*PEOPLE: International Journal of Social Sciences*
*ISSN 2454-5899*

*Narakorn & Seesupan, 2019*

*Volume 5 Issue 2, pp. 77-92*

*Date of Publication: 05th August 2019*

*DOI-https://dx.doi.org/10.20319/pijss.2019.52.7792*

*This paper can be cited as: Narakorn, P., & Seesupan, T., (2019). The Role of Attitude towards Internet of Things (IOT) in Relation to Technology Acceptance Model in Thailand. PEOPLE: International Journal of Social Sciences, 5(2), 77-92.*



# THE ROLE OF ATTITUDE TOWARDS INTERNET OF THINGS (IOT) IN RELATION TO TECHNOLOGY ACCEPTANCE MODEL IN THAILAND

**Prasittichai Narakorn**
*Faculty of Management Science, Pibulsongkram Rajabhat University, Ban Krang, Phitsanulok, Thailand*
*dr.prasittichai@gmail.com*

**Tummatinna Seesupan***
*Faculty of Management Science, Pibulsongkram Rajabhat University, Ban Krang, Phitsanulok, Thailand*
*tummatinna@psru.ac.th*

## Abstract

*The objectives of this study is to investigate the Technology Acceptance Model (TAM) which derives from following factors: Perceived Ease of Use, Perceived Usefulness, Attitude towards Internet of Things, and Continuance intention to use who use products from Internet of Things in Thailand. The researchers applied the quantitative method to 272 users who bought products from Internet of Things and analyzed in term of frequency, mean and Structural Equation Model (SEM) analysis by AMOS. The research findings indicated that Perceived Ease of Use, Perceived Usefulness, Attitude towards Internet of Things had significantly positive influence to Continuance intention to use* ($p < .05$).

**Keywords**

Perceived Ease of Use, Perceived Usefulness, Attitude towards Internet of Things, Continuance Intention to Use, Technology Acceptance Model

## 1. Introduction

Application systems and technology nowadays have been considerably developed and applied to generate business competitive advantage (Wallace & Sheetz, 2014). The most popular technology now is Internet of Things (IoT) which enables devices to communicate to one another through the internet (Zancul et al., 2015). The main and most prevalent services of Internet of Things (IoT) include payment (such as online shopping and mobile payment), downloads of Applications, Transportation-Related Applications (such as taxi payment, traveling payment and online ticketing). However, numerous Internet of Things (IoT) systems failed due to various problems, ranging from usage complication, users' ignorance in using, as well as their negative perception towards use of new technologies that made them stop using after using only once. These problems became the factors that led to failures of technological application (Chen et al., 2018)

Ajzen and Fishbein (1980) found that the intention was a key factor that influenced users in showing positive or negative behaviors towards the use of new technologies. Davis (1989) stated that there were three factors leading to users' intention of use, including Perceived Ease of Use (PEOU), Perceived Usefulness (PU), and Attitudes towards Technology, all contributing to the success in intention of use. Later, Bhattacherjee (2001) added that it was Continuance Intention of Use (CIN) that was more essential than a single use. In other words, Applications or other systems of Internet of Things that could be realistically applied with business and continued being used were more important than being used only once.

It was found that the theoretical study and research on Technology Acceptance Model (TAM) concerning the behavior related to the use of Internet of Things in Thailand were scant in number. To bring research-based conceptualization into practice, the researchers recognized the importance of studying focused on the roles of Attitude towards Internet of Things (IoT) to understand and solve problems by emphasizing on Perceived Ease of Use (PEOU), Perceived Usefulness (PU) and Attitude towards Technology.

This research focuses on answering the research question of whether or not the Perceived Ease of Use (PEOU), Perceived Usefulness (PU), and Attitude towards Internet of Things have effects on Continuance Intention to Use (CIU). The research objective is to study the influence of

Perceived Ease of Use (PEOU), Perceived Usefulness (PU), and Attitude towards Internet of Things on Continuance Intention of Use (CIN).

## 2. Literature Review

### 2.1 Internet of Things

Internet of Things (IoT) was a new concept that electronic devices could be connected and communicated through internet and their functions could also be controlled by internet. Thus, the connection of electronic devices was enabled by internet and in compatible with other functions of Smart appliances (Bandyopadhyay, Balamuralidhar & Pal, 2013), for instance, Smart Device, Smart Grid, Smart Home, Smart Network, Smart Intelligent Transportation without the necessity to enter data every time when using. Apparently, this differed from the past when electronic devices only acted as a medium for sending and showing data (Giusto et al., 2010). The system of Internet of Things (IoT) affected the business system in three ways: 1) Business to Customer (B2C) System such as connected people, connected home and connected car 2) Business to Business (B2B) such as connected agribusiness, connected buildings, connected industry (industrial internet) (3) Business to Business to Consumer (B2B2C) which combined B2B and B2C together such as Smart Cities, Smart Grid, and Smart Utilities (Bandyopadhyay, Balamuralidhar & Pal, 2013). This research was emphasized on B2C, such as the communication through Applications on Smartphone, aimed at increasing business competitive advantage (Hsu & Lu, 2004).

