Behaviors of Thais in Protecting their Smartphones from Cyber Threats
พฤติกรรมของคนไทยในการป้องกันสมาร์ทโฟนจากภัยคุกคามทางไซเบอร์

บทความวิจัย

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Abstract

Smartphone allows us to communicate anywhere and anytime, make high quality calls, take photo, and share data. Amongst these reasons are their portable size and their enhanced functionalities and their abilities to host many useful applications. With this reason, there are 2.1 billion people use smartphones in 2016, and this number continues increasing along with economies (www.statista.com). Now-a-day, cyber attackers have been turning to smartphones. The enormous use of smartphones makes them an attractive target for conducting security attacks such as malware, identity theft, or ransomware. This issue led us to focus on studying the abilities and behaviors of Thai people towards protecting their smartphones from cyber threats. Objectives of this study are: (1) to investigate the abilities and behaviors of Thai people in protecting their smartphones from cyber threats, and (2) to compare their abilities and protection behaviors in protecting their phones from cyber threats, based on demographic differences and their behaviors. The study is based on the Protection Motivation Theory (PMT), proposed by Roger, R.W. in 1983, and used quantitative methodology to collect and analyze the data. A total of 720 samples of smartphone users were collected, with cluster sampling technique, from all six regions of Thailand, namely Bangkok and metropolitan, northern region, north-east region, eastern region, central region, and southern region.

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The results shows that: (1) The overall protection behaviors of Thai people is in good level, (2) females have less degree in protecting themselves from mobile threats than males, (3) people of ages 51 – 60 have less degree in protecting themselves from mobile threats than the other age-groups, (4) people whose smartphones used to be infected by virus/ malware have higher degree in protecting the mselves rom mobile threats than the other, (5) people who use public wifi have higher degree in protecting themselves from mobile threats than the other, (6) people who use money transfer services via their phones have higher degree in protecting themselves from mobile threats than the other.

Keywords: Smartphone, Mobile Threats, Protection Motivation Theory, Protection Behavior

บทคัดย่อ

สมาร์ทโฟนเป็นโทรศัพท์มือถือที่ช่วยให้เราสามารถติดต่อสื่อสารกันได้ทุกที่ทุกเวลา เป็นอุปกรณ์ถ่ายภาพและสามารถแบ่งปันข้อมูลกันได้อย่างมีประสิทธิภาพ นอกจากนี้ สมาร์ทโฟนยังมีขนาดกะทัดรัด มีฟังก์ชันการทำงานที่หลากหลายและสามารถใช้ติดตั้งโปรแกรมที่มีประโยชน์ได้มากมาย ด้วยเหตุนี้จึงมีผู้ใช้สมาร์ทโฟนเป็นจำนวนมาก โดยใน ค.ศ. ๒๐๑๖ มีผู้ใช้สมาร์ทโฟนทั่วโลกสูงถึง ๒.๑ พันล้านคน และมีแนวโน้มเพิ่มขึ้นอย่างต่อเนื่อง (www.statista.com) สมาร์ทโฟนจึงเป็นเป้าหมายสำคัญที่ผู้ไม่หวังดีเลือกที่จะหาผลประโยชน์ด้วยวิธีการต่าง ๆ ซึ่งอาจเป็นการโจมตีด้วยมัลแวร์ การโจรกรรมข้อมูล หรือการเรียกค่าไถ่ข้อมูล ด้วยเหตุนี้ ผู้วิจัยจึงได้ทำการวิจัย โดยมีวัตถุประสงค์เพื่อ (๑) ศึกษาความสามารถ และพฤติกรรมของคนไทยในการระวังป้องกันภัยทางไซเบอร์ที่เกิดขึ้นบนสมาร์ทโฟน และ (๒) เพื่อเปรียบเทียบความแตกต่างของความสามารถ และพฤติกรรมการป้องกันภัยที่เกิดขึ้นบนสมาร์ทโฟนตามความแตกต่างด้านประชากร และพฤติกรรมการใช้สมาร์ทโฟน การวิจัยนี้เป็นการวิจัยเชิงปริมาณ (Quantitative Analysis) โดยได้นำแนวคิด Protection Motivation Theory (PMT) ของ Roger, R.W. (1983) และงานวิจัยที่เกี่ยวข้องมากำหนดเป็นตัวแปร รวมถึงได้นำมาสร้างเป็นแบบสอบถาม ผู้วิจัยได้เก็บรวบรวมข้อมูลจากผู้ใช้สมาร์ทโฟนด้วยวิธีการสุ่มตัวอย่างแบบกลุ่ม (Cluster Sampling) โดยแบ่งเก็บข้อมูลจากผู้ใช้สมาร์ทโฟนในภูมิภาคต่าง ๆ ของประเทศไทย ได้แก่ กรุงเทพฯ และปริมณฑล ภาคเหนือ ภาคตะวันออกเฉียงเหนือ ภาคตะวันออก ภาคกลาง และภาคใต้ ภูมิภาคละ ๑๒๐ คน รวมทั้งสิ้น ๗๒๐ คน

