APPLYING THE THEORY OF PLANNED BEHAVIOR TO ANALYZE THE IMPACT OF PERSONAL INNOVATIVENESS IN INFORMATION TECHNOLOGY ON THE INTENTION OF VIETNAMESE CRYPTOCURRENCIES INVESTOR

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Abstract: This research examines the influence of some independent variables in the Theory of Planned behavior and innovative capacity on intention to invest incryptocurrencies in Vietnam. The analysis of data collected from 334 respondents from customer lists of the banks, financial institutions, and investor groupsindicated that attitude and perceived behavior control significantly associated with intention to search for cryptocurrencies. In which, the effect of the Perceived Behavior Control on the intention to search for cryptocurrencie was greater than that of the attitude variable. In addition, personal innovativenessin information technology (PIIT) moderated the relationship between attitude, perceived behavior control and intention to search for cryptocurrencies.

Keywords: *Theory of Planned Behavior, Personal Innovativeness in Information Technology (PIIT), Cryptocurrency*

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1. Introduction

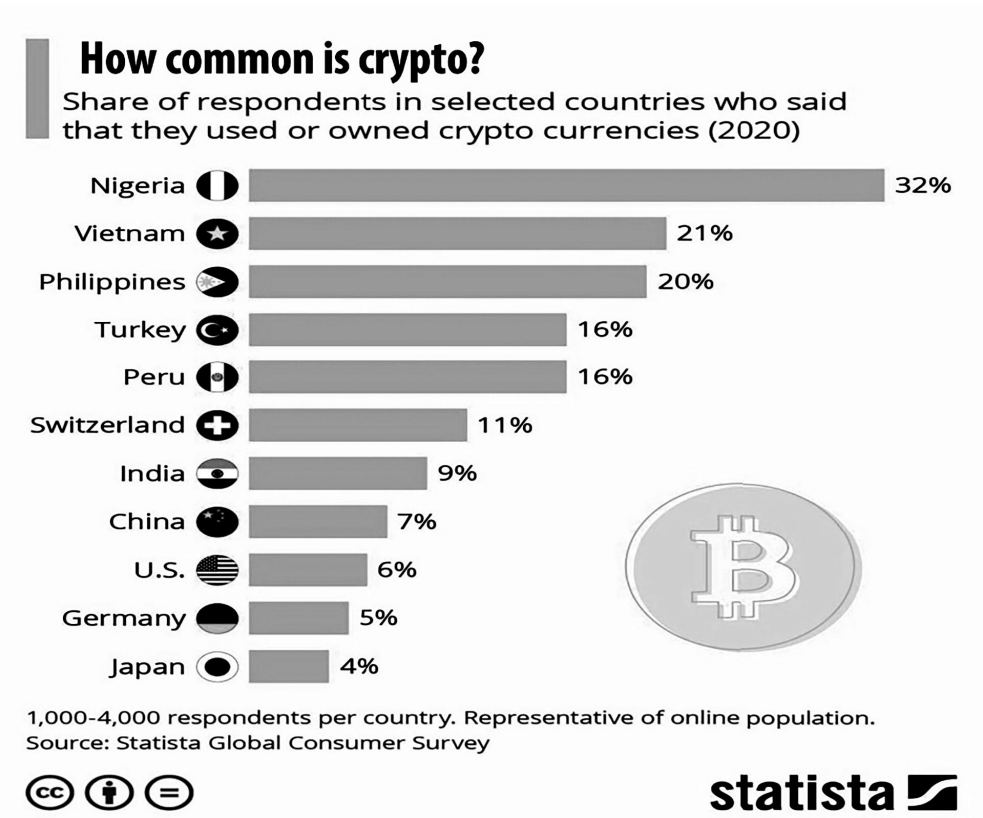
In the previous decade, cryptocurrency was an academic concept and has not been widely known yet. However, this issue has been changed since 2009 with the introduction of Bitcoin, which is known as the world's first cryptocurrency. The cryptocurrency market continues to gain traction in many different investment aspects, such as governments, businesses, and individuals, especially in the last five years; starting from 2017, when Bitcoin reached $20,000/coin, more and more investors are paying attention to this investment channel. Despite of not widely accepted as conventional currencies or legally recognized in many countries, the cryptocurrency exchange market has expanded in recent years. The world cryptocurrency market capitalization is predicted to grow from $1.6 billion in 2021 to $2.2 billion in 2026, with a CARG of around 7.1 % (Research & Market, 2021).

