A Causal Relationship Model of Acceptance and Usage of Smartphone Educational Service Information System (SESIS) of Higher Education in Bangkok

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Abstract

The purposes of this research were to develop and validate a causal relationship model of acceptance and usage of smartphone educational service information system (SESIS) of higher education in Bangkok. The research model consisted of six latent variables: context, trust, personal initiative and characters, perceived usefulness, perceived ease of use, and intention to use. A sample of 382 undergraduate students in both private and government universities in Bangkok who had experiences of using SESIS participated in the study. The research instrument was a Five-point Likert scale. Data were analyzed by using SPSS Program and Mplus program version 6.12.

The findings revealed that a causal relationship model of acceptance and usage of smartphone educational service information system (SESIS) of higher education in Bangkok with regard to the hypothesis was consistent to the empirical data. Trust had a positive direct effect on intention to use. Similarly, the perceived usefulness positively direct affected intention to use. In the contrast, personal initiative and characteristic, and perceived ease of use influenced the intention to use insignificantly. However, context significantly influenced the perceived usefulness and perceived ease of use, whereas perceived ease of use insignificantly affected the perceived usefulness. Finally, this research revealed that latent variable that affected the intention to use SESIS the most was trust. Hence, trust is the most important factor to consider in understanding information system acceptance and usage behavior.

Keywords: smartphone educational service information system, intention to use, acceptance and usage of information technology, structure equation model

■ Introduction

The technology which has already proved itself in last two decades is of course the information technology (IT). It has dramatically changed the lives of the individuals and organizations. Researches from the last two decades has proved that those organizations that do invest in technology and choose the path of innovation increase their market share, financial figures and overall competitiveness. The usage of information technology was an importance factor in Management Information Systems (MIS) research for years, yet the usage and acceptance intentions of users are affected by the factors which are still questioned (Akbar, 2013; Bogart & Wichadee, 2015; Hew, Lee, Ooi, & Wei, 2015; Oye, Iahad, & Ab.Rahim, 2014; Venkatesh, Thong, &

Xu, 2012). New technology provides the opportunity to analyze specific data and plan business journey accordingly. It also provides many tools which can solve complex problems and plan the scalability of business. Furthermore, new technologies provide adoption and acceptance of these new promising technologies have become problems for both practitioners and academicians significantly. Therefore, to understand which factors contribute to users' intentions to use new mobile services is an important issue.

Why people adopt or do not adopt mobile services is the challenge to understand. Sarker and Wells (2003) referred that it is not clear to understand the motivations and circumstances. Goa, Krogstie, and

Siau (2011) found that willingness of users to adopt new mobile service can be partially determined. There are other factors such as reference prices of the services offered (Blechar, Constantiou, & Damsgaard, 2006), infrastructure, standards, and content (Barnes, 2002), individual mobility, compatibility and subjective norms (Schierz, Schilke, & Wirtz, 2010) can affect to the users' intentions. There are many researches investigate the determinants of user acceptance, but few studies integrated the acceptance of mobile services, while there are many studies on mobile services development (Conti, Militello, Sorbello, & Vitabile, 2009; Julien & Roman, 2006; Safar, Sawwan, Taha, & Al-Fadhli, 2009) and wireless networks and mobile (Durresi & Denko, 2009; You & Hara, 2010). Few studies have investigated the factors affecting the user adoption of mobile services (Gao, Krogstie, & Siau, 2011; Koç, Turan, & Okursoy, 2016; Ooi & Tan, 2016). In this context, Koç et al. (2016) offered technology acceptance models and mobile services acceptance model by integrating new theoretical constructs. The new constructs offered in their study are namely context, personal initiative and characteristics, trust, perceived usefulness, perceived ease of use, and intention to behave.

