Factors Influencing The Thai Elderly Intention to Use Smartphone for e-Health Services

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Abstract— **Technology can help persuade people to change their attitudes or behaviors. Elderly population is not familiar with information technology but e-Health services can help people maintain a healthy lifestyle. In order for the elderly to get benefits from e-Health services, they need to change their attitudes or behaviors. To make this change, it is necessary to persuade the elderly to embrace the use of smartphone. This research investigated factors that influence the elderly's intention to use e-Health services via a smartphone. According to the UTAUT model, the factors that influence the user's intention to use e-Health services are as follows: Performance Expectancy, Effort Expectancy, Social Influence, and Facilitating Conditions. Although the UTAUT model has been widely used to explain user acceptance and use of technology, lack of experience with recent technological advancement and age related deficiencies makes it less attractive for the elderly to adopt new technologies such as the smartphone. This is directly related to the elderly's perception of whether new technology can benefit to their lives. Hence, in this study, the UTAUT model has been extended to include a 'Perceived Value' factor. The proposed model identified factors influencing the elderly's intention to use e-Health services via a smartphone. It is found that 'Perceived Value' has a strong significance on the elderly's intention to use smartphone, followed by Facilitating Conditions and Effort Expectancy. In contrast, Performance Expectancy and Social Influence did not have a significant influence on intention. With the proposed model, it is possible to develop better e-Health services to meet the needs of the elderly based on widely available smartphones.**

Keywords-component; Smartphone, UTAUT Model, Perceived Value, Elderly, e-Health Service

I. INTRODUCTION

It is possible to use information technology to persuade people to change their attitude or behavior [1]. It is also possible to use information technology to improve health care services [2]. In community with advanced information technology infrastructure, e-health can help improve well-being and healthy living of people. At present smartphone offers many useful features that can be used to support e-Health services. Smartphone is also widely available in developing community with less developed information technology infrastructure. This gives opportunity for developing community to provide e-health services to people through smartphone.

For elderly were born in an era when personal computers were not yet commonplace; therefore, it can be expected that the elderly population have less familiarity with information technology when compared to the younger generation [3]. If users do not have good understanding of any given technology, they may not have interest to use product from that technology. This unfamiliarity decreases penetration of smartphone in aging community. It is therefore becomes difficult to use smartphone as e-Health enabling tool in community with low smartphone penetration. This study aims to examine the factors that influence the Thai elderly's intention to use smartphone, as tool for receiving e-Health services. Although it is found in [4] that the UTAUT model was able to explain70 about percent of intention to use information technology, we argue that more factors should be considered to explain intention related to smartphone and e-Health in aging community. Value perception can be a predictor of behavior [5] and it is found in [6] that value has effect on user satisfaction. No previous research has studied about relation between perceived value and user intention in aging community.

II. LITERATURE REVIEW

Before new technology is being in use it is necessary to check the intention level of the potential user. The method that is widely used is the acceptance model which many researchers have used to acknowledge the factors that have an effect on selection of particular technology. Nonetheless some models may not contain enough factors to studied individuals adopt information technologies, then many researches extended the model to better explain intention for specific contexts. Wangpipatwong et al [7] proposed and tested citizen's continuance intention to use services from e-government web by employing a survey to users who have well experienced with e-Government website with at least a bachelor's degree. The finding showed that computer self-efficacy has influence on citizen's continuance intention to use, in addition to perceived usefulness and perceived ease of use. Phang et al. [8], found that for elderly with less familiar information technology, the following factors also have influence on acceptance of information technology: self-actualization, resource savings, and Internet safety perception. The UTAUT model in [4] includes Performance Expectancy,

This work was supported by the Higher Education Research Promotion and National Research University Project of Thailand, Office of the Higher Education Commission

978-1-4673-1310-0/12/$31.00 ©2012 IEEE

Effort Expectancy, Social Influence and Facilitating Conditions as factors that have influence on adoption of technology. The UTAUT model has been ability to identify and discussed in various fields in relation to test intention and adoption of technology acceptance. It is confirmed by [9] that the UTAUT model can be used to predict user intention to use e-Health. Pitchayadejanant [10] found that intention to use a smartphone depends on Perceived Value and Facilitating Conditions. This implies that smartphone users do intend to use their smartphone when they recognize its value. It is found in [11] that Perceived Value related to user intention includes Social value, Emotional value, Functional value, Epistemic value and Conditional value [11].

