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Factors affecting acceptance and use of online technology in Thai people during COVID-19 quarantine time

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ABSTRACT

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1. Introduction

The current world situation in 2020 faces the outbreak of a new strain of Coronavirus, known as COVID-19 Disease. This disease affects most countries in the world (World Health Organization Thailand, 2020). Data as of April 20, 2020, found that more than 2,300,000 people were infected and the damage caused by the death of severe people with more than 150,000 people (Emergency Operation Center, Department of Disease Control, Ministry of Public Health of Thailand, 2020; World Health Organization, 2020). World key organizations such as the World Health Organization, for example, have provided recommendations and methods to protect people from infection and outbreaks by refraining from traveling to areas where the outbreak is occurring. In addition, avoiding contact between people and close to others, especially those who are at risk of becoming infected (World Health Organization, 2020). Countries have various measures to stop the outbreak of the COVID-19 epidemic. One of the key measures is to work from home and social distancing. These measures have resulted in different forms of work. Travel is also limited. All types of meetings have changed to online meetings. Both domestic and foreign trade have changed to online trading. And the delivery of goods or logistics plays a crucial role in people's lives in every country that has spread this disease. Thailand is one of the countries that have an epidemic of this disease. The Thai government has implemented various measures to effectively control the disease. Overall, Thailand has a low impact, with less than 3,000 people infected and with a mortality rate of less than 2% (Emergency Operation Center, Department of Disease Control, Ministry of Public Health of Thailand, 2020). An important measure that works well is that the Thai government has announced the Thai people to detain themselves at home, refrain from the meeting, work from home, refrain from joining groups, and avoid all social gatherings to prevent the spread of disease between individuals and pandemic across the country. The

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measure also includes all educational institutions in Thailand. Education at all levels in Thailand must be transformed to be conducted online in order to meet the Thai government's policy on self-quarantine or quarantine at home. This has resulted in Thai students who have to study and communicate with teachers and institutions online via the detention period of Thai citizens in accordance with government policies. One important issue that comes from quarantine at home or work from home is the need to learn to use technology online more or to start learning to use to communicate online because they have never used those technologies. The study found that there were many technologies that Thai people need to learn more, such as Teaching and learning programs include Google Meet, ZOOM, Microsoft Team; Entertainment and relaxation programs like online movies, VDO cutting, Photo editing, Moviemakers; Interpersonal communication programs include LINE group, Facebook group, WhatsApp; Financial programs such as Mobile Banking; Shopping programs like LAZADA, Shopee; and Gameplay programs such as mobile game application. The researcher believes that the use of technology in many areas must definitely use more. But there is still no clear information about how Thai people in the disease quarantine use more technology or programs in any way. One of the objectives of the study is to investigate the amount of usage of technology or programs of Thai people who have quarantine at home and to know that what technology or programs that Thai people in each age group use increases during quarantine at home. In addition, the research needs to study the technology acceptance and use behaviors among Thai people during the quarantine period and to study the factors that influence their intention to utilize those technologies, including the study of which factors influence the use of technology or program. This research considers the use of the UTAUT (Unified Theory of Acceptance and Use of Technology) model as the basis of the study, in which the researchers added important variables in the basic model for greater benefit in this study and for a clear understanding of factors that affects the acceptance and use of important technology of Thai people during the quarantine period from the COVID-19 situation.

2. Research objective

- 1) To study the amount of usage of technology or programs of Thai people who have quarantine at home,
- 2) To study what technology or programs that Thai people in each age group use increases during quarantine at home,
- 3) To study factors that influence user intention to adopt those technologies and programs,
- 4) To study the influence of user intention and facilitating conditions on the use of those technologies or programs.

3. Recent research

The researchers studied literature and previous research from multiple databases in order to consider creating a conceptual framework of research that is new and different from other researches, including to be suitable for studies in the area of Thailand.

