The Role of Privacy, Security and Trust in User Acceptance of Smartphone User in Indonesia

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***Abstract*— Smartphone is one of the technological evolutions that become one of the important things for Indonesian nowadays. By using the Smartphone, variety of work can be done easily, faster and certainly more practical. There are many benefits to be gained from the use of Smartphone, such as e-banking, online shopping, etc. On the contrary, Smartphone usage will lead to negative impact for its users, such as data theft and data misuse. This study aims to identify factors that affect the use of Smartphone by using eight variables constructs, which are Perceive Usefulness, Perceive Ease of Use, Functionality, Perceive Trust, Perceive Privacy, Perceive Security, Social Network and Behavioral Intention. Data were collected by distributing web-based questionnaires to 248 respondents. Structural Equation Modeling (SEM) is used as data analysis method. The result of this study indicates that the factors which have positive affect toward behavioral intention to use Smartphone that will affect the variable actual use of Smartphone are Perceive Usefulness, Perceive Ease of Use, Perceive Trust.**

Keywords*— Smartphone, SEM, Trust, Security, Privacy, User Behaviour.

I. INTRODUCTION

The population of Indonesia in 2015 has reached of more than 250 million. With this large population, Indonesia is a huge market for Smartphones. A Digital Marketing Emarketer Research Institute also estimates that in 2018, Smartphone users in Indonesia will reach of more than 100 million. With this number, Indonesia will be one of country which has the largest Smartphone users in the world after China, India and the United States [22]. Nowadawys, Smartphones become one of important things for Indonesian to perform variety of work, from performing transactions on the financial affairs through mobile banking applications, conducting discussions with existing social media (LINE, WhatsUp, BlackBerry Messanger) to online shopping.

Apart from many benefit that can be obtained from the use of smartphones, there are also negative impact for its users as already shown in several articles in online media i.e. the existence of security issues on smartphone that cause loss or stolen personal data of user. The loss of this personal data due to hacking or it could be because smartphones are attacked by malware. Smartphone vendors already provide security system to avoid the problem, but this security system also still has a weakness. This is certainly very worrying, because personal data stored on the user's Smartphone could be misused.

Another security and privacy issues is GPS tracking feature on Smartphones. Today many people are using social networking application that can identify user's location, e.g. Instagram, Line, Facebook apps and others. This feature could make friends and even strangers on social networks determine user's location [7]. Therefore, it could endanger their privacy and security on Smartphone. Privacy and security of the Smartphone will also affect user's trust on Smartphone. According to some previous studies, trust is one of the most important factors that affect user intention to use a technology or information systems [7].

Besides security, privacy and trust, there are some other important factors that influence user's intention to use smartphone. According to TAM, users evaluate a technology based on its ease of use and benefits [7]. Another factor is functionality and also the influence of social. With the availability of functionality on Smartphone, users will find that Smartphone is useful. In addition, social groups in the user's environment will also affect their intention to use a Smartphone. According to Social Influence Theory, users will be buying and using a Smartphone that are popular among their social circle [7].

This study was adapted from several previous studies. The first one is a study entitled "The Smartphone Technology Acceptance Among Malaysian Young Adults" by Halim Mad Lazim and Sasitharan [15] using TAM with 3 variables construct which are Perceive Usefulness, Perceive Ease of Use, and Behavioral Intention to investigate the influence of perceive usefulness towards acceptance of Smartphone technology among Malaysian young adults. Equipped with research conducted by Dalsang Chung & Sun Gi Chun [7], three variabels are added which are Functionality, Social influence,Security/Privacy. In addition, Perceive Trust is added and adapted from research carried out by Mohammed A. Al-Sharafi et al. [1] to measure the level of user's trust towards the security and privacy on Smartphone.