From our own experiences that the researchers have been teaching in the university for more than ten years, we found that the universities normally inform updated news in their websites and educational service information systems which were created by the universities perspective, not from students' perspective. In the worst case, less students entered to the educational service information system per a day. They accessed to it when it was necessary, not from their willingness to use. Hence, students frequently missed important information to follow the university requirements which leaded to the difficulty to manage them. According to these problems, this study was among the first to study smartphone educational service information system (SESIS) of higher education in Bangkok context. The objective of this work was to understand factors influencing the adoption of smartphone applications. In this study, a smartphone services acceptance model (Koç et al., 2016) based on

Technology Acceptance Theory was used to investigate the degree of acceptance and adoption of smartphone education service information system (SESIS) of five universities in Bangkok among the undergraduate students. Smartphone education service information system (SESIS) which is a system to facilitate students for their study registration, checking academic results, studying and teaching schedule, program curriculum information, Q & A, scholarship news, etc. The study was organized accordingly; a research background with a brief overview of technology acceptance models was presented first. Detailed information about smartphone application adoption and usage in the universities was presented next, followed by research model and hypotheses, methodology, theory testing, results, discussion, and conclusions. Educators can bring this study results to consider about which latent variables that affect the intention to use SESIS significantly. Hence, it will help them develop its SESIS better for drawing students' willingness to use SESIS more and more based on their real demands.

■ **Literature review**

Technology acceptance models and mobile services acceptance model

The Technology Acceptance Model (TAM) (Davis, 1989), and extension of Theory of Resoned Action (TRA) (Fishbein & Ajzen, 1975), is widely applied and empirically tested in MIS research. Legris, Ingham, and Collerette (2003) stated that TAM is widely used models for understandings and simplicity. It is also used to predict user acceptance of a technology consisted of three constructs: perceived usefulness (PU), perceived ease of use (PeU), and behavioral intention (BI). TAM cannot reflect the influences of technological and usage-context factors fully that many influence users' acceptance, therefore, Venkatesh and Davis (2000) proposed the Extended Technology Acceptance Model (TAM2) which includes social influence processes (Subjective norm, voluntarism, and image) and cognitive instrumental processes (job relevance, output quality, result demonstrability, and PeU). Furthermore, Venkatesh, Morris, Davis, and Davis

(2003) proposed the Unified Theory of Acceptance and Use of Technology (UTAUT) which based on the eight prominent information system adoption model including TAM. However, gathering the eight of UTAUT increased complexity.

Rogers (1995) proposed the Innovation Diffusion Theory (IDT) which is well-known theory. Taylor and Todd (1995) studied about the similarity between the constructs of TAM and IDT. Their research results showed that two constructs in IDT (relative advantage and complexity) seem to be the same as perceived usefulness and perceived ease of use in TAM, respectively. Gao et al. (2011) stated that little research has been done on applying IDT to the domain of mobile services.

The smartphone services acceptance model was used to investigate the factors influencing the adoption and the usage of smartphone education service information system (SESIS) of higher education in Bangkok for this study. This research model is based on TAM (perceived ease of use, perceived usefulness), trust, context, personal initiative, and individual characteristics. This model was originally proposed by Gao, Krogstie, and Gransaether (2008), and Koç et al. (2016) continued studied by using the model of Goa et al. (2008). They stated that they prefer to use a new model of Goa et al. (2008) for measuring mobile service acceptance rather than using traditional models, such as TAM, TAM2, and IDT. Koç et al. (2016) stated that mobile learning has been studied to a large extend; however, mobile educational services acceptance studies in developing countries are limited.

Adoption and usage of mobile services in education

The widespread use of mobile phone technologies of university students can provide opportunities for educational purposes. Irby and Strong (2015) studied about the acceptance and use of mobile information systems in education. They suggested that the technology is widely used among majority of college students who rely on the technology in various ways. The ubiquity of mobile devices allows educational pro-

fessionals to use it in a variety of instructional settings (Park, 2011) which is similar to Trebbi (2011) studied that influence of information technology on educational practices as creating a new frontier for learning, with novel roles for students and teachers. There is an interesting study from Thomton and Houser (2005) studied about students using mobile devices. In their research, they sent students messages about upcoming English lessons via the university's information system. The research results showed that students learned more from receiving e-mail via mobile devices. Furthermore, Cheon, Lee, Crooks, and Song (2012) investigated about mobile learning readiness in higher education based on the theory of planned behavior. They suggested that adoption of information system in college and university settings be quicker, compared to primary and secondary school students.