3.1 Basic model of Acceptance and Use Behaviors

This research uses the UTAUT model as the base of the research and is considered in creating the conceptual framework of the research. The model is a technology acceptance model developed from many models related to the adoption of technology such as TAM, TRA, and TPB (Abraham, et al., 2016; Thomas, et al., 2013; Venkatesh, et al., 2016). This model was developed by Venkatesh, Morris, Davis, and Davis in 2003 which has developed from many models that link to the technology acceptance and use behaviors from various perspectives (Bervell & Umar, 2017; Marchewka & Kostowa, 2007; Venkatesh, et al., 2016). This model consists of three key factors, performance expectancy, effort expectancy, social influence, that influence the user intention to adopt technology and two key factors, user intention and facilitating conditions that affect the use behavior of technology (Marchewka & Kostowa, 2007; Thomas, et al., 2013; Venkatesh, et al., 2016). The main focus on behavioral intention was related to three factors included performance expectancy, effort expectancy, and social influence (Abraham, et al., 2016). Also, it uses key variables like Gender, Age, and Experience for the moderating influence of key factors on the intention of users in using online technology (Chao, 2019; Marchewka & Kostowa, 2007; Thomas, et al., 2013). From this model, performance expectancy means people believe that the technology use can gain the performance (Thomas, et al., 2013; Venkatesh, et al., 2016) while effort expectancy is the ease utilization of the technologies for people who expect to use the technology (Chao, 2019; Thomas, et al., 2013; Venkatesh, et al., 2016). Many studies support this influence of performance expectancy and effort expectancy on behavioral intention about technology use (Chao, 2019; Im, et al., 2008; Lee & Song, 2013; Liu, et al., 2019; Tan, 2013; Thomas, et al., 2013; Zuiderwijk, et al., 2015). Another key factor is Social influence that reflects people are convinced by others who believe that the benefit of technology use (Tan, 2013; Thomas, et al., 2013; Venkatesh, et al., 2016). Also, it found that many previous studies confirmed the influence of social influence on the intention of users in using technology (Abraham, et al., 2016; Lee & Song, 2013; Liu, et al., 2019; Tan, 2013; Zuiderwijk, et al., 2015), but some studies found different result where social factor did not influence behavioral intention (An, et al., 2016; Bervell & Umar, 2017). The UTAUT model reveals the direct effect of performance expectancy, effort expectancy, and social factor on user intention to utilize the technologies (Bervell & Umar, 2017; Salim, 2012; Tan, 2013; Thomas, et al., 2013; Venkatesh, et al., 2016) while facilitating condition, that means organizational and technical support the technologies people use, has direct

effects on behavioral use of technology in this model (Bervell & Umar, 2017; Thomas, et al., 2013; Venkatesh, et al., 2016). However, some research showed that facilitating conditions did not influence technology use (Zhou, et al., 2019). Finally, the UTAUT model reflects the relationship between behavioral intention and actual use. It reveals that the intention of users in using technology influence the actual use behavior of technologies (Bervell & Umar, 2017; Marchewka & Kostowa, 2007; Venkatesh, et al., 2016). Previous research supports the effect of user intention on the use behavior of technologies (Tan, 2013; Zhou, et al., 2019). The studies revealed that higher behavioral intention would turn to significant use of technologies (Alwahaishi & Snasel, 2013; Zhou, et al., 2019).