ผลการศึกษาพบว่า (๑) ระดับพฤติกรรมในการป้องกันภัยคุกคามทางโทรศัพท์มือถือของคนไทยอยู่ในระดับดี อย่างไรก็ตาม คนไทยได้รับอิทธิพลด้านข่าวสารจากสื่อหรือจากเพื่อนที่เกี่ยวกับภัยคุกคามทางโทรศัพท์ในระดับที่น้อย รวมถึงมีความสามารถในการประเมินภัยคุกคามในระดับที่น้อยเมื่อเทียบกับตัวแปรอื่น ๆ (๒) เพศหญิงมีระดับพฤติกรรมในการป้องกันภัยคุกคามทางโทรศัพท์มือถือน้อยกว่าเพศชาย (๓) ผู้ที่มีอายุระหว่าง ๕๑ – ๖๐ ปี เป็นกลุ่มที่มีระดับพฤติกรรมในการป้องกันภัยคุกคามทางโทรศัพท์มือถือน้อยกว่ากลุ่มอายุอื่น (๔) ผู้ที่เคยติดไวรัสมีระดับพฤติกรรมในการป้องกันภัยคุกคามทางโทรศัพท์มือถือมากกว่าผู้ที่ไม่เคยติด (๕) ผู้ที่นิยมใช้เครือข่ายไร้สายสาธารณะมีระดับพฤติกรรมในการป้องกันภัยคุกคามทางโทรศัพท์มือถือมากกว่าผู้ที่ไม่ใช้ และ (๖) ผู้ที่ใช้บริการโอนเงินผ่านโทรศัพท์มีระดับพฤติกรรมในการป้องกันภัยคุกคามทางโทรศัพท์มือถือมากกว่าผู้ที่ไม่ใช้

คำสำคัญ: สมาร์ทโฟน, ภัยคุกคามทางโทรศัพท์มือถือ, ทฤษฎีพฤติกรรมการป้องกัน, พฤติกรรมการป้องกัน

Introduction

Smartphones allow us to communicate anywhere and anytime. We can make high quality calls, take photos or videos, share data, and etc. with these single powerful mobile devices. Further, smartphones are portable in size, have abundant functionalities, and can host many useful applications. Presently, more and more people have adopted smartphones as an essential daily tool, however, this phenomenon has been triggering many perpetrators to focus more on attacking the smartphones. As a reason, the researchers decided to conduct this study in order to clarify the understanding of behaviors of people in protecting their smartphones from cyber threats. The study drew constructs from the PMT theory and related studies. Results of this study contribute in academic area as it proposed a model for analyzing protection behaviors of smartphone users. The findings of this study are also useful in practical area as it indicates the groups of smartphone users that are risk to cyber threats, and need to be concerned.

Objective of the Study

The main objectives of this study are as follows:

1) To investigate the overall abilities and behaviors of Thai people in protecting their smartphones from cyber threats.

2) To compare the degree of abilities and protection behaviors of Thai people based on demographic differences and their behaviors in protecting their phones from cyber threats.

Scope of the Study

This study covered smartphone users who live in Thailand, and the study had been conducted during July 2015 to December 2016.

Research Methodology

This study used qualitative technique to collect and analyze data. The questionnaire, consisted of 33 questions with 1 - 5 Likert's scale, was created by reviewing the PMT and the related studies. It was tested for its validity and reliability before using. This study used cluster sampling technique to collect data. The researcher divided into 6 regions, namely, Bangkok and metropolitan, central region, northern region, north-eastern region, eastern region, and southern region. Provinces with large number of population were selected as representatives of each region. In each province, the researcher used convenience sampling technique to gather data from densely populated areas, such as shopping centers, governmental areas, or schools. This study used descriptive statistic to describe basic nature of data, and used t-test and ANOVA to compare the differences of abilities and protection behaviors of smartphone users between demographic differences and behaviors in using smartphones.

Protection Motivation Theory

Protection Motivation Theory (PMT) is a theory for understanding the fear appeals of people. It is a mean to elevate people's motivation in taking actions against the threats by raising their fears (Roger, 1983)

PMT describes the people's adaptabilities and maldaptabilities in coping with health dangers through the process of assessments of the level of threats (Woon, Tan & Low, 2005) and of the cope responses to the threats. These activities increase the protection behaviors against the threats (Boer & Seydel, 1996).

Although, PMT was originally used in health area to study how people react when diagnosed with health related illnesses. Now, the PMT has been extended to other areas of study especially information technology. Recently, the PMT has been used by many scholars in studying the behaviors of people related to cybersecurity (Srisawang, Thongmak & Ngarmyarn, 2015).