A. *Technology Acceptance Model (TAM) and Diffusion Of Innovation (DOI)*

Technology Acceptance Model (TAM) and Diffusion Of Innovation (DOI) is a theoretical framework that has proven to determine acceptance and intentions associated with information technology. Dalsung Shung and Sun Gi Chun [7] use TAM and DOI to determine factors that influence individual to choose and use a specific Smartphone. This developed model used in their research entitled "An Exploratory Study On Determining Factors For The Smartphone Selection Decision". Dalsung Shung and Sun Gi Chun [7] added two variables that do not exist in the TAM and DOI which are variable Social Network (SN) and Security/Privacy (SP).

B. *Technology Acceptance Model (TAM), Security, Privacy and Trust*

Mohammed A. Al-Sharafi et al. [1], using TAM and combine it with Perceive Security, Perceive Privacy, and Perceive Trust to examine Jordanian customer's trust to accept Internet banking services. This model is used for research entitled "The Effect of Security and Privacy Perceptions on Customers' Trust to Accept Internet Banking Services: An Extension of TAM". Basic constructs of TAM were used in this study which are Perceive Usefulness and Perceive Ease of Use as the key determinant that influence user's perception to accept new technology.

II. MODEL STRUCTURE AND HYPOTHESIS

This research used quantitative confirmatory study to test the proposed research model and hypothesis adapted from Halim Mad Lazim [15]; Dalsang Chung [7] and Mohammed A. Al-Sharafi, [1]. Data analysis methods used in this study is Structural Equation Modeling (SEM). SEM analysis process is performed through two phases, first phase is testing the measurement model using CFA and second phase is structural testing model using path analysis. Measurement model test is used to measure relationship between latent variables and manifest variables or indicators whereas structural model test is used to examine relationship between latent variables.

A. *Definition of each construct*

The proposed research model consists of 8 latent variables and actual use of Smartphones variable as well as 30 manifest variables or indicators. The following is an explanation of each construct and indicators of the proposed research model.

Perceive Usefulness (PU)
Perceive Usefulness is defined as the degree of individual believes that using Smartphone technology will improve their job performance [9].

Perceive Easy of Use (PEOU)
Perceive Ease of Use is defined as the degree of individual believes that using Smartphone technology does not require effort [7].

Behavioral Intention (BI)
Behavioral Intention is defined as a desire or intention to use an information technology that will affect the decision to use a particular technology [9].

Functionality
Functionality is functions or features provided by the Smartphone. In this variable consists of 3 constructs which are Perceive Application Update (PAU), Perceive Available Application (PAA), and Willingness to update OS (POS) [7].

Perceive Trust (PT)
Trust has been found to be crucial for user intention towards Smartphone [17]. This is due to Smartphone associated with a virtual world, there will be uncertainty as a result of actions carried out by using a Smartphone.

Perceive Privacy
Perceive Privacy is defined as user's concern about the loss of personal information [10]. Personal information i.e phone's contact list, photos, audio, email address, user's current location and others. Users often unknowingly install an application and agree to share their privacy into applications installed.

Perceive Security
Security is one of the factors in selecting of using particular smartphone because personal data such as phone contacts, photos, passwords are stored on the smartphone [7]. Perceive security defines the level of user concern for security that ensures confidentiality of personal information.

Social Network (SN)
Social Network (SN) is defined as the degree of influence of social groups in the environment around user toward selecting and use a specific smartphone. According to Infuence Social Network Theory (ISNT), in terms of the use of smartphone users will select smartphone that is popular among theier social group [7].

B. *Hypothesis in the proposed research model*

Halim Mad Lazim and Sasitharan [14] explained that Perceive Ease of Use (PEOU) improve the effectiveness of users in completing their work, which is affecting the increasing of Perceive Usefulness. Availability of applications is a critical factors that is influenced Perceive Usefulness of users when using Smartphone as stated by Dalsung Shung & Sun Gi Chun, [7]. Therefore, we hypothesize:

H1: "Perceived ease of use" will have a positive effect on "perceived usefulness".
H2:"Smartphone Functionality (PAU,PAA,POS)" will have a positive effect on "Perceive Usefulness (PU)".