Many universities in Bangkok have been providing various smartphone based services for their students, such as Bansomdejchaopraya Rajabhat University provided E-registrar. In its main menu consists of login, course search, calendar, program information, answer question, scholar new, entry, quality, RRS news, how to do thesis, and undergraduates' summary. This study aims to outline unique attitudes and access behaviors to technology of undergraduate students in Bangkok by utilizing relatively new acceptance and usage model of smartphone educational service information system (SESIS) proposed in Fig 1.
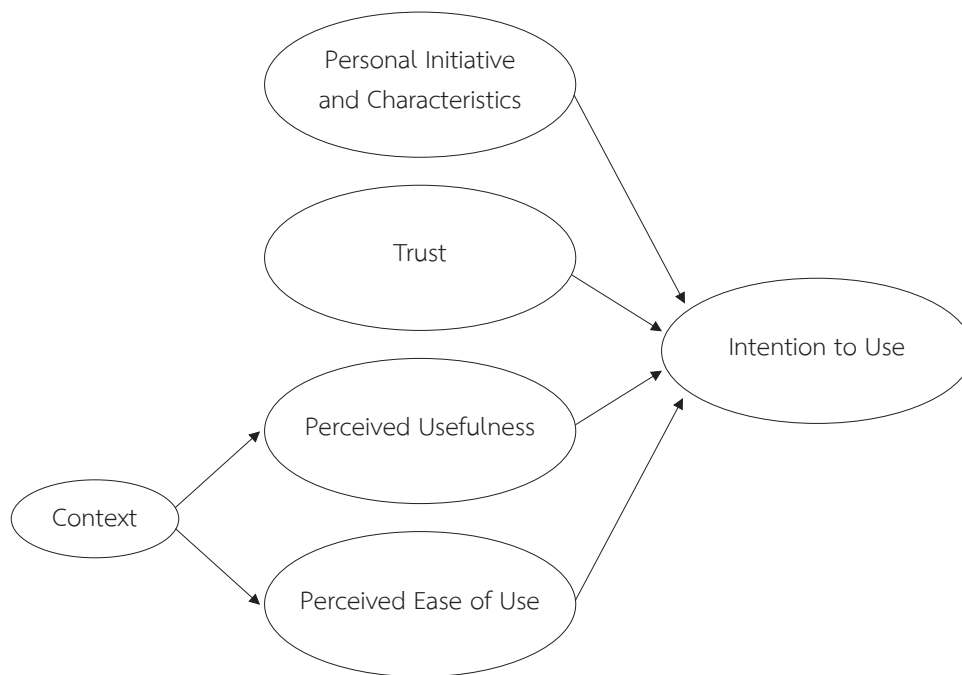
Fig 1. Acceptance and usage model of smartphone educational service information system (SESIS) adopted by Koç et al. (2016)

▬ Research model and hypotheses

The research model was adopted by Koç et al. (2016), and is showed in Fig 1. There were 6 latent variables: context, personal initiative and characteristics, trust, perceived usefulness, perceived ease of use, and intention to use. It created the "Acceptance and usage model of smartphone educational service information system (SESIS)," which the author employed as theoretical framework. The researcher wondered which factors played significant roles in acceptance and usage in this assumption model. This study discussed the constructs of the model and provided the research hypotheses below.

Context

Context can be defined as any information about the situation of an entity which is a person, place, or object. Entity is relevant to the interaction between a user and an application (Dey, 2001). The study of Mallat, Rossi, Tuunainen, and Öömi (2009) found that the use context is an important factor affecting user acceptance of mobile systems. The user can choose whether the mobile applications are easy or useful

to use based on the context information. Greenberg (2001) studied about context as a dynamic construct and found that determining individuals' actions based on a specific context may be very difficult. Therefore, context concerns the good design of interfaces, and it can be determined a particular system's success. Koç et al. (2016) found that context positively affected to perceived ease of use, and perceived usefulness significantly. Furthermore, in their research results they found that context affected to perceived ease of use more than perceived usefulness. Hence, this study proposed a positive relationship with the major TAM construct and let analysis reveal the directions of the relationship. This leads to the following hypotheses:

H1. Context has a positive and direct effect on perceived usefulness.

H2. Context has a positive and direct effect on perceived ease of use.