The PMT model, as shown in Figure 1, shows relationships between variables. It can be explained that threat appraisal (ability to assess severity from threat) is positively affected by perceived threat severity and vulnerability of being target of threat, and negatively affected by rewards (positive aspects of starting or continuing the unhealthy behavior). Coping appraisal (ability to assess how one responses to threat) is positively affected by self-efficacy in avoiding threat and response effectiveness in performing a recommend successfully; and negatively affected by response cost-the costs associated with the recommended behavior. Both threat appraisal and coping appraisal increase protection motivation-intention in protecting themselves from threats.

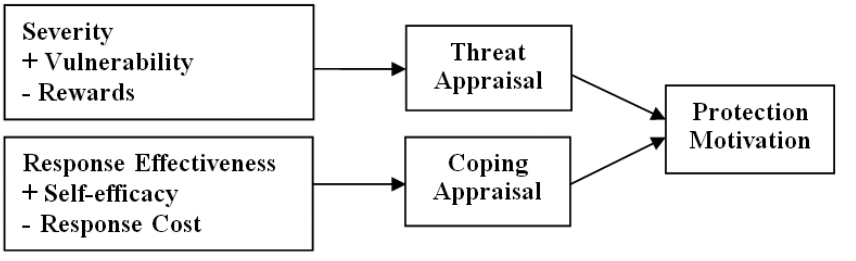

Figure 1: Cognitive Process of Protection Motivation Theory Source: Redrawn from Rogers (1983)

Related Studies

Liang & Xue studied the cyber threat and wrote a paper, entitled "Avoidance of Information Technology Threats: A Theoretical Perspective" in 2009. They proposed the Technology Threat Avoidance Theory (TTAT) which explains behaviors of IT users in avoiding cyber threats by applying two cognitive processes: threat appraisal

and coping appraisal. Their proposed model consists of three main constructs: (1) threat appraisal (with three sub-constructs: perceived susceptibility, perceived severity and perceived threat), (2) coping appraisal (with four sub-constructs: perceived effectiveness, perceived costs, self-efficacy, and perceived avoidability), and (3) coping (with three sub-constructs: avoidance motivation and avoidance behavior, and emotion-focused coping). In addition, two social environment factors were also added on, they are: risk tolerance and social influence.

Srisawang, Thongmak & Ngarmyarn wrote a paper, entitled "Factors Affecting Computer Protection Behavior," in 2015. They proposed six independent factors that affect computer crime protection behavior, consisting of (1) conscientious personality-individuals' traits of being painstaking and careful, (2) perceived value of data-individuals' perceptions on the value of data in term of monetary value and emotional value, (3) prior experience-the past experiences of individuals, (4) subjective norm individual perception on social pressures to perform or not to perform some things, (5) security knowledge individuals' knowledge of computer security, (6) and safeguard costs-costs in performing the recommended behavior. Their theoretical model was tested with 600 samples who were personal computer users in Thailand. The results show that all the factor variables have significant effects on the computer crime protection behavior.

Tu, Z.L. & Yuan, Y.F. performed a study entitled "Understanding User's Behaviors in Coping with Security Threat of Mobile Devices Loss and Theft" in 2012. It focuses on potential risks of mobile devices being loss and theft, and the countermeasures that to cope with these risks. They proposed a behavioral framework of mobile device users in coping with the risk of mobile devices loss and theft, consisting of five constructs: (1) threat appraisal (with two sub-constructs: perceived vulnerability and perceived severity), (2) coping appraisal (with four sub-constructs: locus of control, self-efficacy, perceived cost, and perceived effectiveness), (3) social influence, (4) coping intention of mobile devices loss and theft, and (5) coping behavior of loss and theft threat.

Conceptual Framework for this Study

1. Select Constructs

In selecting variables, the researcher gives precedence to variables that comply with the PMT, and also impact the appraising abilities of the smartphone users in coping with cyber threats. Table 1 shows the selected variables used in this study which consist of perceived severity, perceived vulnerability, social influence, self-efficacy, response effectiveness, threat appraisal, coping appraisal, protection motivation, and protection behavior.

Selected Constructs	Supported Scholars			
	Rogers (1983)	Liang & Xue (2009)	Srisawang, Thongmak, Ngarmyarn (2015)	Tu, Z.L. & Yuan, Y.F., (2012)
Perceived Severity/Prior (Threat) Experience	✓	✓	✓	✓
Perceived Vulnerability/Perceived Susceptibility	✓	✓		✓
Social Influence/Subjective Norm		✓	✓	✓
Response Effectiveness/Perceived Effectiveness	✓	✓		✓
Self-efficacy/Security Knowledge	✓	✓	✓	✓
Threat Appraisal/Perceived Threat	✓	✓	✓	✓
Coping Appraisal/Perceived Avoidability	✓	✓	✓	✓
Protection Motivation/Avoidance Motivation/Coping Intention	✓	✓	✓	✓
Protection Behavior/Avoidance Behavior/ Coping Behavior		✓	✓	✓

Table 1: Selected Constructs and Supported Scholars

The selected variables are defined as follow:

1) Perceived Severity: Perceived severities of consequences of threats (Boer & Seydel, 1996).