Financial markets witness an increase of individual investors in recent years (Calvet et al., 2016). Many investors have recently been interested in investment types such as securities, real estate,

and products related to renewable energy. Although there have been studies on attitudes and behaviors in financial investment, the main focus has been on stock investing. The authors realized that cryptocurrencies are still a new investment channel in Vietnam and even the world, so more research related to this topic is needed to understand it better. However, because cryptocurrencies still need to be universally recognized in many countries worldwide, research on the intention to learn and invest in cryptocurrencies is still limited.

In Vietnam, in 2017, the Prime Minister issued Decision No. 1255/QD-TTg to approve the project to complete the legal framework for managing assets, cryptocurrencies, and e-currencies. This decision has created the foundation for developing and researching a legal corridor for crypto-related issues in Vietnam. A particular working group on virtual assets and cryptocurrencies has also been established by the Ministry of Finance (Decision No. 664/QD-BTC of April 2020) to conduct research and regulatory proposals related to cryptocurrencies. Statistics from the Department of Cyber Security and High-Tech Crime Prevention showed that the number of people using cryptocurrencies in Vietnam is increasing, estimated to have about 1 million people owning and participating in transactions amounting to several hundred billion VND. The popularity of cryptocurrencies in Vietnam has also been reflected in Statista; statistics indicate that 21% of respondents in Vietnam in 2020 said that they used or owned cryptocurrencies, ranked second after Nigeria (32%). Although departments have also researched and explored new methods of managing this new currency, it has yet to be officially recognized by Vietnamese law. Vietnamese law does not currently have a definition of cryptocurrency.

Figure 1. Statistical results of the cryptocurrencies' popularity in some countries in 2020



Source: Statista, 2021

To contribute to the improvement of theory and supplement the foundation to practical activities, multidimensional, comprehensive research with modern approach methods to the intention to

search for cryptocurrencies about cryptocurrency of individual investors in Vietnam should be carried out. Vietnamese individual investors' intention to search for cryptocurrencies depends on many factors. It needs considerable research to understand those factors and their impact on individual investors' intention to search for cryptocurrencies in Vietnam.

2. Literature review and hypotheses

TPB Theory (Ajzen, 1991) is an evolution and extension of the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1975). According to TRA and TPB, the intention to perform a specific behavior is the best predictor of behavior because the more substantial the intention to engage in a behavior, the higher the likelihood of doing it (Ajzen, 2002). Armitage & Conner (2001) reported that TPB accounted for 27% and 39% variance in behavior and intention after observing more than 150 independent studies. Compared to other models, such as TRA, TPB is proposed to answer some limitations in TRA because it assumes that actions are completely under opinion control. For the intention to search for cryptocurrencies, in specific contexts, Chang et al. (2009) suggest that TPB (Ajzen, 1985, 1991) explains the intention to search for cryptocurrencies information better than TRA because cognitive behavioral control factors are thought to be powerful determinant which influences on intention.

The TPB model helps to predict a powersul impact on behavioral intention; specifically, in this study is the intention to search for cryptocurrencies. Several studies involving financial products have used the intention to search for cryptocurrencies as a dependent variable to measure (Ali, 2011; Sivaramakrishnan et al., 2017; Vuk et al., 2017; Akhtar & Das, 2019). In investment, East (1993) applied TPB to make investment decisions in certain stocks. Hofmann et al. (2008) also selected TPB and several other models to explain the impact on bidding behavior in socially responsible investment. Glanz et al. (2008) argued that TPB theory is appropriate for empirical studies in identifying important factors to propose policies and solutions. Therefore, in this study, we use TPB as a model to predict intentions, particularly in the intention to search for cryptocurrencies for cryptocurrency products.