III. Research Framework and Hypotheses

This study aimed to investigate factors that have influence on the elderly's intention to use e-Health services via a smartphone. The research proposes hypotheses based on the factors in the UTAUT model. The additional hypothesis is related to Perceived Value and its influence on elderly's intention to use smartphone. The research model was shown in figure 1.

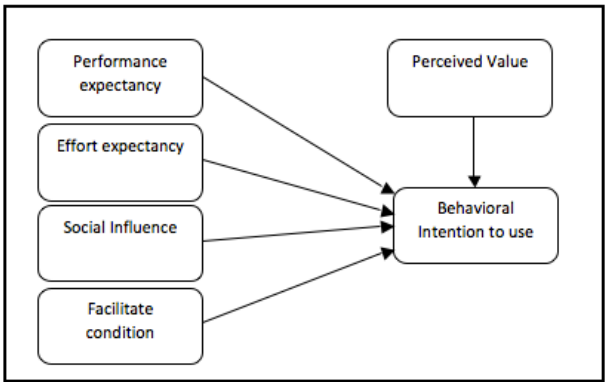

Figure 1. Research Model: Extended of UTAUT.

A. Performance Expectancy

In the context of this study, Performance Expectancy is the degree to which an elderly person feels that using a smartphone for e-Health service will be advantageous to them [4], enhance their performance and also make their life easier. As the e-Health service is an application which is available on a smartphone, it can be useful if the elderly person felt that it helps them have a better quality of life. Therefore, Performance Expectancy is a significant predictor of intention to use.

H1: Performance Expectancy is positively related to the Thai elderly's Behavioral Intention to Use e-Health services through a smartphone.

B. Effort Expectancy

The physiological conditions (e.g. movement, hearing, and memory) decreases as age increases. Elderly have less ability to perform information processing tasks [12]. Previous research mentions the problem the elderly experience while using the complex interface of a mobile phone, the elderly have difficult time remembering what was on the menus, so they spend a lot of time navigating to the right task [13]. Based on this finding, the physical and cognitive abilities of the elderly would impact on using a smartphone for e-Health service. Smartphones combine a variety of features that convenient to use. The Graphics User Interface that is provided as an application on a smartphone need to be simple If the elderly could understand smartphone interface for e-Health services, it would be help reduce effort and difficulty to use. Hence, this should be considered as an influencing factor for the using a smartphone for e-Health services.

H2: Effort Expectancy is positively related to the Thai elderly's Behavioral Intention to Use e-Health services through a smartphone.

C. Social Influence

Social influence is defined as the degree to which an individual perceived the opinions of others whether he or she should use the new system [4]. As the elderly have less familiarity with a smartphone. Then people such as family, friends or others that are important to them would have influence on the opinions toward of the elderly and may convince them to use it for a healthier lifestyle. Hence, in this study, it was expected that Social Influence may directly or indirectly affect intention to use. Then the hypothesis is as follows:

H3: Social Influence is positively related to the Thai elderly's Behavioral Intention to Use e-Health services through a smartphone.

D. Facilitating Conditions

Facilitating Conditions are defined as the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system [4]. Hence, using a smartphone for e-Health service must consider whether helpful and convenient support is available to the elderly. This study would like to know the impact of available support on the Thai elderly decision to use e-Health service. It is hypothesized that Facilitating Conditions will directly affect intent to use.

H4: Facilitating Conditions are positively related to Thai elderly's Behavioral Intention to Use e-Health services through a smartphone.

E. Perceived Value

According to Sweeney et al. [14], Perceived Value refers to four dimensions. First, it is described as the emotional value feeling or affective states that a product generates, including pleasure and enjoyment when users accept a mobile commerce service [15]. Second, social value defines the product's ability to enhance social self-concept. Third, performance/Quality value defines the utility derived from the perceived quality and expected performance of the product. And the last one, price/value for money explains the utility derived from the product due to the reduction of its perceived short term and longer term costs. All dimensions of Perceived Value were found as a strong predictor to explain behavioral intention to use [16]. If the elderly realized the values and benefits of using the services via a smartphone, it may persuade them to use it. Then this study is interested in examining the impact of Perceived Value.

H5: Perceived Value is positively related to the Thai elderly's Behavioral Intention to Use e-Health services through a smartphone.

