Factor Analysis (CFA)

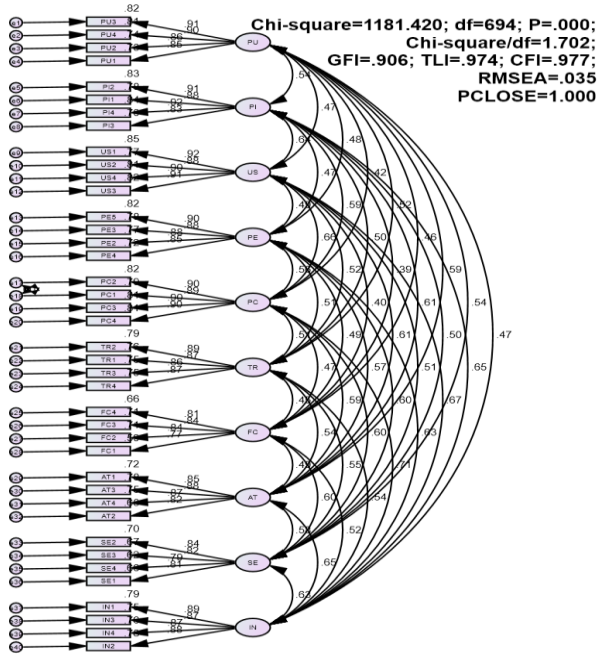

Figure 2. The results of the Confirmatory Factor Analysis (CFA)

Source: The study results

From the result of CFA in Figure 2, the model fit was good with the data collected as the results satisfied the suggested thresholds as follows: p = 0.000 < 0.05; chi-square/df = 1.702 < 2; GFI = 0.906 > 0.9; TLI = 0.974 > 0.9; CFI = 0.977 > 0.9; RMSEA = 0.035 < 0.08 (Hair et al., 2010) and PCLOSE = 1.000 > 0.05 (Hu & Bentler, 1999). All the standardized regression weights were over 0.5 (p = 0.000), so all observed variables were convergent validity.

Table 3

Convergent and discriminant validity and reliability tests

	CR	AVE	MSV	SE	PU	PI	US	PE	PC	TR	FC	AT	IN
SE	0.887	0.662	0.396	**0.814**									
PU	0.932	0.775	0.353	0.542	**0.881**								
PI	0.936	0.785	0.420	0.503	0.540	**0.886**							
US	0.945	0.812	0.448	0.510	0.474	0.636	**0.901**						
PE	0.931	0.771	0.403	0.596	0.482	0.470	0.495	**0.878**					
PC	0.943	0.806	0.510	0.596	0.416	0.589	0.658	0.558	**0.898**				
TR	0.927	0.760	0.301	0.549	0.517	0.502	0.516	0.512	0.508	**0.872**			
FC	0.888	0.666	0.359	0.599	0.465	0.392	0.403	0.487	0.468	0.449	**0.816**		
AT	0.916	0.731	0.420	0.584	0.594	0.611	0.608	0.566	0.587	0.539	0.489	**0.855**	
IN	0.930	0.770	0.510	0.629	0.467	0.648	0.669	0.635	0.714	0.545	0.518	0.648	**0.877**

Source: The study results

Table 3 illustrates the results of convergent and discriminant validity and reliability tests. The smallest Composite Reliability (CR) was 0.887 > 0.7, so all CR scores were good (Hair et al., 2010). All the scales were highly convergent as the Average Variance Extracted (AVE) values were over 66.2% > 50% (Hair et al., 2010). Moreover, discriminant validity was satisfied as all square roots of the AVE for each factor were greater than the inter-construct correlations and all Maximum Shared Variance (MSV) were smaller than AVE (Hair et al., 2010).

4.4. The Structural Equation Modeling (SEM) and hypothesis test of the proposed model

To test the hypotheses, we conducted SEM analyses. The results of the SEM indicated that the research model was a good fit for the QR code payment service with Chi-square = 1247.483; df = 699; p = 0.000 < 0.01; Chi-square/df = 1.785 < 2; GFI = 0.901 > 0.9; TLI = 0.971 > 0.9, CFI = 0.974 > 0.9, RMSEA = 0.037 < 0.08 (Hair et al., 2010), and PCLOSE = 1.000 > 0.05 (Hu & Bentler, 1999). Therefore, we can conclude that the research model was completely consistent with the collected data and statistical significance at a 99% confidence level (p < 0.01).