According to research conducted by Mohammed A. Al-Sharafi et al. [7], Perceive Security, Privacy and Perceive

Usefulness is an important factor that would have positive effect toward Perceive Trust. Therefore, we hypothesize:

H3: "Usefulness (PU)" will have a positive effect on "Perceive Trust".
H4: "Perceive Privacy (PP)" will have a positive effect on "Perceive Trust".
H5: "Perceive Security (PS)" will have a positive effect on "Perceive Trust".

According to research conducted by Dalsung Shung and Sun Gi Chun [7], Perceive Security is important factor that influence behavioral intention. In addition, Mohammed A. Al-Sharafi et al. [1] explained that Trust is one of the important factors that affect user's intention to using technology or information systems. Therefore, we hypothesize:

H6: "Perceive Trust" will have a positive effect on "Behavioral Intention".
H7: "Perceive Security (PS)" will have a positive effect on "Behavioral Intention".

Dalsung Shung and Sun Gi Chun [7] explained that Social Network would have positive effect towards user intention to use Smartphones, whereas it will reduce along with increasing user experince. Availability of applications is a critical factors that is influence user intention to use smartphones [7]. Therefore, we hypothesize:

H8: "Social Network/Social Peers" will have a positive effect on "Behavioral Intention".
H9: "Smartphone Functionality (PAU,PAA,POS)" will have a positive effect on "Behavioral Intention".

According to TAM, users evaluate a technology based on ease of use and the benefits. From research conducted by Halim Mad Lazim and Sasitharan [14], Dalsung Shung and Sun Gi Chun [7], Perceive Usefulness and Perceive Security would have positive effect toward intention to use a Smartphone. Therefore, we hypothesize:

H10: "Perceived usefulness" will have a positive effect on "Behavioral Intention".
H11: "Perceived ease of use" will have a positive effect on "Behavioral Intention".
H12: "Perceive Privacy (PP)" will have a positive effect on "Behavioral Intention".

C. Proposed Research model

Based on hypothesis that has been made, the research model is described and shown in Fig 1.

III. DATA ANALYSIS

The research data are gathered by distributing web-based questionnaires to Respondents. Respondents of this research are Smartphone users ranging from 15 to 35 years old. Based on SEM method, the size of sample needed in this research is at minimum 200 respondents [14].

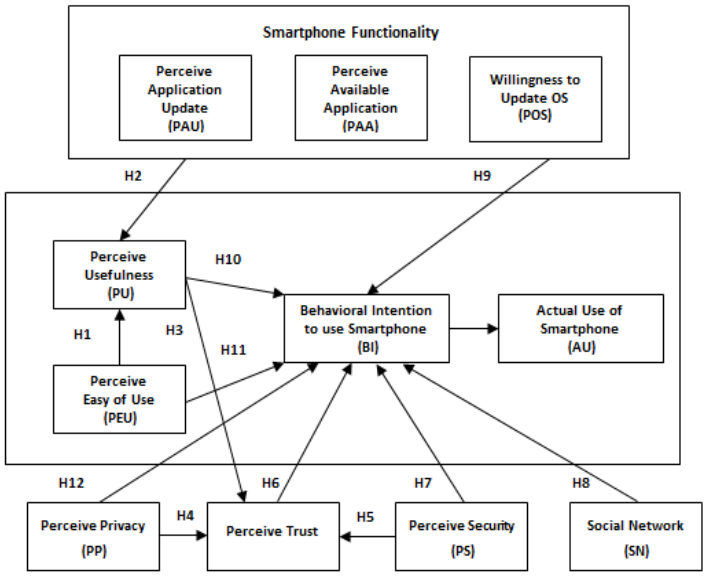

Fig. 1. Proposed Research Model

A. Basic data analysis

Questionnaires were distributed to smartphone users. Total number of distributed questionnaires are 248. The distribution of questionnaires conducted over three weeks in November 2016, and 98.02% of the questionnaires were returned. There are 5 questionnaires that have been answered invalid due to incomplete data. Some basic data analysis which are explained below.