2) Perceived Vulnerability: Perceived probabilities that their smartphones may be attacked by threats (Boer & Seydel, 1996).

3) Social Influence: Perceived social pressure to perform or not perform a given behavior (Ajzen, 1991).

4) Self-efficacy: Capabilities in performing the recommended behavior successfully (Boer & Seydel, 1996).

5) Response Effectiveness: Effectiveness in avoiding the negative consequences of threats (Boer & Seydel, 1996).

6) Threat Appraisal: Assessment of level of danger posed by threats (Woon, Tan, & Low, 2005).

7) Coping Appraisal: Assessment of their abilities in coping with threats (Woon, Tan, & Low, 2005).

8) Protection Motivation: Intentions in performing the recommended behavior (Boer & Seydel, 1996).

9) Protection Behavior: Performing the recommended behavior (Boer & Seydel, 1996).

2. Determine the Relationships between Constructs

Next, the relationships between the selected constructs are determined according to the PMT and the related studies. Details are shown in Table 2.

Relationships (Positive Impact)	Supported Theory or Related Studies			
	Rogers (1983) [1]	Liang & Xue (2009) [10]	Srisawang, Thongmak, Ngarmyarn (2015) [6]	Tu, Z.L. & Yuan, Y.F., (2012) [15]
Perceived Severity → Threat Appraisal	✓	✓	✓	✓
Perceived Vulnerability → Threat Appraisal	✓	✓		✓
Social Influence → Threat Appraisal		✓	✓	
Social Influence → Coping Appraisal		✓	✓	
Response Effectiveness → Coping Appraisal	✓	✓		✓
Self-efficacy → Coping Appraisal	✓	✓	✓	✓
Threat Appraisal → Protection Motivation	✓	✓	✓	✓
Threat Appraisal → Protection Behaviour			✓	
Coping Appraisal → Protection Motivation	✓	✓	✓	✓
Coping Appraisal → Protection Behaviour			✓	
Protection Motivation → Protection Behaviour		✓	✓	✓

Table 2: Relationships between Constructs and the Supported Scholars

3. Conceptual Framework for this Study

Based on the selected constructs and their relationships found in the previous section, the researcher depicts them as a diagram the shows the constructs, their descriptions, and the relationships between them. Details are shown in Figure 2.

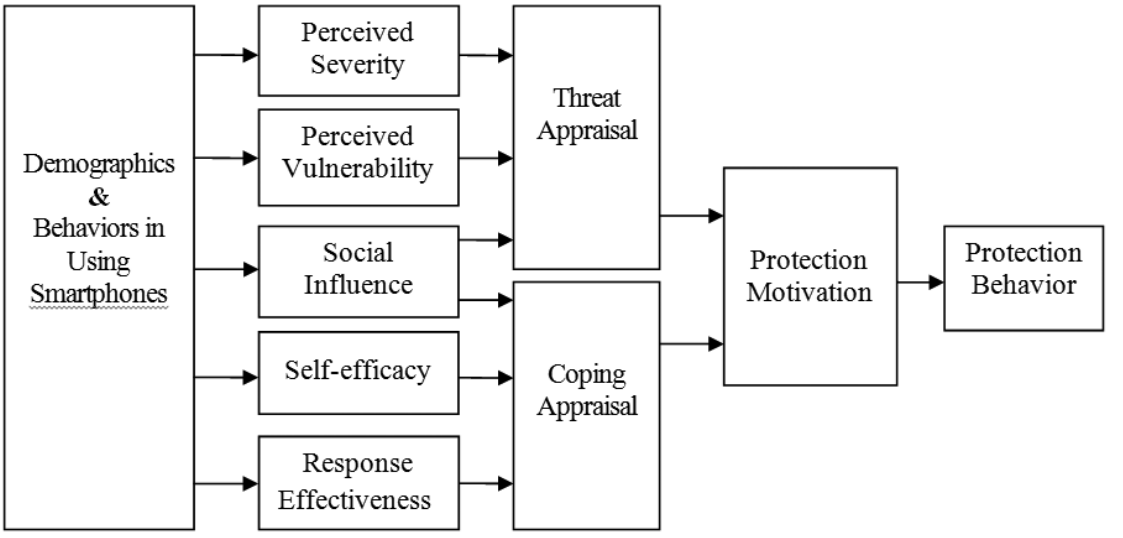

Figure 2: Conceptual Framework for this Study

Hypotheses for this Study

To meet the objectives of this study, the follow hypotheses are set up as follows:

Hypothesis 1: Males have higher degrees of abilities and behaviors in protecting their phones from threats than females.