Trust

Trust refers to a psychological expectation that others will be sincere in keeping promises and will not

behave opportunistically in expectation of a promised service from mobile transactions (Ooi & Tan, 2016). Trust is defined as the belief in a person's competence to perform a specific task or expectancy that the promise of an individual can be relied upon (Morgan & Hunt, 1994). Furthermore, trust can be defined as a willingness to depend on exchange partner (Kim, Ferrin, & Rao, 2008). Researchers directly addressed the impact of trust on internet commerce (Blank & Dutton, 2012; Lee & Song, 2013; Ooi & Tan, 2016; Wang, Lin, & Luarn, 2006; Wei, Marthandan, Chong, Ooi, & Arumugam, 2009), and Zhang, Zhu, & Liu (2012) found that trust cannot be ignored in investigating mobile service adoption. According to Yang and Lin (2014), it is more difficult for a retailer and consumer to build online trust compared to an offline trust. This is caused by the absent of any face-to-face interactions between both parties during any online transactions. Furthermore, Koç et al. (2016) found that trust positively directly affected to intention to use. This leads to Hypothesis 4.

H4. Trust positively influences intention to use.

Personal initiative and characteristics

Personal initiative is users' willingness to try out new applications and personal characteristics that are individuals' opinions of their perceived capabilities to use the new systems (Gao et al., 2008). Goa, Ganapathy, Gopalakrishnan, and Gopalakrishnan (2012) stated that personal initiative and characteristics vary from person to person depending on their educational background, age, gender, interest to learn, and openness to experience new things. Goa et al. (2008) found that personal initiative and characteristics positively directly affected to intention to behave. However, Koç et al. (2016) did not find personal initiative and characteristics positively directly affected to intention to use. In this research, personal initiative and characteristics are may assumed to directly affect intention to use in Bangkok context. This leads to Hypothesis 5.

H5. Personal initiative and characteristics have a positive effect on intention to use.

Perceived usefulness

Davis (1989) referred that perceived usefulness is relevant to job-related productivity, performance, and effectiveness. Researchers found this construct in e-service context such as mobile payment service (Chandra, Srivastava, & Theng, 2010), e-commerce (Gefen, Karahanna, & Straub, 2003; Pavlou, 2003), health information system (Mou & Cohen, 2014), online banking (Bhattacherjee, 2001). By adding this study model into the TAM, it is assumed that perceived usefulness directly affects to behavioral intention (Goa et al., 2008; Hadji & Degoulet, 2016; Koç et al., 2016; Ooi & Tan, 2016). This leads to Hypothesis 6.

H6. Perceived usefulness positively affects intention to use.

Perceived ease of use

Perceived ease of use (PeU) has the same meanings as ease of use and complexity of using a particular IT/IS (Venkatesh et al., 2003). PeU is the most influential determinant of software acceptance (Chau, 1996). PeU is dominant factor explaining perceived usefulness as well as system use (Igbaria, Zinatelli, Cragg, & Cavaye (1997). Marchewka and Liu (2007) stated that the use of new technology becomes easy, which has a positive effect on PeU of the technology. Dutot (2015) stated that when customers start to adopt a new system, they tend to stress on the possibility of learning success and in this case directly affect their intention to use a particular technology. Koç et al. (2016) found that perceived ease of use influences perceived usefulness, but it insignificantly affects behavioral intention. Furthermore, Perceived ease of use was revealed to affect the customer intention to use to adopt contactless m-payment and m-payment in Malaysia (Teo, Tan, Ooi, Hew, & Yew., 2015; Teo, Tan, Ooi, & Lin, 2015) This leads to Hypotheses 3 and 7.

H3. Perceived ease of use positively affects perceived usefulness.

H7. Perceived ease of use positively influences intention to use.

Intention to use

Behavioral intention refers to personal willingness or likelihood of someone to engage a particular behavior (Fishbein & Ajzen, 1975). Behavioral intention is the predictor of behavior. Behavioral intention is based on personal initiative and characteristics, trust, perceived usefulness, and perceived ease of use (Goa et al., 2008). Koç et al. (2016) found that behavioral intention was positively directly affected by personal initiative and characteristics, trust, perceived usefulness, and perceived ease of use.