The TPB model consists of the following factors: attitudes, subjective norms, and perceived behavior control. Attitude is the first important determinant of behavioral intention, which refers to the extent to which a person has an evaluation or a favorable or unfavorable assessment of the behavior in question (Ajzen, 1991). Attitudes generate from a more specific, more prominent set of behavioral beliefs that reflect the cognition outcomes of the targeted behavior. Ajzen (1991) has explained that positive or negative attitudes are directly proportional to behavioral thinking about a possible result of action derived from the predictive value model. Attitudes that directly impact the intention to search for cryptocurrencies are examined in the following studies (Schmidt, 2010; Phan & Zhou, 2014; Gazali et al., 2018; Yee et al., 2022). From the above analysis, we proposed the following hypothesis:

H1: *Attitude has a direct positive impact on the intention to search for cryptocurrencies of individual investors in Vietnam*

Subjective norm is defined as the normative human belief that a behavior accepted, encouraged, and promoted by those around them has an effect on them. However, after the potential impact of this variable in some cases, plus the unclear nature of availability, no specific hypothesis has been put forward (Ajzen, 1991). The subjective norm refers to an individual's perception of social pressure to consider whether or not to perform the behavior, influenced by the judgment of other significant people (parents, spouses, friends, teachers...). However, in some studies, subjective norm has been repeatedly identified as the least effective predictor for TPB (Armitage & Conner, 2001). Overview of research on intention to search for cryptocurrencies, the results of studies also concluded that subjective norm is a decisive factor in the formulation of individuals' intention to search for cryptocurrencies (Phan & Zhou, 2014; Pahlevi & Oktaviani, 2018; Akhtar & Das, 2019; Lai, 2019; Nugraha & Rahadi, 2021; Yee et al., 2022) or in the field of cryptocurrency investment (Gazali et al., 2018). From the above overview results, the following hypothesis is proposed:

H2: *Subjective norm has a direct positive impact on the intention to search for cryptocurrencies for cryptocurrencies of individual investors in Vietnam*

The success of TPB is attributed to the discovery that behavior is not entirely voluntary and not always manageable; therefore, perceived behavior control (PBC) was added to the model. PBC is the perception

of how easy or difficult a person may encounter when performing a particular behavior. In TPB, subjective norm is considered to express the increase of cognitive behavioral control through the perception of opportunity. At the same time, it reflects beliefs about access to the resources and opportunities necessary to facilitate a behavior (Ajzen, 1991). By adding this variable to traditional models of behavior attitudes, significant improvements in predicting intentions have been created (Ajzen, 1991). Individuals can follow the initial intent and lead to specific behaviors when there is sufficient control. However, depending on the specific context, the ability to control actions is low and possibly diminished, and intention is not enough to predict behavior (Ajzen, 1991). As a result of the growth of markets such as stocks, real estate, and cryptocurrency investment is increasing, previous financial investment-related research has concluded that perceived behavior control has a direct impact on individuals' intention to search for cryptocurrencies (Mo & Mak, 2009; Mak & Davis, 2014; Raut et al., 2020). Since cryptocurrency investment is a new product in the field of financial investment, the authors expect that perceived behavior control will have the same impact on intention to search for cryptocurrencies as previous financial investment products and propose to test the hypothesis:

H3: *Perceived Behavior Control has a direct positive impact on the intention to search for cryptocurrencies of individual investors in Vietnam*

In addition to the familiar variables in the TPB model that are believed to powerfully impact the intention to search for cryptocurrencies in many studies, PIIT is one of the variables that influence those effects. Research by Lu et al. (2005) has also shown that people with high PIIT are more willing to use or likely to try new technologies. Moreover, cryptocurrencies are digital tokens created as the product of new technology, tokens that use encrypted data chains called blockchain (ASIC by Cho, 2018). Especially when technology becomes an inevitable part of modern life, technology knowledge also determines whether investors are willing to search for technology products. Therefore, PIIT will undoubtedly have a significant influence on investors' Perceived Behavior Control, attitudes, and intention to search for cryptocurrency-related products and services. PIIT, inherited from the study of Agarwal & Prasad (1998), is still a relatively new variable in the exploration and investment in virtual assets. However, this variable is quite commonly studied in other areas.