3.2 Extended Acceptance and Use Model

This model is popular for conducting research studies on technology acceptance and use behaviors in many academic and many dimensions around the world. However, the model is still being developed continuously, with researchers trying to find variables or factors related to the adoption of technology or innovation, or expanding this model to be more comprehensive and more useful (Abrahao, et al., 2016; Abubakar & Ahmad, 2013; Acharya, et al., 2019; Alwahaishi & Snasel, 2013; Huang & Kao, 2015; Lafraxo, et al., 2018; Mandal & McQueen, 2012). For example, some studies added Trust in the research model to investigate User trust affected behavioral intention to use technology (Chao, 2019; Lee & Song, 2013). However, some studies showed that Trust did not influence user intention (Lafraxo, et al., 2018). Previous studies proved that the influence of Perceived risk on user intention about technology use (Abrahao, et al., 2016; Chao, 2019; Lee & Song, 2013; Liebanacabanillas, et al., 2014). Nevertheless, some studies found that Perceived risk did not influence behavioral intention (An, et al., 2016; Lafraxo, et al., 2018). Much research did the study on the influence of facilitating conditions on Behavioral intention to utilize technology. Many studies summarized that facilitating condition influence the behavioral intention to adopt the technology (Huang & Kao, 2015; Thomas, et al., 2013; Turan, et al., 2015). But some studies did not find the effect of facilitating condition on behavioral intention to technology use (Lafraxo, et al., 2018; Zuiderwijk, et al., 2015). Therefore, this research selected the key variables included Trust and Perceived risk for improving the UTAUT model. The researchers expected to examine the influence of Trust and Perceived risk on user intention to use of technologies. In addition, the researchers expected to investigate the link between facilitating condition and user intention. Finally, the researchers were interested in the moderating influence of Perceived risk on the link between performance expectancy and user intention, and the link between effort expectancy and intention to use the technology. Many previous studies showed the results of this issue were different. Some studies did not find the moderating influence of perceived risk on the link between performance expectancy and user intention while other studies found perceived risk negatively moderate that relationship (Chao, 2019). One research concluded that perceived risk was proven the moderating effect in the UTAUT model (Im, et al., 2008). Therefore, this research intends to prove the moderating influence of perceived risk on the research model.

4. The proposed study

From the literature review related to this research, the researchers created a conceptual framework of the research as shown in Fig. 1 and the researcher determined 10 hypotheses for statistical testing (H1-H10).

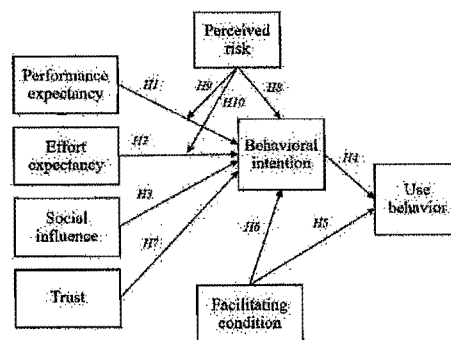


Fig. 1. Research framework

- H₁: Performance Expectancy significantly influences user intention in using online technology.
- H₂: Effort Expectancy significantly influences user intention in using online technology.
- H₃: Social influence significantly influences user intention in using online technology.
- H₄: Behavior intention significantly influences Use behavior.
- H₅: Facilitating condition positively influences Use behavior.
- H₆: Facilitating condition positively influences user intention in using online technology.
- H₇: Trust significantly influences user intention in using online technology.
- H₈: Perceived risk significantly influences user intention in using online technology.
- H₉: The effect of Performance Expectancy on user intention is moderated by Perceived risk.
- H₁₀: The effect of Effort Expectancy on user intention is moderate by Perceived risk.

5. Research methodology

5.1 Population and sample

The population of this research was Thais who stay at home during the quarantine period in the COVID-19 crisis. As this population could not be determined, the authors used Cochran's formula for calculation of the optimal sample number (Cochran, 1977). The authors calculated the number at the confidence level and error term of 95% and 5 %, respectively, the optimal sample size was 385.

5.2 Research tool

The author developed a structured questionnaire from previous research that relates to the UTAUT model (Table 1). It consisted of 3 parts. The first part was for demographic data (gender, age, education, income, occupation), the second part was behavioral use in technology or programs during COVID-19 situation, and the final part was about key variables in the research framework including performance expectancy, effort expectancy, social influence, trust, perceived risk, facilitating conditions, user intention in using online technology, and use behavior of the technology. The questionnaire used 10 points scale (totally disagree=1 to totally agree=10) to measure the key variables in this research. Cronbach's alpha statistic was used for questionnaire reliability. The results were between 0.767-0.919 as shown in Table 1. This indicated that there was acceptable reliability (Hair, et al., 2014).