### 2.2 Perceived Ease of Use (PEOU)

Perceived Ease of Use is the degree to which a person believes that using a particular technology system would be free of effort (Davis et al, 1989, Hsu & Lu, 2004). It was revealed that technology which was easy to use did affect the Attitude towards Internet of Things (ATT) of users. Hsu and Lin (2016) measured Perceived Ease of Use (PEOU) by four observed variables, including: (1) IoT is easy to use (PEOU1), (2) Interacting with IoT system is clear and understandable (PEOU2), (3) It is easy to use IoT to do what I want it to do (PEOU3) and (4) It is easy to learn how to use IoT (PEOU4).

### 2.3 Perceived Usefulness (PU)

Perceived Usefulness means the degree to which a person perceives that using a technology would enhance his or her job performance (Davis, 1989). Hsu and Lin (2016) appraised Perceived Usefulness (PU) with five Observed variables, including (1) Using IoT enhances quality of life and work (PU1), (2) Using IoT increases the efficiency in lifestyle and work (PU2), (3) Using IoT

helps finish many tasks quickly (PU3), (4) Using IoT obtains useful information for work and life (PU4), and (5) Using IoT is beneficial to life and work (PU5). According to the relation between Perceived Ease of Use (PEOU) and Perceived Usefulness (PU) posited by Hsu and Lin (2016), the researchers proposed the research hypothesis as follows.

H1: Perceived Ease of Use has an effect on Perceived Usefulness (PU)

**2.4 Attitude towards Internet of Things (ATT)**

Attitude towards Internet of Things (IoT) is the degree of individual attitude which results in positive and negative behavior reflecting feeling and knowledge of using Internet of Things (Ajzen, 1991; Fishbein and Ajzen, 1975). Lin and Bhattacherjee (2008) argued that attitude consists of three components, including affect, cognition and behavior which are all correlated with users' satisfaction towards Internet of Things. Hsu and Lin (2016) evaluated Attitude towards Internet of Things (ATT) with five Observed variables: (1) Feeling fun when using IoT (ATT1), (2) Thinking it is a good idea to use IoT (ATT2), (3) Feeling good when using IoT (ATT3), (4) Feeling happy when using IoT (ATT4), and (5) In Overall, having a positive attitude towards using IoT (ATT5). Based on the relation between Perceived Ease of Use (PEOU) and Attitude towards Internet of Things (ATT) proposed by Hsu and Lin (2016), the researchers maintained next research hypothesis as follows.

H2: Perceived Ease of Use (PEOU) has an effect on Attitude towards Internet of Things (ATT)

**2.5 Continuance Intention to Use (CIN)**

Continuance Intention to Use (CIN) is users' behavior which reflected their plan to use continuously (Bhattacherjee, 2001) and this seemed different from the behavior of users when using for the first time. Continuance Intention to Use (CIN) is the post-behavior (Ahmad & Laroche, 2017) and the behavioral crisis of users whether to continue using it or not. Oliver (1999, p. 36) maintained that Continuance Intention to Use (CIN) was a part of behavior loyalty (Narakorn & Seesupan, 2018; Narakorn & Seesupan, 2019) which indicated the bonding of user with his or her intention to use and use continuously and the user tended to like online products and services (Limayem et al., 2007). Hsu and Lin (2016) assessed Continuance Usage Intention (CIN) with four Observed variables, including (1) Wanting to use IoT continuously rather than not use it (CIN1), (2) Intending to use IoT continuously rather than use other channels (CIN2), (3) Intending to use IoT in the future (CIN3), and (4) If possible, determining to use IoT continuously (CIN4).

According to the relation between Perceived Ease of Use (PEOU) and Continuance Intention to Use (CIN) by Hsu and Lin (2016), the researchers proposed more research hypotheses as below.

H3: Perceived Ease of Use (PEOU) had an effect on Continuance Intention to Use (CIN)

H4: Perceived Ease of Use (PEOU) had an effect on Attitude towards Internet of Things (ATT)

H5: Perceived Usefulness (PU) had an effect on Continuance Intention to Use (CIN)

H6: Attitude towards Internet of Things (ATT) had an effect on Continuance Intention to Use (CIN)

## 3. Methodology

### 3.1 Tool for Data Collection

This study is a quantitative research. An online questionnaire was used to collect data from a sample of 272 Internet of Things (IoT) users throughout Thailand. The data consisted of three parts, which are (1) demographic data (2) behaviors related to the use of Internet of Things (IoT) and (3) Perceived Ease of Use (PEOU), Perceived Usefulness (PU), Attitudes towards Internet of Things (ATT) and Continuance Intention to Use (CIN), as shown in Table 1.