IV. METHODOLOGY

A. Constructs and Items Used

In order to test the proposed model, a questionnaire has been constructed by reviewing questionnaires used in previous studies that utilize the UTAUT model. Constructs and question items relevant in this research were approved for validity in Venkatesh et.al. [4]. The UTAUT model was extended with Perceived Value and question items were modified to comply with Thai elderly's behavioral intention to use e-Health services. The questionnaire composed of two parts as shown in table I. First, the respondents were asked about their demographic information such as sex, age, education level, and mobile phone experience. The second part required the respondents to give their attitude on each item. All items used in the second part were scored on a seven-point Likert scale (7=strongly week; 6=agree; 5= weakly agree; 4= neutral; 3= weakly disagree; 2=disagree; 1= strongly disagree). As the survey was conducted in Thailand the questionnaire was translated into the Thai language so it could be clearly understood.

TABLE I. ITEMS USED IN ESTIMATING UTAUTAND EXTENDED WITH PERCEIVED VALUE

Constructs	Question Items
Performance Expectancy [4]	PE1: I would find a smartphone for e-health service useful in my job.
	PE2: Using a smartphone for e-health service enables me to accomplish tasks more quickly.
	PE3: Using a smartphone for e-health service increases my productivity.
	PE4: If I use a smartphone for e-health service, I will increase my chances of getting a raise.
Effort expectancy [4]	EE1: My interaction with a smartphone for e-health service would be clear and understandable.
	EE2: It would be easy for me to become skillful at using a smartphone for e-health service.
	EE3: I would find the smartphone for e-health service easy to use.
	EE4: Learning to operate a smartphone for e-health service is easy for me.
Social influence [4]	SN1: People who influence my behavior think that I should use a smartphone for e-health service.
	SN2: People who are important to me think that I should use a smartphone for e-health service.
	SN3: The senior management of this business has been helpful in the use of a smartphone for e-health service.
	SN4: In general, the organization has supported the use of a smartphone for e-health service.
Facilitating Conditions [4]	FC1: I have the resources necessary to use a smartphone for e-health service.
	FC2: I have the knowledge necessary to use a smartphone for e-health service.
	FC3: A smartphone for e-health service is not compatible with other systems I use.
	FC4: A specific person (or group) is available for assistance with a smartphone for e-health service difficulties.
Behavioral Intention to Use [4]	BI1: I intend to use a smartphone for e-health service in the next few months.
	BI2: I predict I would use a smartphone for e-health service in the next few months.
	BI3: I plan to use a smartphone for e-health service in the next few months.
Perceived Value [16]	PV1: Smartphone for e-health service has consistent quality.
	PV2: Smartphone for e-health service is well made
	PV3: Smartphone for e-health service has an acceptable standard of quality
	PV4: Smartphone for e-health service has poor workmanship (*)
	PV5: Smartphone for e-health service would *not* last a long time (*)
	PV6: Smartphone for e-health service would perform consistently
	PV7: Smartphone for e-health service is one that I would enjoy
	PV8: Smartphone for e-health service would make me want to use it
	PV9: Smartphone for e-health service is one that I would feel relaxed about using
	PV10: Smartphone for e-health service would make me feel good
	PV11: Smartphone for e-health service would give me pleasure
	PV12: Smartphone for e-health service is reasonably priced
	PV13: Smartphone for e-health service offers value for money
	PV14: Smartphone for e-health service is a good product for the price
	PV15: Smartphone for e-health service would be economical
	PV16: Smartphone for e-health service would help me to feel acceptable
	PV17: Smartphone for e-health service would improve the way I am perceived
	PV18: Smartphone for e-health service would make a good impression on other people
	PV19: Smartphone for e-health service Would give its owner social approval

* reverse scale

B. Data Collecting

In preliminary study, 31 Thai elderly people with a good education background and knowledge of technology were asked to participate in the survey.

C. Reliability

To test the reliability of the constructs from the UTAUT model with extension to Perceived Value, Cronbach's alpha was used as a measure. The commonly accepted for describing internal consistency, the value of Cronbach's alpha coefficient should greater than 0.7 [17]. Table II illustrates the reliability coefficient for each construct.