Table 1
Research questionnaire design and reliability test

Variables	Measures	Sample of Items	References	Cronbach Alpha
Performance expectancy (PERFORM)	Per1, Per2, Per3, Per4, Per5	This technology is useful for your lifestyle. This technology is effective for your lifestyle. This technology provides results that meet your needs.	Venkatesh et al. (2003); Khechine et al. (2014); Salim (2012)	0.867
Effort expectancy (EFFORT)	Eff1, Eff2, Eff3, Eff4	At first, I thought that this technology should be easy to use. You can learn to use this technology by yourself.		0.767
Social influence (SOCIAL)	Soc1, Soc2, Soc3, Soc4	You use this technology because some friends use it. You use this technology because it has a well-known reputation.	Chao (2019); Acharya, et al. (2019)	0.882
Trust (TRUST)	Trus1, Trus2, Trus3, Trus4	You are confident that this technology provider is honest. You are confident in the service and quality of this technology.		0.871
Perceived risk (RISK)	Risk1, Risk2, Risk3, Risk4	You think that your information may be disclosed when using this technology. You think that others may be able to access your information through this technology.	Chao (2019); Liebana-Cabanillas, et al. (2014)	0.831
Facilitating condition (FACIL)	Fac1, Fac2, Fac3, Fac4	This technology provider recommends and supports usage. This technology service provider provides assistance when problems occur.	Venkatesh et al. (2003); Khechine et al. (2014); Thomas, et al. (2013)	0.782
Behavioral intention (INTENT)	Int1, Int2, Int3, Int4	Overall, the use of this technology is interesting. Overall, you will use this technology more.	Venkatesh et al. (2003); Khechine et al. (2014)	0.919
Use behavior (USE)	Use1, Use2, Use3, Use4	Overall, the use of this technology enhances work efficiency or quality of life, you use this technology consistently		0.902

5.3 Statistical analysis

This research analyzed the descriptive statistics by the SPSS Statistics version 25 program. In the analysis of inferential statistics, the researchers used Partial Least Square-Structural Equations Modeling (PLS-SEM) method with the Smart PLS 3.3.0 program to test the hypotheses (Ringle et al., 2015). The first step is to check the measurement model with various statistics such as validity and reliability coefficients by Average Variance Estimates (AVE), Composite Reliability (CR), and Cronbach's Alpha; discriminant validity; Heterotrait-Monotrait (HTMT) test. After that, the researchers examined the structural model by testing the effect of the independent variables on dependent variables according to the hypotheses of the research. Finally, the researchers evaluated the structural model by beta coefficients, the significance of t-statistics, and coefficient of determination (R square) (Hair, et al., 2017). For the calculation of the PLS-SEM's significance of the research hypotheses, the authors used 5,000 subsamples of the bootstrapping process as Hair et al. (2017) recommendation.

6. Research result

The sample data used for statistical analysis were 390. The analysis results of the descriptive statistics showed that most of the participants were female. The number of females is 294 (75.4%) and males are 96 (24.6%). Most of the participants were younger than 25 years, with the number of 254 people (65.1%), followed by the age of 25-40 years, equal to 99 people (25.4%). The majority of the participants have had a bachelor's degree, equal to 303 people (77.7%). Moreover, it found that most participants had a monthly income of fewer than 300 USD, equal to 256 people (65.6%), followed by monthly income between 300-450 USD was 60 people (15.4%). In addition, most of the participants were 208 university students (53.3%), followed by 86 government workers (22.1%). The study of participants' concerns or stress during the quarantine in the COVID-19 situation found that the samples tend to have moderate or high levels of anxiety or stress as shown in Fig. 2.