**Table 1:** *Tests of Reliability and Convergent Validity*

| Constructs/Observed variables | | Factor Loading | $\alpha$ | AVE | CR |
|---|---|---|---|---|---|
| **Perceived Ease of Use (PEOU)** | | | **0.917** | **0.734** | **0.917** |
| PEOU1 | IoT is easy to use | 0.867 | | | |
| PEOU2 | Interacting with IoT system is clear and understandable | 0.838 | | | |
| PEOU3 | It is easy to use IoT to do what I want it to do | 0.847 | | | |
| PEOU4 | It is easy to learn how to use IoT | 0.874 | | | |
| **Perceived Usefulness (PU)** | | | **0.926** | **0.722** | **0.929** |
| PU1 | Using IoT enhances the quality of my life and work | 0.851 | | | |
| PU2 | Using IoT increases the efficiency in lifestyle and work | 0.856 | | | |
| PU3 | Using IoT helps me to quickly finish many tasks | 0.808 | | | |
| PU4 | Using IoT helps obtain useful information for work and life | 0.851 | | | |
| PU5 | Using IoT is beneficial to life and work | 0.882 | | | |
| **Attitude towards Internet of Things (ATT)** | | | **0.928** | **0.732** | **0.932** |
| ATT1 | I feel fun when using IoT | 0.829 | | | |
| ATT2 | I think it is a good idea to use IoT | 0.852 | | | |
| ATT3 | I feel good when using IoT | 0.856 | | | |
| ATT4 | I feel happy when using IoT | 0.900 | | | |
| ATT5 | Overall, I have a positive attitude towards IoT | 0.833 | | | |
| **Continuance Intention to Use (CIN)** | | | **0.911** | **0.709** | **0.907** |
| CIN1 | I want to use IoT continuously rather than not use it | 0.923 | | | |

| | | | | | |
|---|---|---|---|---|---|
| CIN2 | I intend to use IoT continuously rather than use other channels | 0.800 | | | |
| CIN3 | I intend to use IoT in the future | 0.827 | | | |
| CIN4 | If possible, I will use IoT continuously | 0.812 | | | |

Remarks : CR = $\frac{(\sum \lambda)2}{(\sum \lambda)2 + \Sigma(\theta)}$ ; and AVE = $\frac{(\sum \lambda 2)}{(\sum \lambda 2) + \Sigma(\theta)}$

### 3.2 Test of Quality of Instrument

Content validity was tested by using corrected item-total correlation. Three experts in Internet of Things were asked to evaluate each item of the questionnaire in correspondence with the questionnaire's objectives. All questionnaire items should obtain an item-total correlation more than 0.3 (Field, 2005). The reliability was also assessed before handing out the questionnaire to the sample. Data for the reliability test were collected from thirty respondents. All constructs of the questionnaire obtained Cronbach's alpha coefficients over 0.7, which is higher than a minimum acceptable level of reliability at a Cronbach's alpha of 0.7 (Nunnally, 1978). Kaiser-Olkin Measure of Sampling Adequacy (KMO) was equal to 0.923 (KMO should be over 0.5.). The model can explain 69.50 percent, which is considered acceptable. In conclusion, the KMO of a proposed model was statistically significant at .05 (Show on Table 1).

**Table 2:** *Discriminant Validity*

| Construct | AVE | PEOU | PU | ATT | CIN |
|---|---|---|---|---|---|
| PEOU | 0.734 | **0.856** | | | |
| PU | 0.722 | 0.713 | **0.850** | | |
| ATT | 0.732 | 0.697 | 0.719 | **0.856** | |
| CIN | 0.709 | 0.714 | 0.713 | 0.794 | **0.842** |

Table 2 shows results of a test of discriminant validity. Discriminant validity determines whether each construct of a measurement model can be specifically measured and differentiated among other constructs. If a value of $\sqrt{AVE}$ is higher than a value of correlation between constructs in the same row, the scale achieves discriminant validity.