Hypothesis 2: People with age differences have different degrees of abilities and behaviors in protecting their phones from threats.

Hypothesis 3: People whose phones used to be infected by virus/malware have higher degrees of abilities and behaviors in protecting their phones from threats than the other.

Hypothesis 4: People who use public wifi have higher degrees of abilities and behaviors in protecting their phones from threats than the other.

Hypothesis 5: People who use money transfer services via their phones have higher degrees of abilities and behaviors in protecting their phones from threats than the other.

Research Results

1. Overall Behaviors of Smartphone Users

The result shows that overall protection behavior of Thai people is 3.55. They are good in perceiving severities of threat consequences on their smartphones and in performing the recommended behavior in protecting their phones from threats (with mean values of 3.85 and 3.62 respectively). However, they have low response to social recommendation to perform or not perform given behaviors in protecting their phones from threats. In addition, they are not good in estimating of chance of contracting a threat and seriousness of a threat (with mean values of 3.34 and 3.40 respectively).

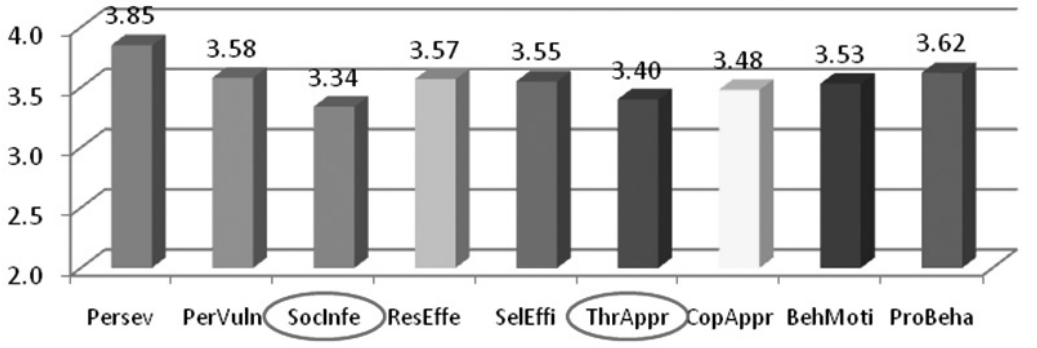

Figure 3: Behaviors in Protecting Smartphones from Threats

2. Behaviors of Smartphone Users Categorized by Gender

When compare the behaviors between male and female, the result shows that only the mean value of response effectiveness between male and female is statistically significant different (at .05 level). This indicates that male has higher capacity in avoiding the negative consequences of threats than female (mean value of male is 3.64 while female's is 3.50).