◼ Research Methodology

Sampling method and data collection

A pilot test was conducted on a convenience sample of 30 university students to clarify the wording and to improve understanding of the question. Multiple stage stratified random sampling were used, with 400 printed questionnaires distributed in three private and two government universities in June, 2016. The questionnaires were administered using a direct face to face survey method because of the relatively high response rate of this method (Lee & Song, 2013). 382 completed and usable questionnaires were collected. For multivariable study, Hair, Black, Babin, and Anderson (2010, p. 102) stated that the proportion between samples and observed variables should be at least 5:1, more acceptable ratio is 10:1. There were 33 observed variables for this study, therefore, the sample size should be 330, but this study was considered for 400 samples for unusable questionnaires.

Measurements

The survey instrument consists of three parts. The same questions were used in each survey. There were two questions ("Do you have smartphone?" and "Did you have experience of using smartphone for enrollment, grade result checking, and etc.?") in the first part to screen samples. When a respondent answered "No" in one of each, he/she returned the questionnaire. In the contrast, a respondent continued answering all questions if he/she answered "Yes" for two questions. The second part of the questionnaire

in Table 2 contained questions about demographic variables, such as gender, study year, and some usage characteristics of the SESIS. The third part of the questionnaire, this study adopted items from Koç et al. (2016)'s study (instrument survey: an education management information system (SABIS-Sakarya University Information System)) to measure perceived usefulness (PU) perceived ease of use (PeU0 trust (T) personal initiative and characteristics (PIC) context © and intention to use (IU). There were 6 latent variables and 33 questions in part three. All the items used in this study were measured using 5-point Likert-type scales ranging from strongly disagree=1 to strongly agree=5.

Data analysis

The statistical package for social sciences (SPSS) was employed for descriptive and inferential analyses to provide respondents' profiles and the Cronbach's Alpha reliability scores. First, pretest was conducted to ensure the reliability of measurement scale using data collected from 30 university students. The Cronbach's alpha scores for the latent variables in Table 1 varied from 0.714 to 0.818, all of the scores exceeded the benchmark of 0.7 (Nunnally and Bernstein, 1994), suggesting a good level of internal consistency of the factor analysis (Hair, Anderson, Tatham, and Black, 2002). A confirmatory Factor Analysis (CFA) was performed to empirically evaluate the construct validity of the developed components model. After CFA, proposed hypotheses were tested utilizing a structural equation modeling (SEM) approach. The Mplus 6.12 computer program was used to test the proposed hypotheses.

Table 1 Characteristics of respondents

Characteristics	N	(%)
Gender		
Male	178	46.6
Female	204	53.4
Study Year		
1st	88	23.0
2nd	97	25.4
3rd	105	27.5
4th	92	24.1
How many years do you use a smartphone?		
≤ 1 year	5	1.3
2-3 years	47	12.3
4-5 years	145	38.0
> 5 years	185	48.4
How much do you connect to the internet (daily) in your smartphone?		
≤ 1 hour	68	17.8
2-4 hours	201	52.6
5-7 hours	87	22.8
> 7 hours	26	6.8
How often do you use your smartphone per a week for Education Service Information System (ESIS) which a system to facilitate you for your study registration, checking academic results, studying and teaching schedule, program curriculum information, Q & A, scholarship news, etc.?		
1 day	46	12.0
2-3 days	235	61.5
4-5 days	87	22.8
6-7 days	14	3.7

Table 2 Validity of the survey instrument

Evaluation construct (number of items)	Cronbach's α
Context (7)	0.798
Perceived Ease of Use (5)	0.774
Perceived Usefulness (5)	0.818
Trust (7)	0.812
Personal Initiative and Characteristics (7)	0.810
Intention to behave (2)	0.714

■ **Results**

Table 3 Path co-efficient and t-values for structural model

| Hypotheses	Causality	Path coefficients	t-values
H1	Context has a positive direct effect on the perceived usefulness.	.73	13.59
H2	Context has a positive direct effect on perceived ease of use.	.49	6.54
H3	Perceived ease of use has a positive direct effect on the perceived usefulness.	.07	1.09[a]
H4	Trust has a positive direct effect on the intention to use.	.68	8.52
H5	Personal initiative and characteristics have a positive direct effect on the intention to use.	.04	0.59[a]
H6	Perceived usefulness has a positive direct effect on the intention to use.	.35	5.29
H7	Perceived ease of use has a positive direct effect on the intention to use.	.02	0.42[a]