### 3.3 Population and Sample Size

The population of this research was Internet of Things (IoT) users throughout Thailand. To determine a sample size appropriate for the population, the sample size was determined by following the work of Hair, Black, Babin, and Anderson (2010). They suggested that a sample size suitable for an analysis of Sequential Equation Modeling (SEM) should be between 10-20 times of the number of observed variables. This study specified eighteen observed variables;

therefore, an appropriate size of the sample should be between 180 to 360 respondents. In this research, the data were collected from 272 respondents, a suitable sample size. Accidental sampling was used to recruit online questionnaire respondents in Bangkok and four regions (central, northern, northeastern, and southern parts).

# 4. Conclusions

## 4.1 Population/Sample

**An online questionnaire sample of 272 respondents:** Most of the respondents were female (66.90 percent). Most of the sample were in the age group 21-29 years old (50.40 percent). They had an average of monthly income lower than 10,000 baht. Most respondents were students. Frequently used services of IoT were payment, for example, payment for online shopping, mobile payment, etc. (See Table 3).

**Table 3:** *Number and Percentage of Respondent's Demographic Data*

| Demographic data | | Number (respondents) | Percentage |
|---|---|---|---|
| Gender | Male | 90 | 31.10 |
| | Female | 182 | 66.90 |
| Age | Less than 20 years old | 11 | 4.00 |
| | 21-29 years old | 137 | 50.40 |
| | 30-39 years old | 48 | 17.60 |
| | 40-49 years old | 49 | 18.00 |
| | Over 50 years old | 27 | 9.90 |
| Income | Less than 10,000 baht | 118 | 43.40 |
| | 10,000-19,999 baht | 37 | 13.60 |
| | 20,000-29,999 baht | 30 | 11.00 |
| | 30,000-39,999 baht | 27 | 9.90 |
| | 40,000-49,999 baht | 15 | 5.50 |
| | More than 50,000 baht | 45 | 16.50 |
| Occupation | Civil servants/State employees | 67 | 24.60 |
| | Employees of a private company | 52 | 19.10 |
| | Students | 132 | 48.50 |
| | Business owners | 21 | 7.70 |
| Frequently Used IoT Services | 1. Payment such as online shopping, mobile payment | | 86.00 |
| | 2. Downloads of applications | | 65.40 |
| | 3. Transportation-related technology such as online ticketing, taxi payment | | 33.80 |

### 4.2 Results of Questionnaire Analysis

An analysis of the questionnaire responses revealed constructs that the respondents considered important in an descending order as follows: (1) Perceived Usefulness ( $\overline{X}$ = 4.30) (2) Continuance Intention to Use ( $\overline{X}$ = 4.13) (3) Attitude towards Internet of Things ( $\overline{X}$ = 4.07) and (4) Perceived Ease of Use ( $\overline{X}$ = 4.07).

### 4.3 Results of Analysis of Factors Affecting Continuance Intention to Use

A model of factors affecting Continuance Intention to Use was composed of Perceived Ease of Use, Perceived Usefulness, and Attitudes towards Internet of Things. An analysis of SEM using AMOS program revealed that the model, after a modification, corresponded with the empirical evidence ($\chi^2$ = 147.441, df = 123, p-value = 0.066, $\chi^2$/df = 1.199, GFI = 0.944, AGFI = 0.923, IFI = 0.994, CFI = 0.994, RMR = 0.012, RMSEA = 0.027). It can be concluded that Continuance Intention to Use achieved an overall fit with the specified theoretical model at an acceptable level (Figure 1).