The scholars who researched this variable also suggest that its positive and significant moderation can only be observed with the relationship between the perceptions of IT adopters and their behavioral intentions. Hence, PIIT's moderate capabilities are worth exploring. PIIT has also been included in earlier studies as a moderated variable in some specific areas, such as tourism (Goldsmith, 2000), consumption (Joeng et al., 2009), education (Cheng, 2014), green innovation (Iranmanesh et al., 2017). Still, the current amount of research on the moderate impact of this variable in the cryptocurrency-related and investment fields is relatively modest. Those who use personal innovativeness in adopting new technologies can act as a leader to change the opinions of others (Lestari, 2019). Recently, individual innovativeness also showed a positive and moderate impact on the relationships between perceived risk, reward sensitivity, and intention to move to the cryptocurrency market in Sun et al. (2020) study. In the context of this study, cryptocurrencies are a product of new technology. Therefore, PIIT will undeniably influence the relationship between attitude, subjective norms, perceived behavior, and intentions about products and services related to this currency. Therefore, added this variable to the TPB original model to consider its impact on Vietnamese individual investors' intention to search for cryptocurrencies products.

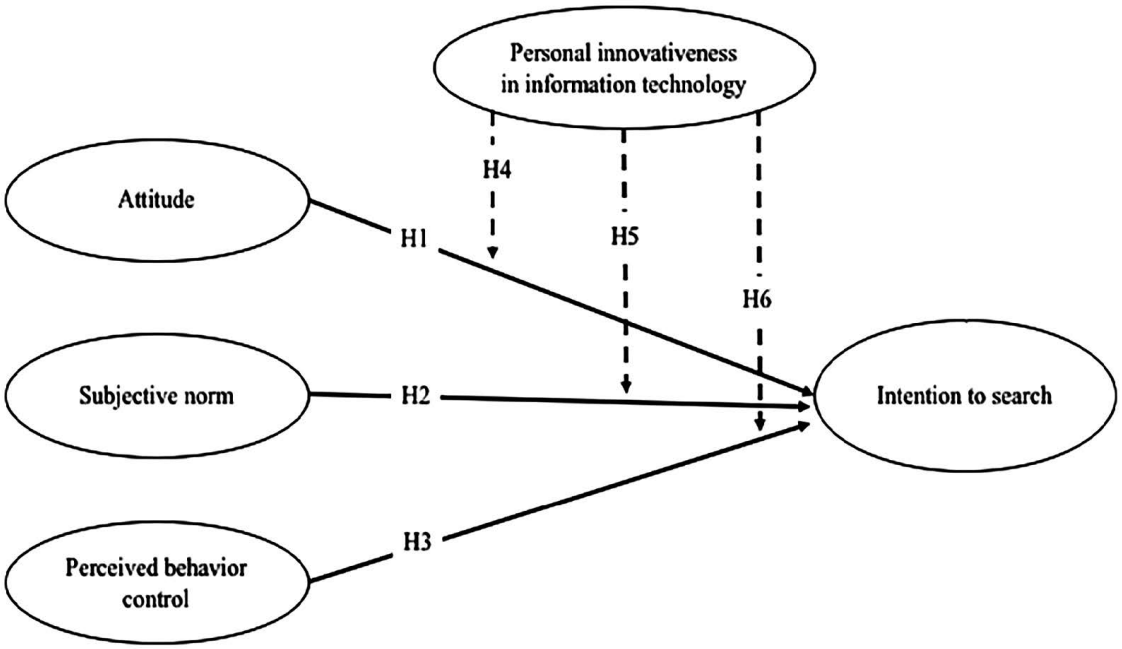
H4*: PIIT positively moderates the relationship between attitude and intention to search for cryptocurrencies*

H5*: PIIT positively moderates the relationship between subjective norms and intention to search for cryptocurrencies*

H6*: PIIT positively moderates the relationship between Perceived Behavior Control and intention to search for cryptocurrencies*

From the above findings and literature review, the authors focus this study on the intention to search for cryptocurrencies products of Vietnam individual investors. Personal innovativeness in information technology (PIIT) is included in this research to examine its moderating impact on the relationship between the independent variables and the dependent variable, as demonstrated in Figure 1.

Figure 2. Research model



3. Research methodology

The target audience in this research is Vietnamese individual investors. Due to limited time and cost, as well as social distancing methods in 2021, the authors managed our survey via the use of Google Forms and the internet by using email lists of banks, investment funds, and investment groups on different channels such as Facebook, Zalo... The team collected 368 responses, of which 334 answers (90.8% of the collected responses) qualified for analysis. Some responses were removed since respondents declared they had no idea about virtual currencies.