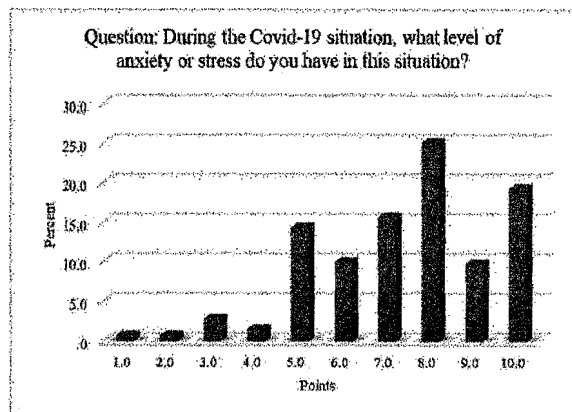


Fig. 2. Level of anxiety or stress during COVID-19

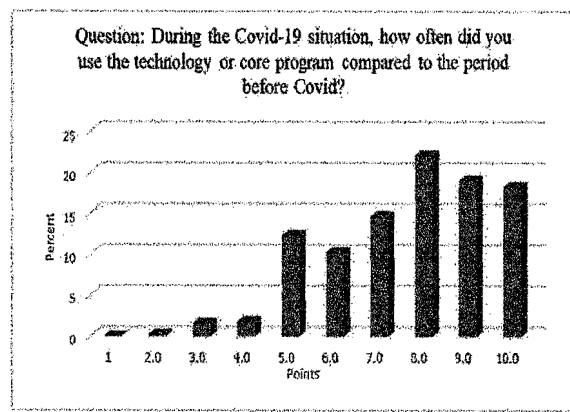


Fig. 3. Level of Technology use during COVID-19

The anxiety or stress of the respondents during this time together with staying in their own homes and having to be separated from each other, resulting in a significant increase in the use of technology or programs when comparing with normal periods in the past as shown in Fig. 3. According to the respondents in this research, 15% of all respondents use all 6 types of programs or technologies during the quarantine period. Six key programs or technologies are (1) Teaching or working programs such as Google meet, Google classroom, ZOOM; (2) Entertainment or leisure programs such as Facebook, LINE, online movie; (3) Shopping programs such as LAZADA, Shopee; (4) programs for Communications such as LINE, Messenger, WhatsApp, Facebook group; (5) Financial programs such as Mobile Banking App; and (6) game programs such as Game mobile applications. It was found that 9.5% of all respondents used 5 types of programs or technologies during quarantine without using game programs. One interesting point of the data analysis is that 8.5% of respondents focus on entertainment programs such as entertainment programs on Facebook, LINE. Statistics shown in Table 2 revealed the measurement model was accepted. It was found that the outer loadings of almost all variables are greater than 0.7 except for one variable that is below the standard is Eff1. It found that most outer loadings were higher than 0.7, except for just one variable that is lower than 0.7 (Eff1), as recommended by Hair et al. (2017). To evaluate validity and reliability by CA, CR, and AVE, it showed that all variables were accepted as suggested by Hair et al. (2017). CA and CR were accepted when the value was higher than 0.7 while AVE was accepted when it was higher than 0.5 (Hair, et al., 2017).

Table 2

Validity and reliability of measurement model

Factors	Measures	Loading	CA	CR	AVE
PERFORM	Per1, Per2, Per3, Per4, Per5	0.910, 0.915, 0.925, 0.890, 0.905	0.947	0.960	0.826
EFFORT	Eff1, Eff2, Eff3, Eff4	0.675, 0.876, 0.925, 0.859	0.855	0.904	0.704
SOCIAL	Soc1, Soc2, Soc3, Soc4	0.840, 0.793, 0.752, 0.773	0.891	0.869	0.625
TRUST	Tru1, Tru2, Tru3, Tru4	0.872, 0.855, 0.911, 0.887	0.906	0.933	0.777
RISK	Ris1, Ris2, Ris3, Ris4	0.902, 0.887, 0.914, 0.875	0.917	0.941	0.800
FACIL	Fac1, Fac2, Fac3, Fac4	0.844, 0.822, 0.895, 0.856	0.879	0.916	0.731
INTENT	Int1, Int2, Int3, Int4	0.920, 0.940, 0.946, 0.928	0.951	0.964	0.871
USE	Use1, Use2, Use3, Use4	0.949, 0.946, 0.944, 0.930	0.958	0.969	0.888

Next, the authors checked the discriminant validity by using the Fornell-Larcker criteria as shown in Table 3. It found that the criteria were satisfied when the comparison between all bolded loadings in the diagonal dimension and the vertical loadings. Almost all pairs of loadings were bolded values were higher than vertical loadings, except only one pair was different that was INTENT/USE pair. In addition, the authors checked a robust approach of discriminant validity by Heterotrait-Monotrait (HTMT) method as the result in Table 4. The assessment result was the same as the discriminant validity test Table 3. Only INTENT/USE pair had value more than 0.9 but other values were acceptable (Henseler, et al., 2015).