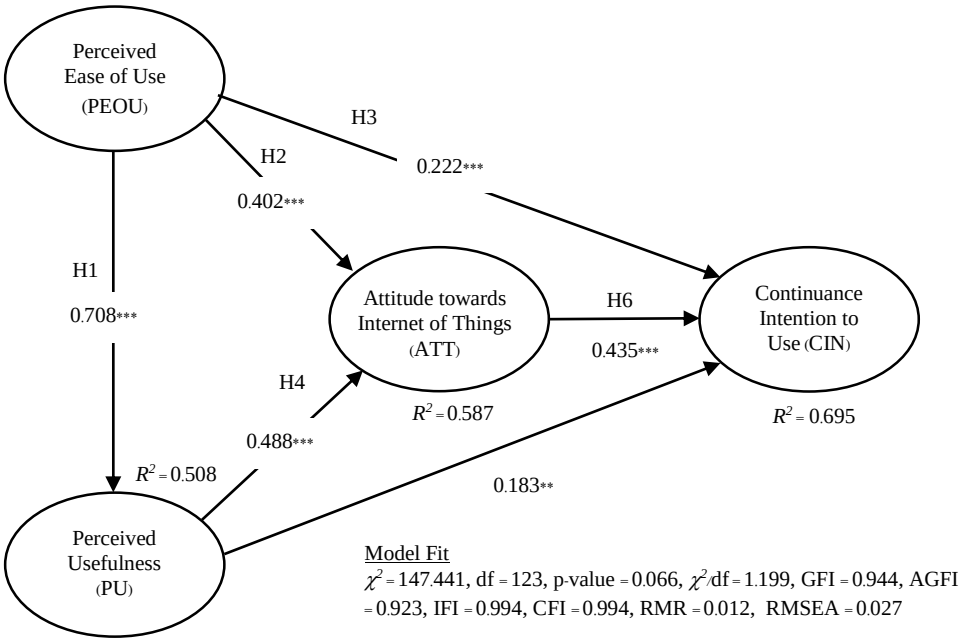


**Figure 1:** *Conceptual Framework of Research*

**Table 4:** *Results of Hypothesis Test*

| | Path | *B* | *t*-value | Result |
|---|---|---|---|---|
| H1 | Perceived Ease of Use → Perceived Usefulness | .708 | 11.817*** | Support |
| H2 | Perceived Ease of Use → Attitude towards Internet of Things | .402 | 5.354*** | Support |
| H3 | Perceived Ease of Use → Continuance Intention to Use | .222 | 3.359*** | Support |
| H4 | Perceived Usefulness → Attitude towards Internet of Things | .488 | 6.386*** | Support |
| H5 | Perceived Usefulness → Continuance Intention to Use | .183 | 2.700** | Support |
| H6 | Attitude towards Internet of Things → Continuance Intention to Use | .435 | 6.786*** | Support |

Remarks (1) * means statistical significance at 0.05 ($p < 0.05$) ($1.96 \leq t\text{-value} < 2.576$); (2) ** means statistical significance at 0.01 ($p < 0.01$) ($t\text{-value} \geq 2.576$); (3) *** means statistical significance at 0.001 ($p < 0.001$) ($t\text{-value} \geq 3.291$)

As shown in Table 4, hypothesis 1 stating Perceived Ease of Use has an effect on Perceived Usefulness was statistically significant at .001, with a path coefficient equal to .708 ($\beta_1 = .708$, $t = 11.817$, $p < 0.001$). Hypothesis 2 stating Perceived Ease of Use has an effect on Attitudes Towards Internet of Things was statistically significant at .001, with a path coefficient equal to .402 ($\beta_2 = .402$, $t = 5.354$, $p < 0.001$). Hypothesis 3 stating Perceived Ease of Use has an effect on Continuance Intention to Use was statistically significant at .001, with a path coefficient equal to .222 ($\beta_3 = .222$, $t = 3.359$, $p < 0.001$). Hypothesis 4 stating Perceived Usefulness has an effect on Attitudes towards Internet of Things was statistically significant at .001, with a path coefficient equal to .488 ($\beta_4 = .488$, $t = 6.386$, $p < 0.001$). Hypothesis 5 stating Perceived Usefulness has an effect on Continuance Intention to Use was statistically significant at .001, with a path coefficient equal to .183 ($\beta_5 = .183$, $t = 2.700$, $p < 0.01$). Hypothesis 6 stating Attitudes towards Internet of Things has an effect on Continuance Intention to Use was statistically significant at .001, with a path coefficient equal to .435 ($\beta_6 = .435$, $t = 6.786$, $p < 0.001$) (See Table 4).

**Table 4:** *Effects of antecedent on Continuance Intention to Use*

| Constructs | $R^2$ | Effect | Antecedents | | |
|---|---|---|---|---|---|
| | | | PEOU | PU | ATT |
| PU | 0.508 | DE | 0.708 | 0.000 | 0.000 |
| | | IE | 0.000 | 0.000 | 0.000 |
| | | TE | 0.708 | 0.000 | 0.000 |
| ATT | 0.587 | DE | 0.402 | 0.488 | 0.000 |
| | | IE | 0.346 | 0.000 | 0.000 |
| | | TE | 0.748 | 0.488 | 0.000 |

| | | | | | |
|---|---|---|---|---|---|
| CIN | 0.695 | DE | 0.222 | 0.183 | 0.435 |
| | | IE | 0.455 | 0.212 | 0.000 |
| | | TE | 0.677 | 0.395 | 0.435 |

Remarks: DE = Direct Effect, IE = Indirect Effect, TE = Total Effect

As seen in Table 5, the factor having the highest total effect on Continuance Intention to Use was Perceived Ease of Use (TE = 0.677). Attitudes towards Internet of Things was a factor having second highest total effect (TE = 0.435) whereas Perceived Usefulness had the lowest total effect (TE = 0.395). All factors predicted 68.70 percent of Continuance Intention to Use ($R^2$ = 0.687).

## 5. Discussion of Results

The results of this research can be explained in accordance with the six hypotheses as follow.