The research scales were inherited from published studies in reputable international journals with high citations and are widely applied in many different areas of behavioral intention, but yet in intention to search for cryptocurrencies. In particular, the variables of the TPB model's scales were inherited from its own author Ajzen (1991), and personal innovativeness in information technology (PIIT) was inherited from the first scientists who defined it - Agarwal & Prasad (1998). The questionnaire was translated from English to Vietnamese to suit Vietnamese better. A back translation procedure was used to minimize any potential loss in translation. A pilot study was conducted with 30 financial experts and cryptocurrency investors for comments on the clarity and understandability of the questionnaire. Some wording adjustments were made after the pilot study to improve the final questionnaire further. This study uses Cronbach's Alpha to test the scale's reliability in data analysis. Assess the discriminant and convergence validity using exploratory factor analysis (EFA) and then test the degree of correlation using Pearson's correlation. Finally, the research hypotheses are tested using hierarchical regression.

Table 1. Inherited scales

Variable	Number of observations	Authors
Intention to search for cryptocurrencies	I plan to search for cryptocurrency information.	Ajzen (1991)
	I decided to search for crypto when I qualified.	
	I will convince people to search for cryptocurrencies.	
Subjective norm	My influencers support me in searching for cryptocurrency information.	
	My influencers expect me to search for crypto more than other investment instruments.	
	I will convince people to search for cryptocurrencies.	

Variable	Number of observations	Authors
Perceived Behavior Control	It will be easy for me to use crypto for my investments.	Ajzen (1991)
	I can control my crypto-related investments.	
	I have the resources, knowledge & ability to search for cryptocurrencies.	
Attitude *(with adjustment of the bipolar scale to adapt to the cryptocurrency context)*	*For me, the option to learn and search for crypto is: (choose from 1 – Strongly disagree to 5 – Strongly agree)*	
	1. Does not affect the future - Affects the future	
	2. Unattractive – Attractive	
	3. Difficulty – Easy	
	4. Disadvantages – Advantage	
	5. Risk – No Risk	
	6. Silly – Wise	
Personal innovativeness in information technology	I love testing new investment instruments	Agarwal & Prasad (1998)
	If I hear about a new investment tool, I will find a way to test it.	
	I am often the first to try new investment tools among my friends.	
	Overall, I hesitate to try a new investment tool.	

Source: Authors' work

4. Results

4.1. Descriptive statistics

Descriptive statistics showed that the number of women participating in the survey accounted for 63.5%, while fewer men participated (36.5%). Besides, the age of investors participating in the survey is mainly from 18-30 (57.8%), followed by 31 to 45 years old (38.6%); the remaining age groups account for a negligible proportion. Regarding education, the group with undergraduate and postgraduate degrees dominates, with corresponding ratios of 75.7% and 14.7%; the total percentage of remaining education level is no more than 10%.

Table 2. Descriptive statistics

Indicators	Frequency	Percentage	Cumulative percentage
Gender	334	100. 0	
South	122	36.5	36.5
Female	212	63.5	100.0
Age range	334	100.0	
Age 18-30	3	.9	.9
Ages 31-45	29	8.7	9.6
46-60 years old	253	75.7	85.3
>60 years old	49	14.7	100.0
Education	334	100.0	
Under High School	3	.9	.9
High School, Intermediate	29	8.7	9.6
Colleges and Universities	253	75.7	85.3
Postgraduate	49	14.7	100.0
Major	334	100.0	
Economic	108	32.3	32.3
Technique	61	18.3	50.6
Law	7	2.1	52.7
Service	9	2.7	55.4
Art	7	2.1	57.5
Army	14	4.2	61.7
Education	104	31.1	92.8
Health	8	2.4	95.2
Different	16	4.8	100.0
Income	334	100.0	
Less than 5 million	164	49.1	49.1
5-25million	158	47.3	96.4
25-50million	6	1.8	98.2
>50M	6	1.8	100.0

Source: Calculated result from SPSS

Regarding the major of study, the highest proportion is the economic group, with 32.3%. This was followed by education major, with 31.1%. The third highest major is engineering, with 18.3%. The remaining major groups accounted for relatively modest numbers, below 5%. Descriptive statistical results show a differential distribution in the income of survey participants. Income under VND 5 million accounted for the most trend (49.1%) and ranked second in the income group from 5 to 15 million VND (47.3%). The other two groups with fewer incomes of 25 to 50 million and incomes over 50 million both accounted for 1.8%.