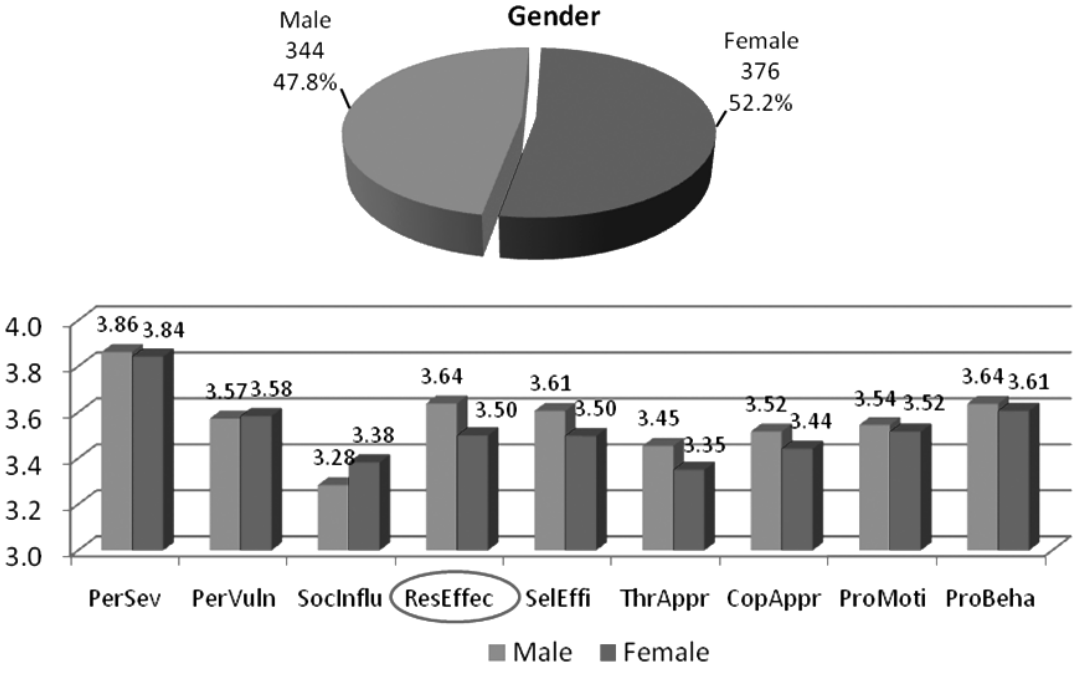

Figure 4: Behaviors of smartphone users categorized by gender

3. Behaviors of Smartphone Users Categorized by Age

When compare behaviors of smartphone users by their age ranges, the result shows that people of ages 51 – 60 have higher risk to phone threats than other groups. The bar-graph shows that they have lower response to social recommendations in protecting their phones from threats, lower capabilities in performing the recommended behavior successfully, lower capabilities in assessing their own abilities in coping with threats, and lower intentions in performing the recommended behaviors (with mean values of 3.04, 3.11, 3.16, 3.15, and 3.45, at.05 statistically significant level). Moreover, when compare to people of ages 23 - 30 and 41 – 50, people of ages 51 – 60 also have lower degree in performing the recommended behaviors.

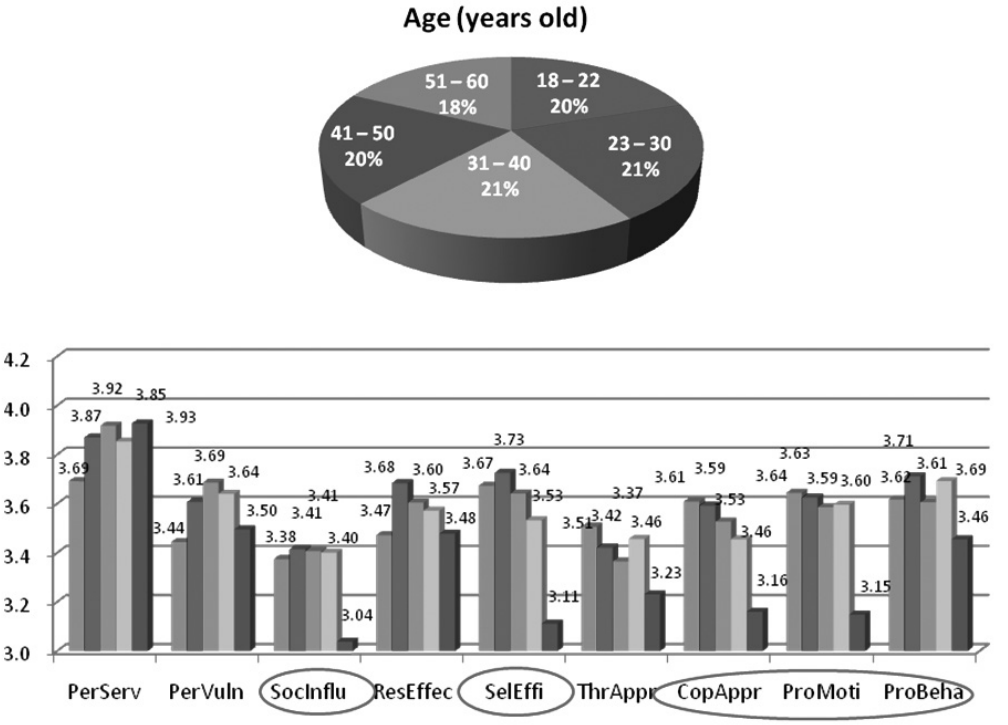

Figure 5: Behaviors of smartphone users categorized by age

4. Behaviors of Smartphone Users Categorized by Virus Infection

Virus or malware can pose a serious threat to smartphones. Pie-chart in Figure 6 shows that 31.3% of smartphone users used to have bad experience with virus/malware infection on their phones. However, this group has lower risk to phone threats than the other. The bar-graph shows that they have higher capability in perceiving probabilities that their phones may be attacked by threats, higher capability in assessing level of danger posed by threats, and has higher level of intention in performing the recommended behavior than the other (at .05 statistically significant level)