### 5.1 Perceived Ease of Use had a Relationship with Perceived Usefulness

The results of research showed that Perceived Ease of Use has a direct effect on Perceived Usefulness (Davis, 1989). This result is along the same line with the research work of Chen and Peng (2018) and Sharifzadeh et al. (2017). When users can easily use a technology and the technology increases a work efficiency, users will perceive that the technology is beneficial (Davis, 1989).

### 5.2 Perceived Ease of Use had a Relationship with Attitude towards Internet of Things

Research results showed that Perceived Ease of Use has a positive relationship with Attitude towards Internet of Things (Davis, 1989). Corresponding with the work of Choi et al. (2014) and Cheng et al. (2015), a technology that is easy to use would enhance positive attitudes towards using the technology. This research also found that the easier it is to learn how to use IoT, the happier the user will be when using the technology (Hsu & Lin, 2016).

### 5.3 Perceived Ease of Use had a Relationship with Continuance Intention to Use

Results showed that Perceived Ease of Use has a direct effect on Continuance Intention to use (Davis, 1989). This result is similar to the research work of Caniels et al. (2014) and Kim (2015) which stated that a technology that is easy to use would invite users to use the technology again (Hsu & Lin, 2016). Based on our research, the easier the users can learn how to use IoT, the more likely the user will continue to use IoT services rather than not use it (Hsu & Lin, 2016).

**5.4 Perceived Usefulness had a Relationship with Attitude towards Internet of Things**

This study's results confirmed that Perceived Usefulness has a positive relationship with Attitudes towards Internet of Things (David, 1989). Similarly, the studies of Lai and Li (2005), Muk and Chung (2015), Read et al. (2011) and Rese et al. (2014) indicated that positive attitudes towards Internet of Things could be increased when users perceive that the technology helps improve work efficiency. Based on this research's results, using IoT helps improve life and work efficiency. These benefits of IoT make users more pleased to use IoT and have a better positive feeling while using IoT (Cheng et al., 2015).

**5.5 Perceived Usefulness had a Relationship with Continuance Intention to Use**

Results confirmed that Perceived Usefulness has a positive relationship with Continuance Intention to Use (David, 1989). In the same vein, the research work of Cheng et al. (2015), Hsu and Lin (2016), Lin and Lu (2011), Zhou (2015) and Zhou and Lu (2011) specified that the more users perceive benefits of the technology, the more users will continue using the technology. This research's results revealed that using IoT can help increase life and work efficiency of users. The more users are aware of these benefits, the more likely that users will intend to use IoT continuously rather than stop using or use it from time to time (Bhattacherjee, 2001).

**5.6 Attitude towards Internet of Things had a relationship with Continuance Intention to Use**

Attitude towards Internet of Things had a positive relationship with Continuance Intention to Use (David, 1989). This study's results are in line with the work of Fayad and Paper (2015), Kim and Woo (2016), Lin and Kim (2016) and Yoon (2016) in that users' positive attitudes towards using IoT and their happy feeling when using the technology will lead to Continuance Intention to Use. Moreover, this research revealed that users' overall positive attitude and good feeling towards using IoT will make users intend to use IoT continuously now and in the future (Bhattacherjee, 2001).

## 6. Theoretical Contribution

This study was an analysis of sequential equation modeling, composing of two theories: Technology Acceptance Model (TAM) (Davis, 1989) and Continuance Intention to Use (CIN) (Bhattacherjee, 2001). The Technology Acceptance Model includes three variables: Perceived Ease of Use, Perceived Usefulness and Attitude. The Continuance Intention to Use is a success indicator of technology usage that is repeatedly and continuously used. This research applied both theories to Internet of Things users in Thailand. A new theoretical benefit is that owners of

business- to- customer ( B2C) businesses can employ these two theories to develop a new technology and create a business competitive advantage.

## 7. Practical Contribution

For online business entrepreneurs as a manager of an organization, building a novel technology for customer services is an approach to create a business competitive advantage. To develop a new IoT- based customer services technology that customers will frequently and continuously use, the technology must be easy to use, increase work efficiency, and be happy to use and invite a positive attitude towards using the technology.

## 8. Limitations of Research

1. The sample obtained in this research might have a high error because the population of this research was too large and a nonprobability sampling technique was employed. Thus, the research in the future should examine the population and use a sampling method more specifically and appropriately.

2. The sample of this research was too broad for a study of consumer behavior. Therefore, a future work should specify a business or a kind of product to obtain a more specific model and research results.

## 9. Recommendations

### 9.1 Recommendations for Internet of Things Service Provider

Service providers of Internet of Things should develop a new technology by taking into account ease of use, enhancement of efficiency in users' life and work, making users feel happy and have a positive attitude while using the technology.