[a] Hypothesis was not supported.
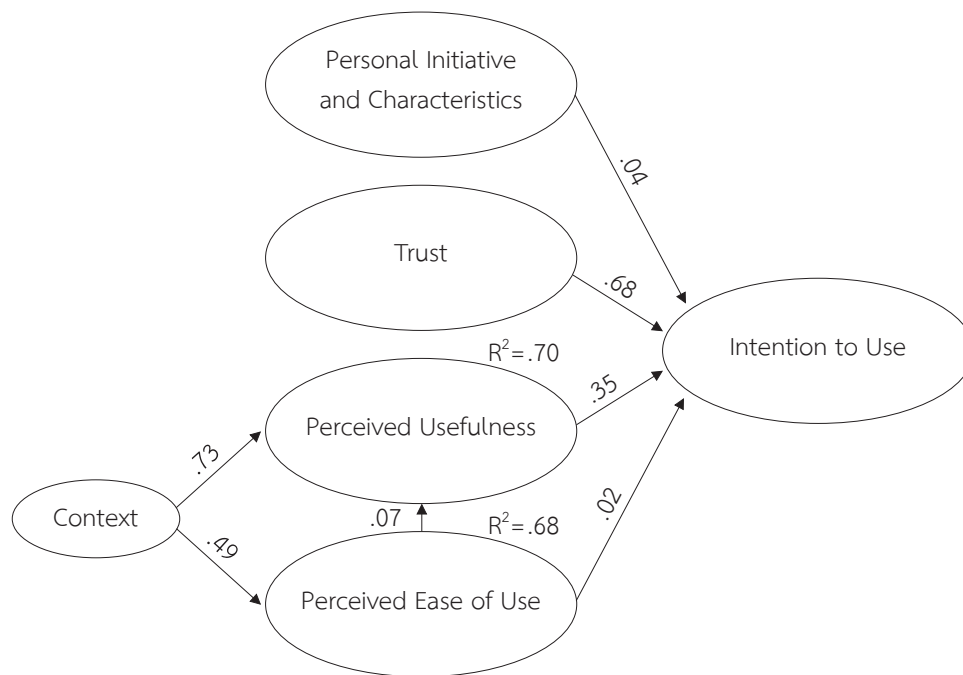
Fig 2. Mobile Services Acceptance Model (Koç et al., 2016)

Delineating the goodness-of-fit is an important step of any SEM approach. For models with good fit, it is suggested that the chi-square normalized by degrees of freedom (X^2/df) should not exceed 3; P-Value (p-value) should exceed .05; Comparative Fit Index (CFI) should exceed 0.95; Tuker-Lewis Index (TLI) should not exceed 0.95 the standardized root mean-square residual (SRMR) should not exceed .05; and the root mean square error of approximation (RMSEA) should not exceed .07 (Chin and Todd, 1995; Gefen, Straub and Boudreau, 2000; Hair et al., 2010; Kline, 2011). This research results are in agreement with these recommendation. X^2/df was 2.47 (X^2=259.75; df=105), p-value was .07; CFI was 0.97, TLI was 0.96, SRMR was 0.49, and RMSEA was 0.50.

The data provided support for the hypotheses to a large extent. Trust had a positive direct effect on intention to behave with a standardized path coefficient of 0.68. This provided support for Hypothesis H4. Similarly, the perceived usefulness positively direct affected intention to behave with a standardized path coefficient of 0.35. This provided support for Hypothesis H6. In the contrast, Hypotheses H3 and H7 were rejected because personal initiative and characteristic, and perceived ease of use influenced the intention to behave insignificantly with a standardized path coefficient of 0.4 and 0.2, respectively. However, context significantly influenced to the perceived usefulness and perceived ease of use with a standardized path coefficient of 0.73 and 0.49, respectively. This confirmed support for Hypotheses H1 and H2, while Hypothesis H3 was rejected due to insignificant influence relationship with a standardized path coefficient of 0.7. Additionally, when considering the influence of latent variables in the Mobile Services Acceptance Model of Fig 1 found that latent variable that affected the intention to behave the most was trust. The results are presented in Table 6.