4.2. Reliability testing

The smallest Cronbach's Alpha belongs to the Subjective Norm variable (0.656) but is still higher than the required standard of 0.6, and no corrected item-total correlation lower than 0.3, so no items were excluded. The remaining scales' Cronbach's Alpha are all greater than 0.9 (Perceived Behavior Control) or 0.8 (PIIT, Attitude, Intention to search for cryptocurrency investment) thus these scales' reliability is good. There are minor concerns for PIIT4 and AT1 since the deletion of these items would increase the respective scale's reliability. However, such increases are not significant and the related corrected item-total correlations are still greater than 0.3 so the items are kept for further investigation in exploratory factor analysis (EFA) step.

EFA was conducted twice in this research to test for the convergence and discriminant validity. The 1st EFA saw satisfactory in 0<KMO<1, Barlett's sig.=0.000 <0.05, and the factor loadings of accepted items are greater than 0.5, except AT5 being rejected due to unsatisfactory in convergence and discriminant validity because AT5 did not converged with the other 5 items (AT1 to AT4, and AT6) of attitude. In the 2nd run, after AT5 was deleted, EFA is satisfactory with 0 < KMO = 0.876 < 1, Barlett's sig. <0.05, total variance explained > 50%, all factor loadings > 0.5 and all items satisfy the convergence and discriminant validity. The remaining items are now ready for Pearson correlation and hierarchical regression analysis.

The results of Pearson analysis found no signs of multilinear phenomena. Most relationships are statistically significant, with r between -1 and 1 and sig. < 0.05. However, Pearson analysis result also hinted that there is no evidence of any relationship between Subjective Norm and Intention to search for cryptocurrency investment. A hierarchical regression analysis will followed to formally conclude the strength and direction of all relationships in the research model.

Table 3. Results of Reliability and validity testing

Variable	Corrected item-total correlation	Cronbach's alpha if observations are deleted	Factor loading
Intention to search for cryptocurrency investment: 0.865			
INS1	.829	.729	-
INS2	.717	.836	-
INS3	.690	.858	-
Subjective Norm: 0.656			
SN1	.442	.591	.759
SN2	.543	.460	.829
SN3	.422	.626	.724
Perceived Behavior Control: 0.901			
PBC1	.814	.849	.783
PBC2	.827	.837	.788
PBC3	.769	.886	.806
Attitude: 0.852			
AT1	.464	.860	.638
AT2	.649	.825	.689
AT3	.679	.819	.783

Variable	Corrected item-total correlation	Cronbach's alpha if observations are deleted	Factor loading
AT4	.777	.801	.854
AT5	.569	.840	Eliminated at EFA
AT6	.711	.814	.745
PIIT: 0.830			
PIIT1	.713	.760	.813
PIIT2	.754	.743	.845
PIIT3	.655	.787	.705
PIIT4	.520	.844	.654

Source: Calculated result from SPSS

4.3. Hypothesis testing using hierarchical regression

The hierarchical process is performed to test research hypotheses in 3 steps. Step 1 involves testing the impact of control variables. Step 2 tests the direct relationship in the research model with all independent variables. Step 3 focuses on the moderation impacts.

In this research, results show that control variables can explain 9.3% while independent variables (including Attitudes, Subjective Norms, and Perceived Behavior Control) can explain 55.7% of the change in Intention to search for cryptocurrency investment. Amongst the direct impact, the influence of PBC on Intention to search for cryptocurrency investment appears to be the strongest (β = 0.560, sig. <0.05), followed by Attitude (β = 0.228, sig. <0.05). However, Subjective Norm does not impact Intention to search for cryptocurrency investment due to Sig. >0.05. In addition, all VIFs are less than 2 thus there is no multicolinearity phenomenon. In short, H1 and H3 are accepted while H2 is rejected.