### 9.2 Recommendations for National Policy

To meet the growing number of e-commerce and Internet of Things users, the government should promptly improve the efficiency of information and communication infrastructure of Thailand and expand the infrastructure to all parts of the country. Moreover, an organization responsible for constantly checking the accuracy and safety of information on the internet is necessary to help users consume information and use information sources on the internet correctly.

## References

Agarwal, R., Karahanna, E., 2000. Time flies when you're having fun: cognitive absorption and beliefs about information technology usage. MIS Q. 665–694. https://doi.org/10.2307/3250951

Ahmad, S. N., & Laroche, M. (2016). Analyzing electronic word of mouth: A social commerce construct. *International Journal of Information Management*: 1-12.

Ajzen, I. (1991), "The theory of planned behavior", Organizational Behaviors and Human Decision Processes, Vol. 50 No. 2, pp. 179- 211. https://doi.org/10.1016/0749-5978(91)90020-T

Ajzen, I. and Fishbein, M. (1980), Understanding Attitudes and Predicting Social Behavior, Prentice Hall, Englewood Cliffs, NJ.

Bandyopadhyay, S., Balamuralidhar, P., & Pal, A. (2013). Interoperation among IoT standards. *Journal of ICT Standardization, 1*, 253-270. https://doi.org/10.13052/jicts2245-800X.12a9

Bhattacherjee, A. (2001). Understanding information systems continuance: An expectation-confirmation model. *MIS Quarterly, 25*(3), 351–370. https://doi.org/10.2307/3250921

Carniels, M. C. J., Lenaerts, H. K. L., & Gelderman, C. J. (2014). Explaining the internet usage of SMEs, The impact of market orientation, behavioral norms, motivation and technology acceptance. *Internet Research, 25*(3): 358-377. https://doi.org/10.1108/IntR-12-2013-0266

Cheng, S-I., Chen, S-C., & Yen, D. C. (2015). Continuance intention of E-portfolio system: A confirmatory and multigroup invariance analysis of technology acceptance model. Computer Standards & Interfaces, 42: 17-23. https://doi.org/10.1016/j.csi.2015.03.002

Chen, S-C., Yen, D-C., & Peng, S-C. (2018). Assessing the impact of determinants in e-magazines acceptance: An empirical study. *Computer Standards & Interfaces, 57*: 49- 58. https://doi.org/10.1016/j.csi.2017.11.004

Choi, J., Lee, H. J., Sajjad, F., & Lee, H. (2014). The influence of national culture on the attitude towards mobile recommender systems. *Technological Forecasting & Social Change,* 86 :65-79. https://doi.org/10.1016/j.techfore.2013.08.012

Chui, M., Markus, L., & Roger, R. (2010). The Internet of things. *McKinsey Quarterly, 2:* 1-9.

Davis, F.D., 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quart. 13*: 319-340. https://doi.org/10.2307/249008

Fayad, R. & Paper, D. (2015). The Technology Acceptance Model E-Commerce Extension: A Conceptual Framework. *Procedia Economics and Finance, 26*: 1000- 1006. https://doi.org/10.1016/S2212-5671(15)00922-3

Fishbein, M., & Ajzen, I. (1975). Belief, attitude, intention and Behavior: An introduction to theory and research. Reading, MA: Addison-Wesley.

Giusto, D., Iera, A., Morabito, G. and Atzori, L. (Eds) (2010), The Internet of Things, ISBN: 978-1-4419-1673-0, Springer, New York, NY. https://doi.org/10.1007/978-1-4419-1674-7

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2010). Multivariate data analysis. Upper Saddle River, NJ: Prentice-Hall. https://doi.org/10.1016/j.jmva.2009.12.014

Hsu, C-L. & Lin, J. C-C. (2016). An empirical examination of consumer adoption of Internet of Things service: Network externalities and concern for information privacy perspectives. *Computer in Human Behavior, 62*: 516-527. https://doi.org/10.1016/j.chb.2016.04.023

Hsu, C. L., & Lu, H. P. (2004). Why do people play on-line games? an extended TAM with social influences and flow experience. *Information & Management, 41*( 7) , 853- 868. https://doi.org/10.1016/j.im.2003.08.014

Kim, J. (2015). An extended technology acceptance model in behavioral intention towards hotel tablet apps with moderating effects of gender and age. *International Journal of Contemporary Hospitably, 28* (8): 1535- 1553. https://doi.org/10.1108/IJCHM-06-2015-0289

Kim, Y. G., & Woo, E. (2016). Consumer acceptance of a quick response (QR) code for the food traceability system: Application of an extended technology acceptance model (TAM). *Food Research International, 85*:266-272. https://doi.org/10.1016/j.foodres.2016.05.002