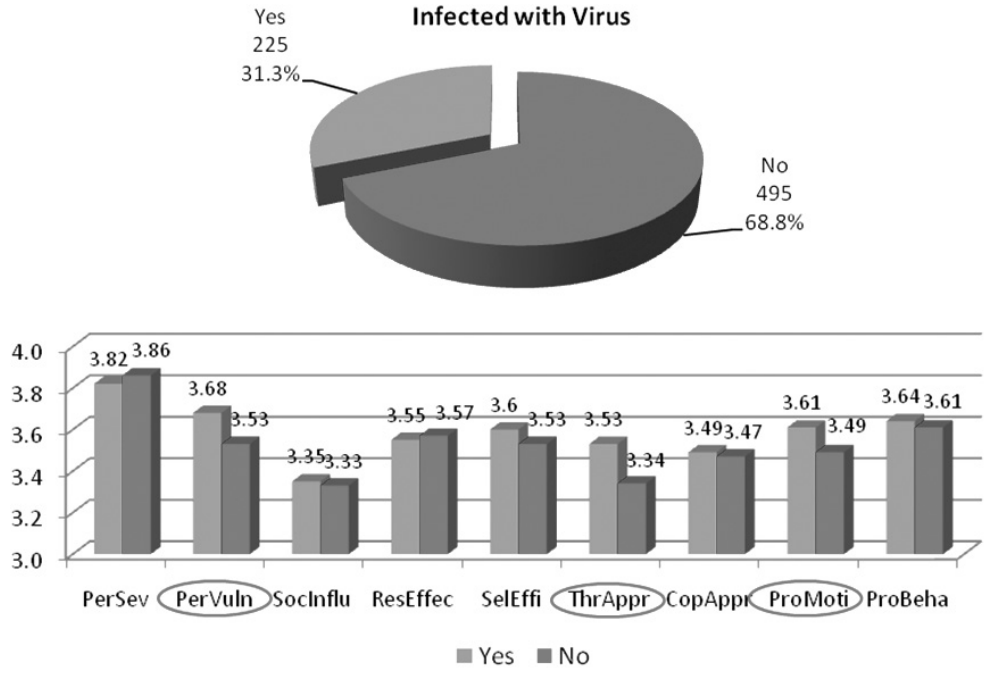

Figure 6: Behaviors of smartphone users who experienced with virus/malware

5. Behaviors of Smartphone Users Categorized by Using Public Wifi

Public wifi are free internet connection services provided by many stores such as shopping malls or restaurants. Results in Figure 7 show that 60.6% of samples prefer to connect their phones to public wifi services. In comparison with the people who do not use public wifi, results show that people who use public wifi have higher capabilities in performing the recommended behavior successfully, higher capabilities in assessing their abilities in coping with threats, higher degree of intentions in performing the recommended behavior, and higher capabilities in performing the recommended behavior than other group (at the .05 statistically significance level).

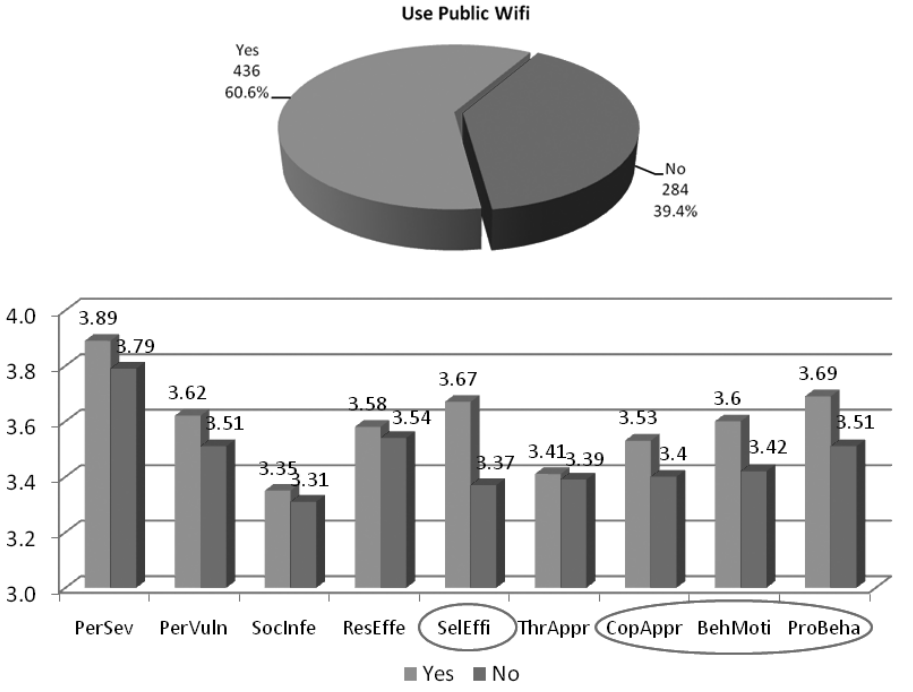

Figure 7: Perceptions and behaviors of smartphone users who use public wifi

6. Behaviors of Smartphone Users Categorized by Using Money Transfer Services

The popularity of using smartphone to transfer money is increasing as it is easy, fast, and convenient. Pie-chart in Figure 8 shows that 41.8% of smartphone users prefer transferring money through their phones. The result shows that people who use money transfer services via their phones have higher degrees in most of the protection behavioral variables than people who do not use mobile money transfer services (at .05 statistically significant level). They are good in perceiving probabilities that their smartphones may be attacked by threats, perceiving social pressure to perform or not perform a given behavior, performing the recommended behavior successfully, and avoiding the negative consequences of threats. In addition, they can assess their abilities in coping with phone threats, have high intentions in performing the recommended behavior and prefer to perform the recommended behavior to protect their phones.