Table 4. Hierarchical regression results

Variable	Adjusted R squared	ANOVA F	Standardized coefficient β	Sig.	VIF
Gender	.093	4.147	.018	.765	1.318
Age range			-.223	.000	1.370
Education			.109	.061	1.204
Major			-.107	.072	1.249
Income			.072	.241	1.354
Gender	.557	36.815	.014	. 540	1.325
Age range			-.085	. 067	1.450
Education			.012	. 207	1. 231
Major			-.072	. 068	1. 259
Income			.052	. 979	1. 364
Attitude			. 228	. 000	1.551
Subjective Norm			-. 002	. 958	1.051
Perceived Behavior Control			. 560	.000	1.494
PIITx Attitude	.596	39.464	.431	.000	4.764
PIITx Subjective Norm	.604	40.885	.331	.000	2.312
PIITx Perceived Behavior Control	.591	38.625	.470	.000	6.551

Source: Calculated results from SPSS

In moderation hypotheses, research results showed that the moderation of PIIT on the relationship between Attitude and Intention to search for cryptocurrency investment can further explain 3.9% (from 55.7% to 59.6%) of the dependant variable's change and 3.4% (from 55.7% to 59.1%) on the relationship between PBC and Intention to search for cryptocurrency investment. On the other hand, there is no moderation effect of PIIT on the relationship between Subjective Norms with Intention to search for cryptocurrency investment since the direct relationship never existed between these two. Although both have moderate effects, the impact of PIIT on the relationship of Attitude - Intention to search for cryptocurrency investment relationship (β= 0.431) is weaker than that on the PBC - Intention to search for cryptocurrency investment relationship (β= 0.470) In short, H4 and H6 are accepted, while H5 is rejected.

5. Conclusions and implications

From the results of the study, the direct impact on the Intention to search for cryptocurrency investment only valid for Attitude and PBC but not for Subjective norms. In particular, PBC has a stronger impact than Attitudes. These results are predictable and in line with the majority of previous research because the TPB model has shown a rather consistent results despite being applied in different empirical research of different contexts, times and objectives (Shim et al., 2001; Mo & Mak, 2009; Schmidt, 2010; Ali, 2011; Mak & Davis, 2014; Phan & Zhou, 2014; Gazali et al., 2018; Lai, 2019; Raut et al., 2020; Huang & Ells, 2021; Yee et al., 2022).

However, Subjective Norms in this research did not stay in line with previous studies and did not impact the Intention to search for cryptocurrency investment. This result was beyond the authors' expectations but still had similarities to the study of Bohon et al. (2016), when they concluded that subjective norms did not affect the intentions of individuals. This lead to no moderation impact of PIIT on the relationship between Subjective Norms and Intention to search for cryptocurrency investment. The results of this research also depicted that PIIT had a positive moderating effect on the relationships of Attitude – Intention to search for cryptocurrency investment and PBC - Intention to search for cryptocurrency investment. These result are consistent with some previous scholars' conclusion of the moderating effects of PIIT (Chiu et al., 2005; Lee et al., 2007; Fang et al., 2009).

The reason for this will be explained in the following points. *Firstly*, there are not many expert in Vietnam in cryptocurrency and given the young history of cryptocurrency, most important persons to a Vietnamese investor wouldn't know enough about the subject to make valid and influential comments. The reason might be most cryptocurrency documents are published in English, thus limiting the access and understanding of Vietnamese general public and investors. This may explain why Subjective norms did not matter in this research context. *Secondly*, Vietnamese media has dedicated programs that teach and analyze the stock exchange and real estate investment markets but similar program about cryptocurrency was not develop or online with low coverage, thereby limiting the accessibility and awareness of individual investors who also do not understand this investment product that well. This, in turns, will minimize the influence of public Subjective norms from the media to the investors. *Thirdly*, cryptocurrencies are not legalized in Vietnam. Hence, investors are still concerned about the high risks and validity of this new investment medium.

From the research results and a review of practical experience in some countries, the authors propose some recommendations in the context of Vietnam as follows:

Firstly, the Civil Code of 2005 and 2015 does not have a specific concept for virtual assets, including digital currencies and cryptocurrencies. Therefore, it is necessary to study relevant regulations of other countries in order to come up with a clear definition of cryptocurrency in these legislations and clearly define a legal position for cryptocurrency in our country's economy.

Secondly, setting a goal to propagate and raise awareness about cryptocurrencies for investors from the beginning will help strengthen the ability

to avoid the risks and minimize consequences of conducting illegal business in cryptocurrencies.

Thirdly, if the Government is looking at legalizing cryptocurrencies, it is necessary to have a well-planned roadmap to build a system of legal documents in order to ensure the existence and management of cryptocurrencies. This will make investors and stakeholders feel less risky, apprehensive, and more secure when investing and trading this currency.

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