Lai, V. S., Li, H. (2005). Technology acceptance model for internet banking: an invariance analysis. Information & Management, 42: 373-386. https://doi.org/10.1016/j.im.2004.01.007

Limayem, M., Hirt, S., & Cheung, C. (2007). How habit limits the predictive power of intention: The case of information systems continuance. MIS Quarterly, 31( 4) , 705– 737. https://doi.org/10.2307/25148817

Lin, C. A., & Kim, T. (2016). Predicting user response to sponsored advertising on social media via the technology acceptance model. *Computer in Human Behavior, 64*: 710- 718. https://doi.org/10.1016/j.chb.2016.07.027

Lin, C. P., & Bhattacherjee, A. (2008). Elucidating individual intention to use interactive information technologies: the role of network externalities. *International Journal of Electronic Commerce, 13*: 85-108. https://doi.org/10.2753/JEC1086-4415130103

Lin, K-Y. & Lu, H-P. (2011). Why people use social networking sites: An empirical study integrating network externalities and motivation theory. Computers in Human Behavior, 27: 1152-1161. https://doi.org/10.1016/j.chb.2010.12.009

Narakorn, P., & Seesupan, T. (2018). The influence of social network site identity, active control, flow, trust in members and customer loyalty of Facebooks users. *Silpakorn University Journal*, *38* (2), 121-145.

Narakorn, P., & Seesupan, T. (2018). Trust in Seller Catalyst Social Commerce Construct to Continuance Intention. *Journal of Business Administration, 41* (159), 24-44.

Narakorn, P., & Seesupan, T. (2019). Social Commerce Constructs and Buyer-Seller Relationship Quality. *Modern Applied Science*, *13* (2), 169-176. https://doi.org/10.5539/mas.v13n2p169

Nunnally, J. (1978). Psychometric Theory, McGraw-Hill, New York, NY.

Muk, A. & Chung, C. (2015). Applying the technology acceptance model in a two-country study of SMS advertising. Journal of Business Research, 68:1-6. https://doi.org/10.1016/j.jbusres.2014.06.001

Oliver, R. (1999) .Whence consumer loyalty?. Journal of marketing, 63:33-44. https://doi.org/10.2307/1252099

Read, W., Robertson, N., & McQuilken, L. (2011). A novel romance: The Technology Acceptance Model with emotional attachment. *Australasian Marketing Journal, 19*: 223- 229. https://doi.org/10.1016/j.ausmj.2011.07.004

Rese, A., Schreiber, S., & Baier, D. (2014). Technology acceptance modeling of augmented reality at the point of scale: Can surveys be replaced by an analysis of online reviews?. *Journal of Retailing and Consumer Service, 21*:869-876. https://doi.org/10.1016/j.jretconser.2014.02.011

Sharifzadeh, M. S., Damalas, C. A., Abdollahzadeh, G., & Ahmadi-Gorgi, H. (2017). Predicting adoption of biological control among Iranian rice farmers: An application of the extended technology acceptance model (TAM2). *Crop Protection, 96*: 88-96. https://doi.org/10.1016/j.cropro.2017.01.014

Shen, C.C., Chiou, J.S., 2010. The impact of perceived ease of use on internet service adoption: the moderating effects of temporal distance and perceived risk. *Compute. Hum. Behav. 26* (1), 42–50. https://doi.org/10.1016/j.chb.2009.07.003

Wallance, L. G., & Sheetz, S. D. (2014). The adoption of software measures: A technology acceptance model (TAM) perspective. *Information & Management, 51*: 249- 259 https://doi.org/10.1016/j.im.2013.12.003

Yoo, H-Y. (2016). User Acceptance of Mobile Library Applications in Academic Libraries: An Application of the Technology Acceptance Model. *The Journal of Academic Librarianship, 42*: 687-693. https://doi.org/10.1016/j.acalib.2016.08.003

Zancul, E. d. S., Takey, M. S., Barquet, A. P. B., Kuwabara, L. H., Miguel, P. A. C., & Rozenfeld, H. (2015). Business process support for IoT based Products-Service System (PSS). Business Process Management Journal, 22 (2), 2016. https://doi.org/10.1108/BPMJ-05-2015-0078

Zhou, T. (2015). The effect of network externality on mobile social network site continuance. *Program electronic library and information systems, 49* (3):289-304. https://doi.org/10.1108/PROG-10-2014-0078

Zhou, T. & Lu, Y. (2011). Examining mobile instant messaging user loyalty from the perspectives of network externalities and flow experience. *Computer in Human Behavior, 27*: 883-889. https://doi.org/10.1016/j.chb.2010.11.013