Table 3

Discriminant validity (Fornell-Larcker)

Variables	EFFORT	FACIL	INTENT	PERFORM	RISK	SOCIAL	TRUST
EFFORT	0.84						
FACIL	0.73	0.86					
INTENT	0.68	0.72	0.93				
PERFORM	0.73	0.76	0.81	0.91			
RISK	0.44	0.50	0.58	0.53	0.90		
SOCIAL	0.34	0.44	0.37	0.33	0.26	0.79	
TRUST	0.45	0.60	0.71	0.65	0.52	0.38	0.88
USE	0.67	0.71	0.97	0.82	0.58	0.35	0.68

Table 4
Heterotrait-Monotrait Ratio (HTMT)

Variables	EFFORT	FACIL	INTENT	PERFORM	RISK	SOCIAL	TRUST
FACIL	0.83						
INTENT	0.76	0.77					
PERFORM	0.81	0.81	0.85				
RISK	0.49	0.55	0.62	0.56			
SOCIAL	0.41	0.53	0.41	0.37	0.30		
TRUST	0.49	0.65	0.74	0.57	0.57	0.44	
USE	0.74	0.76	1.02	0.86	0.61	0.40	0.71

The last assessment was the collinearity assessment in Table 5 to evaluate common method bias (CMB). The result in Table 5 revealed that the model did not take the CMB issue seriously. Because all values equal to 3.3 and lower (Hair, et al., 2017).

Table 5
Collinearity Statistics (VIF)

Variables	INTENT	USE
PERFORM	3.5	
EFFORT	2.6	
SOCIAL	1.3	
TRUST	1.8	
RISK	1.6	
RISK * EFFORT	3.1	
RISK * PERFORM	3.2	
FACIL	3.3	2.1
INTENT		2.1

The PLS-SEM assessment or structural model analysis is reported in Table 6 and graphically is depicted in Fig. 4. It summarized that H1, H2, H4, H7, and H8, were supported. From the results, PERFORM (beta = 0.465, $p < 0.001$), EFFORT (beta = 0.140, $p < 0.01$), TRUST (beta = 0.333, $p < 0.001$), and RISK (beta = 0.097, $p < 0.05$) positively affect INTENT but SOCIAL (beta = 0.018, $p > 0.05$) and FACIL (beta = -0.003, $p > 0.05$) did not have significant effects on INTENT. In addition, RISK did not have any moderating effect for the influence of PERFORM and EFFORT on INTENT. Finally, it found the effect of INTENT (beta = 0.958, $p < 0.001$) on USE but did not find the effect of FACIL (beta = 0.029, $p > 0.05$) on USE.

Table 6
Result of Structural analysis

Relationship	Standard Beta	Standard Deviation	T Statistics	P Values	f ²	Evaluation
PERFORM → INTENT	0.465	0.050	9.333	0.000***	0.296	Supported
EFFORT → INTENT	0.140	0.042	3.291	0.001**	0.034	Supported
SOCIAL → INTENT	0.018	0.030	0.603	0.546	0.001	Not supported
TRUST → INTENT	0.333	0.039	8.612	0.000***	0.269	Supported
RISK → INTENT	0.097	0.039	2.470	0.014*	0.027	Supported
RISK * EFFORT → INTENT	-0.008	0.011	0.760	0.447	0.002	Not supported
RISK * PERFORM → INTENT	0.003	0.013	0.243	0.808	0.000	Not supported
FACIL → INTENT	-0.003	0.053	0.052	0.958	0.000	Not supported
FACIL → USE	0.029	0.018	1.558	0.119	0.010	Not supported
INTENT → USE	0.958	0.014	68.820	0.000***	10.601	Supported

Note: ***, **, * means statistical significance at 0.001, 0.001, and 0.05 respectively

When considering the overall model performance by R-Square values, we have found that the overall performance for variance in INTENT was 78.3%. This means INTENT was predicted by 4 variables including performance expectancy, effort expectancy, trust, and perceived risk at a variance of 78.3%. The variance in USE was 95.8% by behavioral intention in using the technology. The final research model is graphically shown in Fig. 5.