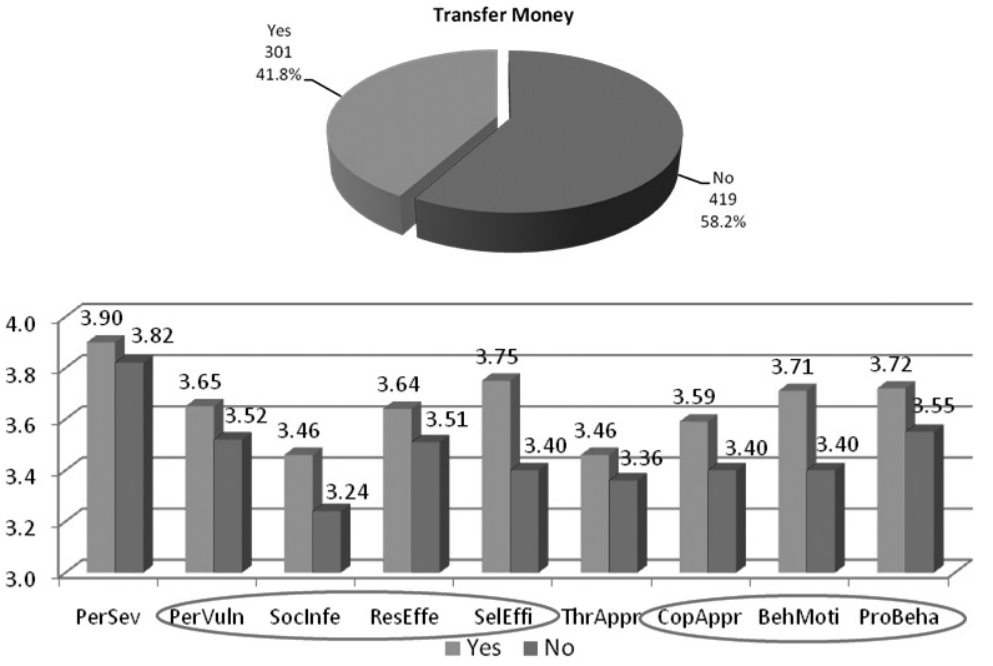

Figure 8: Behaviors of people who prefer to transfer money via smartphones

Results of Tested Hypotheses

The hypotheses of this study were tested and the results show that all hypotheses are accepted as shown in Table 3.

Tested Hypotheses	Result
Hypothesis 1: Males have higher degrees of abilities and behaviors in protecting their phones from threats than females.	Accepted
Hypothesis 2: People with age differences have different degrees of abilities and behaviors in protecting their phones from threats.	Accepted
Hypothesis 3: People whose phones used to be infected by virus/malware have higher degrees of abilities and behaviors in protecting their phones from threats than the other.	Accepted
Hypothesis 4: People who use public wifi have higher degrees of abilities and behaviors in protecting their phones from threats than the other.	Accepted
Hypothesis 5: People who use money transfer services via their phones have higher degrees of abilities and behaviors in protecting their phones from threats than the other.	Accepted

Table 3: Results of Tested Hypotheses

Conclusions and Discussions

Results of this study are summarized as follows:

1. Thai smartphone users have lower social influence and threat appraisal than other behavioral variables. Thus, they should be provided with more information to encourage smartphone users to protect their phones from threats as well as the ability to assess the level of danger posed by threats.

2. Female smartphone users have less response effectiveness than male. So, more effort should be made to increase females' abilities in responding to reactions in avoiding the negative consequences of threats.

3. Smartphone users of ages 51 – 60 have lower social influence, self-efficacy, coping appraisal, and protection motivation than other groups. It is clear that elder smartphone users are far more risk to the threats than others. So, to improve their protection motivations and behaviors, this group should be provided with more information about severity of the threats and how to cope with them, increased capabilities in performing the recommended behavior successfully, and educated them on how to assess their own abilities in coping with threats.

4. Finally, people whose smartphones used to be infected by virus/malware have higher perceived vulnerability, threat appraisal, and protection motivation than those who did not. Also, people who use public wifi have higher self-efficacy, coping appraisal, protection motivation, and protection behaviors than those who do not. In addition, people who use their phones to transfer money have higher perceived vulnerability, social influence, response effectiveness, self-efficacy, coping appraisal, protection motivation, and protection behavior than the other who do not. These results indicate that people who have experiences with virus/malware infections, who use public wifi, and who use mobile money transfer services concern more about the severities of consequence of the threats, vulnerabilities to be attacked by threats, have abilities to performed the recommended advises successfully, are opened mind to advises from peers or news, and are effectiveness in avoiding the negative consequences of threats.

Recommendation for Future Study Direction

The following statements are recommended for future study direction.

1) Based on the conceptual framework, investigate cause-effect relationships among variables to indicate the direct and indirect effects on the protection behavior variable.

2) The future study may cover users of other internet-connected devices such as desktop computers, laptop computers or tablets.

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