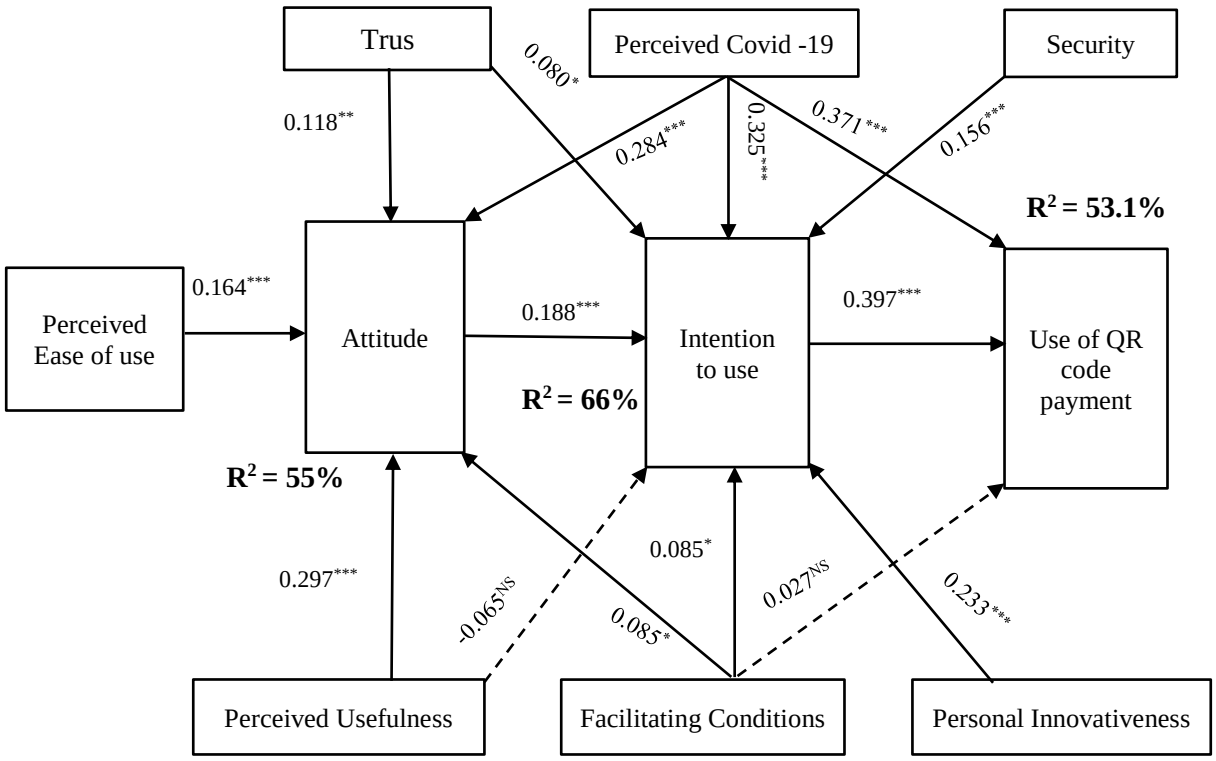

Figure 3. The SEM's results about standardized regression weights and the squared multiple correlations

Note: * p < 0.05; ** p < 0.01; *** p < 0.001; NS p > 0.05
Source: The study results

R^2 in Figure 3 illustrated that perceived ease of use, facilitating conditions, perceived usefulness, perceived Covid-19, and trust accounted for 55% of the variance of attitude. Similarly, attitude, facilitating conditions, personal innovativeness, security, perceived Covid-19, and trust accounted for 66% of the variance of intention to use. Moreover, perceived Covid-19 and intention to use accounted for 53.1% of the variance of the use of the QR code payment.

Based on the results of the SEM analysis, the result of hypothesis testing is shown in Table 4.

Table 4

		P	Standardized Regression Weights	Result
H1 +	PE--->AT	0.000	0.164	Supported
H2 +	PU--->AT	0.000	0.297	Supported
H3 +	PU--->IN	0.126	-0.065	Rejected
H4 +	FC--->AT	0.046	0.085	Supported
H5 +	FC--->IN	0.037	0.085	Supported
H6 +	FC--->US	0.505	0.027	Rejected
H7 +	PI--->IN	0.000	0.233	Supported
H8 +	TR--->AT	0.007	0.118	Supported
H9 +	TR--->IN	0.045	0.080	Supported

		P	Standardized Regression Weights	Result
H10 +	PC--->AT	0.000	0.284	Supported
H11 +	PC--->IN	0.000	0.325	Supported
H12 +	PC--->US	0.000	0.371	Supported
H13 +	SE--->IN	0.000	0.156	Supported
H14 +	AT--->IN	0.000	0.188	Supported
H15 +	IN--->US	0.000	0.397	Supported

Results of the hypothesis test
Source: The study results

4.5. Discussion

The first hypothesis (H1) was supported, so perceived ease of use significantly impacted attitude toward QR code payment (Ngo & Nguyen, 2021). The hypotheses originating from perceived usefulness had contrasting results (H2 and H3). H2 indicated that perceived usefulness and attitude had a significantly positive relationship (Chawla & Joshi, 2019; Liébana-Cabanillas et al., 2015). H3 was rejected. As a result, perceived usefulness didn't positively impact intention to use, conflicting with the literature reviewed as Yan et al. (2021), Hajazi et al. (2021) stated that the effect of perceived usefulness to intention to use QR code payment was significant and positive. However, perceived usefulness indirectly and positively impacted the intention to use via the relationship with attitude. We can see the same results for H4, H5, and H6 that derived from facilitating conditions. H4 illustrated that facilitating conditions and attitude had an insignificantly positive relationship (Alswaigh & Aloud, 2021), H5 also indicated that facilitating conditions and intention to use had an insignificantly positive correlation (Chawla & Joshi, 2019). By contrast, H6 was rejected. As a result, facilitating conditions didn't positively impact the use of QR code payment. This contrasts with the study of Imani and Anggono (2020).