Table 7
Coefficient of Determination

Variables	R Square	R Square Adjusted
INTENT	0.783	0.779
USE	0.958	0.958

7. Discussion

This research studied the behavioral intention and use of technology or online programs of Thai people during the quarantine period in the COVID-19 situation. It was found that most of the participants were female, under 25 years old, had a bachelor's degree education, and had a monthly income of less than 300 USD. The descriptive results have shown that the participants

were at medium to high levels of anxiety or stress from the COVID-19 situation. In addition, the results have shown that most respondents spent more time using online programs or technology at home than in the past, using all important programs in their daily lives such as educational or working programs, entertainment programs, communication programs, and financial programs. As a result, the researchers believe that the increased use of technology was due to quarantine at home or working from home, according to Thai government policy that did not allow Thai people to leave the house and did not allow to meet in groups in COVID-19 Crisis.

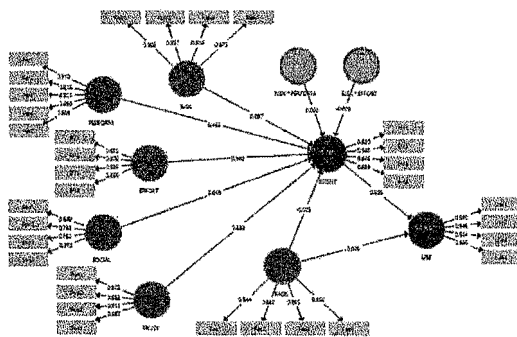


Fig. 4. PLS-SEM analysis result

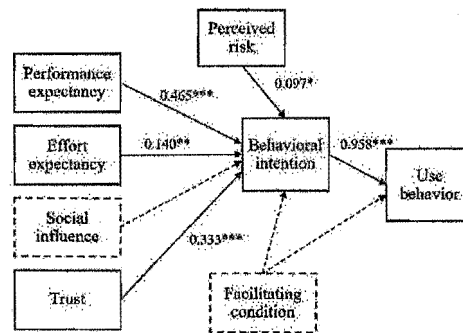


Fig. 5. Final model

The inferential statistical analysis that tests the hypotheses of the research is shown in Fig. 5. It revealed that the important factors that influence user intention in using technology include performance expectancy, effort expectancy, trust, and perceived risk. This summary is consistent with numerous previous studies (e.g. Abraham, et al., 2016; Chao, 2019; Im, et al., 2008; Lee & Song, 2013; Liebana-Cabanillas, et al., 2014; Liu, et al., 2019; Tan, 2013; Thomas, et al., 2013; Zuiderwijk, et al., 2015). However, the research found the effect of social influence and facilitating conditions on user intention was different from previous studies. The result found that no significant effect of social influence and facilitating conditions on user intention in using technology, the finding was consistent with some research in the past (e.g. An, et al., 2016; Bervell & Umar, 2017; Lafraxo, et al., 2018; Zuiderwijk, et al., 2015). Another result found that facilitating conditions did not affect the actual use of technology during the COVID-19 situation. This was similar to the result of some studies (e.g. Zhou, et al., 2019). From that result, it is possible that the respondents have to stay home almost all the time. Therefore, these Thai people are focusing on the use of technology by themselves, not influenced by the surrounding society or from the support of other organizations. Finally, behavioral intention positively influences the actual use of technology during crisis. This result was consistent with many previous studies (Alwahaishi & Snasel, 2013; Bervell & Umar, 2017; Tan, 2013; Zhou, et al., 2019).

8. Conclusion

During a crisis when people have to detain themselves at home or work from home, the use of technology and programs online or via mobile is extremely important. With the increased use of technology, users still have expectations of the benefits of technology and the need for easy utilization of technology. Moreover, the trust and risk of using technology also affect the intention to use. Therefore, when the intention to use is higher, it will result in real use is higher too, especially during the crisis that people need to stay at home all the time, such as in the COVID-19 Crisis. The results of this study can benefit both policy-makers and people who have the duty to plan strategies for technology use, which need to focus on the benefits of technology to people life, ease of technology use, reliability and trust in that technology, and the risks involved in using technology that requires users to understand that risks and choose the level of risk that is appropriate to their own.

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