■ **Discussion**

The research revealed that trust had the most positive and direct effect on student intention to use the SESIS which associated with the previous research results (Koç et al., 2016; Ooi & Tan, 2016). Hence, it is the most important factor to consider in understanding information system acceptance and usage behavior such as the university should have a clear conception of the functionality of the system (ß=0.86), and it is

widely acknowledge (ß=0.61). Researchers directly addressed the impact of trust on internet commerce (Blank & Dutton, 2012; Lee & Song, 2013; Ooi & Tan, 2016; Wang et al., 2006; Wei et al., 2009). Yang and Lin (2014) stated that it is more difficult for a retailer and consumer to build online trust compared to an offline trust because of the absent of any face-to-face interactions between both parties during any online transactions. Hence, trust cannot be ignored in investigating mobile service adoption (Zhang et al., 2012).

Surprisingly, the perceived usefulness significantly influenced intention to use which was associated with the study of Goa et al. (2008), Hadji and Degoulet (2016), and Ooi and Tan (2016), whereas the study of Koç et al. (2016) was not supported. It indicated that Thai undergraduate students concerned on the SESIS which should be able to increase the efficiency of their daily study (ß=0.84), to allow them to better schedule their time (ß=0.81), and to make it easier to keep track of their weekly tasks (ß=0.71).

To enhance the SESIS, the university should understand and develop its context (e.g. to use the system in smartphone easy as in desktop computer or laptop (ß=0.82), to be meaningful/relevant to student daily tasks (ß=0.63)) which in this research results were shown that it had a positive and direct effect on the students perceived usefulness and perceived ease of use. As the study of Mallat et al. (2009) found that the use context is an important factor affecting user acceptance of mobile systems. The user can choose whether the mobile applications are easy or useful to use based on the context information.

Student intentions to use the SESIS was not influenced by personal initiative and characteristics, and perceived ease of use in this research results. However, Goa et al. (2008) found that personal initiative and characteristics positively directly affected to intention to behave. Hence, further research should be investigated in different context of samples to find out more whether personal initiative and characteristics, and perceived ease of use influence student intentions to use the SESIS or not as Goa et al. (2012) stated that personal initiative and characteristics vary from person

to person depending on their educational background, age, gender, interest to learn, and openness to experience new things. Additionally, The perceive ease of use had an insignificant direct effect on student intentions to use the SESIS which was associated with the study of Koç et al. (2016) and Ooi and Tan (2016).

As theses reseach results showed that students did not see the importance of personal initiative and characteristics for their intention to use SESIS. Reasons might be students had no expectation to use SESIS for being different from others such as: 1) to be the first one to use SESIS; 2) to be advantages of using SESIS over who do not; and 3) to find it rewarding to use SESIS. Furthermore, the perceive ease of use students did not see SESIS importance. The reason was students preferred to see the university develop SESIS as the useful system. Usefulness is relevant to job-related productivity, performance, and effectiveness. Therefore, the SESIS developers at the university should add more benefits or usefulness of using SESIS to sovle student daily problems such as SESIS should increase the efficiency of student daily study, allow them to find rooms and buildings at the university, make it easier to keep track of their weekly tasks, and allow them to better schedule the time. Additionally, Context presented highly the significance between the context and perceived usefulness. To consider each item of the context variable, we found that students appreciated it as similar way with the perceived usefulness of SESIS. For example, students will use SESIS wherever they are and they will use SESIS if it is meaningful to their daily tasks.

▄ Conclusion

A causal relationship model of acceptance and usage of smartphone educational service information system (SESIS) of higher education in Bangkok with regard to the hypothesis was consistent to the empirical data. Trust had a positive direct effect on intention to use. Similarly, the perceived usefulness positively direct affected intention to use. In the contrast, personal initiative and characteristic, and perceived ease of use influenced the intention to use insignificantly. However,

context significantly influenced the perceived useful-ness and perceived ease of use, whereas perceived ease of use insignificantly affected the perceived usefulness. Finally, this research revealed that latent variable that affected the intention to use SESIS the most was trust. Hence, trust is the most important factor to consider in understanding information system acceptance and usage behavior.

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