Hypotheses H7 and H13 about the impacts on intention to use from personal innovativeness and security were supported. It means that personal innovativeness significantly and positively affected the intention to use the QR code payment (Slade et al., 2015), there was a significant and positive relationship between intention to use and security (Zhao & Bacao, 2021). The conjectures concerning the positive effects of customer trust on attitude (H8) and intention to use the QR code payment (H9) were accepted. The effect of customer trust on attitude was positive and significant (Alswaigh & Aloud, 2021), while the effect of customer trust on intention to use the QR code payment was insignificantly positive.

The hypotheses originating from perceived Covid-19 had the same results (H10, H11, H12). We proved that the effects of perceived Covid-19 on attitude, intention to use, and the use of QR code payments were significant and positive. Therefore, it is important to stress that the Covid-19 pandemic can bring a big opportunity for developing QR code payment in Vietnam. Lastly, this study proved that the impact of the intention on the use of the QR code payment (H15) was the most significant and positive (Imani & Anggono, 2020), as H15 was supported. Similarly, the effect of attitude on intention to use was also significantly positive ($\beta = 0.188$ with $p = 0.000$), as H14 was supported (Alswaigh & Aloud, 2021; Ngo & Nguyen, 2021).

Table 5

The indirect effects

Variables	The use of QR code payment
Perceived ease of use (PE)	0.012***
Facilitating Conditions (FC)	0.04*
Security (SE)	0.062**
Trust (TR)	0.041*
Personal Innovativeness (PI)	0.093**
Attitude (AT)	0.075**
Perceived Covid-19 (PC)	0.15**

Note: * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
Source: Analysis results from AMOS 24

Table 6 shows that the indirect effect of Perceived Covid-19 on the use of QR code payment was the strongest. This is a new finding because there was no research about it. The total effect of Perceived Covid on the use of QR code payment was 0.521 (direct effect with 0.371 and indirect effect with 0.15). Therefore, Perceived Covid-19 plays the most important role in the use of QR code payment. Moreover, news variables added to our model (Trust, Personal Innovativeness, and Security) also play indirect roles in the use of QR code payment, particularly, Personal Innovativeness's indirect impact on the use of QR code payment ranks second ($\beta = 0.093$).

From the perspective of TAM theory, the study shows Attitude and Perceived ease of use as indirect roles in the use of QR code payment. However, perceived usefulness didn't indirectly impact the use of QR code payment, conflicting with the literature reviewed by Davis (1989). Facilitating conditions also show its indirect role in the use of QR code payment through the UTAUT2 theory like the study by Venkatesh et al. (2012) ($\beta = 0.04$)

5. Conclusions

Our proposed model extended based on combining the TAM and UTAUT2 as well as previous research to identify determinants, directly and indirectly, affecting the customers' use of the QR code payment in HCM City, Vietnam. We collected data via an online survey, with the official sample size being 567, and used SPSS 25 and AMOS 24 software for analysis. The results affirmed that our proposed model was suitable for the QR code payment, completely consistent with the collected data, and was statistically significant at a 95% confidence level ($p < 0.05$). Almost all hypotheses were accepted except for hypotheses H3 and H6. The result of H3 conflicted with the study of Yan et al. (2021), Hajazi et al. (2021), and the TAM theory and the result of H6 contrasted with the study of Imani and Anggono (2020) and the UTAUT2 theory.

In the theoretical contribution, our proposed model is new findings. This is the first study to empirically analyze the effect of the Covid-19 pandemic on the use of QR code payment in HCM City and to extend based on combining the TAM and UTAUT2 with four other determinants as following: security, trust, personal innovativeness, and perceived Covid-19. The total effect of

perceived Covid-19 on the use of the QR code payment was the strongest, with the second rank on the direct impact and the first rank on the indirect impact. Security, Trust, and Personal Innovativeness play indirect roles in the use of QR code payment. Lastly, our proposed model can be applied further as the reference or literature regarding the use of QR code payment in Vietnam as well as other countries.

In the practical contribution, the results of this paper can be used to increase the level of the use of QR code payments in Vietnam. Firstly, because of direct and indirect relationships between perceived Covid-19 and the use of QR code payment, providers of the QR code payment need to have more promotion strategies about the benefits that the QR code payment can bring to customers as this service is one of the best solutions for preventing the risks of Covid-19 pandemic. Secondly, the providers also improve the system of the QR code payment towards convenience, ease of use, safe, and increase the level of customer trust because of the indirect and positive correlation between the use of the QR code payment and perceived ease of use, perceived usefulness, trust, and security. Thirdly, facilitating conditions indirectly and positively impact the use of the QR code payment. Hence, the providers should focus on having a customer assistance strategy at any time when the customer needs help. Finally, because of the significant and positive effect of personal innovativeness and intention to use the QR code payment, providers of the QR code payment need to focus on affirming that the potential customers are people with a high level of personal innovativeness.

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