TABLE II. RELIABILITY COEFFICIENT OF CONSTRUCTS

Constructs	Cronbach's Alpha Coefficient(α)
Performance Expectancy	0.77
Effort Expectancy	0.85
Social Influence	0.80
Facilitating Conditions	0.75
Attitude Toward Using	0.75
Perceived Value	0.87
Behavioral Intention to Use	0.93

All of the constructs had the value for Cronbach's alpha Coefficient greater than 0.7. Therefore, every construct is acceptable for use in this study.

D. Result

The result of the Thai elderly attitudes is shown in Table III. The seven-point Likert scales was used for all of the constructs' measurement, with 1 being the strongly disagree end of the scale and 7 being the strongly agree end of the scale. The results show that the Thai elderly agree that the main concerns about using a smartphone are Performance Expectancy and Effort Expectancy. In addition, Facilitating Conditions, Behavioral Intention to Use, and Perceived Value are less agree in this study.

TABLE III. DESCRIPTIVE STATISTICS OF SAMPLE

Construct	Code	Number of Indicator	Mean	Standard Deviation
Performance Expectancy	PE	4	5.33	0.76
Effort Expectancy	EE	4	5.39	0.83
Social Influence	SN	4	5.22	0.82
Facilitating Conditions	FC	4	5.05	0.78
Behavioral Intention To Use	BI	4	5.04	1.19
Perceived Value	PV	19	5.08	0.62

A Pearson correlation analysis was conducted in this study. With Pearson correlation the values are between -1 to 1, 1 means they are positively related, 0 means there is no correlation, and -1 means they correlate in the opposite direction. The result of correlation analysis is shown in Table IV. There was a significant relationship between Effort Expectancy (r=0.578, p<0.01), Facilitating Conditions (r=0.629, p<0.01) and Perceived Value (r = 0.678, p < 0.01) with Behavioral Intention to Use. The Linear Regression determined that five factors could predict the Behavioral of Intention to Use at about 60.6%.

TABLE IV. RESULTS OF HYPOTHESIS TESTING

Hypothesis	Pearson Correlation(r)	Significant(p)	Conclusion
PE -> BI	.333	.067	Not Support
EE -> BI	.578**	.001	Support
SN -> BI	.344	.058	Not Support
FC -> BI	.629**	.000	Support
PV -> BI	.678**	.000	Support

** Correlation is significant at the 0.01 level (2-tailed).

V. DISCUSSION

This study examined the factors that influence the intention of the Thai elderly to use a smartphone for e-Health service. The proposed model was used in this study for testing the intention. The results found there are positive relation between Behavioral of Intention to Use and three proposed constructs: Perceived Value, Effort Expectancy, and Facilitating Conditions.

Performance Expectancy has a weak impact and does not significantly affect Behavioral Intention to Use. The sample had knowledge about the technology but most of the sample was not so concerned that using smartphone for e-Health service has more benefit in improving health than traditional mobile phone. It is confirmed that Performance Expectancy was less salient to the elderly.

Social Influence was not a significant indicator of Behavioral of Intention to use. This follows what were found in previous research. However the results are contrasted with the UTAUT model which suggests that older workers place more emphasize on Social Influence. Since the participants in this study are elderly people who had good education and experience with technology, the effect from Social Influence declines.

It is interesting that the Perceived Value, which was the extended factor in this study was the highest positive indicator related to the Thai elderly's behavioral intention to use e-Health services through a smartphone. The results define that the elderly concerns about emotional, social, quality/performance and price/value for money when they using the service.

VI. CONCLUSION AND FUTURE WORK

This research attempted to understand the intention of Thai elderly's intention to use a smartphone for e-Health service. The study conducted the survey based on the UTAUT model with extension of Perceived Value. The results revealed that Perceived Value Effort Expectancy, and Facilitating Conditions were positively related with Behavioral Intention to Use. Performance Expectancy and Social Influence were not positively related to Behavioral Intention to Use.

The outcomes from this study revealed that the UTAUT model with extension of Perceived Value could be applied to understand the Thai elderly behavioral intention to use a smartphone for e-Health service. To develop a better e-Health service on a smartphone, the developer should note that Perceived Value, Effort Expectancy, and Facilitating Conditions are the important determinants.

The limitation of this study is the focus on specific characteristics of the respondents with good education and knowledge in technology. Hence the next phase should further exploration into different groups of elderly. More dimensions should be considered in the research model and should represent wider population. However the results of the research is still useful for developing better e-Health services for the elderly based on widely available smartphones.

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