1. *Missing data*
   This missing data analysis is used to find incomplete data research. Analysis of missing data in this study used Little's MCAR test (Missing Completely at Random). From this analysis we know that there are no missing data.
2. *Outlier*
   Outlier data is data that deviate too far from the other data in a single data set. Outlier data will cause analysis of the data does not reflect the actual phenomenon. Identification of outlier data conducted by determining mahalanobis distance value, which in this reseacrh is 50.89218131. If the value of mahalonobis distance is greater than 50.89218131 then data is outlier and should be eliminated. From 253 questionnaires, we found 13 outliers data. So the number of data that can be used for further analysis in the next process is 235.

*B. KMO (*Kaiser Meyer Olkin)

KMO is used to measure whether the research data that obtained is appropriate for the nest step. KMO will measure sampling adequacy for each variables in the research model. If the result velue of KMO test was 0.80 to 1, then the sampling adequacy is good and research data can be analyzed at the next process [4]. KMO test result shown that value of sampling adequacy is 0.821. So, we can conclude that sampling adequacy is good and this sample is feasible for the next process.

C. *Reability*

Reliability test would show that the instrument used as a data collection tool can be trusted because the instrument is reliable. Cronbach's Alpha is used as parameter in this reability test. Cronbach's Alpha below 0.5 is not good, Cronbach's Alpha less than 0.7 is acceptable, and Cronbach's Alpha above 0.8 is good [27]. Two variables which are Social Network (SN) and Perceive Security have Cronbach's Alpha of less than 0.6, therefore we conduct modification to increase thier Cronbach's Alpha. Modifications are done by removing three indicators of latent variables (SN and PS).

D. *Normality test*

Normality test aims to determine whether each variable distributed normally or not. If data distribution is not normal then it can be affecting the estimation process or the interpretation of the results in the SEM analysis[14]. Test for normality in this study used skewness and kurtosis. Normality can be seen from skewness statistic and kurtosis statistics. The criteria for skewness statistic is ± 1,5 and for kurtosis statistic ± 1,5 [29]. From normality test we can conclude that our data is distributed normally.

E. *Structural Equation Modeling (SEM)*

Data analysis in this study is using Structural Equation Modeling (SEM). SEM is used to analyze collected data through questionnaires. This study aimed to confirm previous study, so we conducted Goodness of Fit test. According to Hair, et al. [26] Goodness of Fit test is to evaluate the degree of fit between data and model in several stages.

a) *Overall Model Fit*

To test if the proposed model fit to the data, we conducted overall model fit. Confirmatory Factor Analysis (CFA) used to test this overall model fit. Goodness of fit indicies values presented in Table 1.

TABEL 1. GOODNESS OF FIT INDICIES VALUE

Fit index	Recommended value	Value	Reference
Chi-square	>0,05	269,558	Bryne (2001) [2], Hair *at al.* (2006)[14]
CMIN/DF	(1,0<CMIN/DF<3,0)	1,498	
GFI	>0,9	0,909	
RMSEA	(<0,05 *good fit*; <0,08 *acceptable fit*)	0,045	
NFI	>0,9	0,900	
CFI	>0,9	0,964	
AGFI	>0,8	0,872	Ershi Qi et al. (2013)[28]

b) *Measurement model fit*

Measurement model fit is used to test relationship between latent variables and manifest variables. Measurement model fit is performed with CFA as an analysis tools to determine whether manifest variables that exist are able to explain latent variables [24]. From measurement model fit testing we knew that all of manifest variable have significanct relationship with their latent variable. So, we can conclude that all of manfest variabel which exist are able to explain latent variables.

c) *Structural model fit*

To perform structural model testing, path analysis is used. Path analysis is performed to determine the relationship between latent variables in the model. This test was conducted to test hypothesis of the proposed model. The hypothesis is supported if the relationship between latent variables is significant. Structural models fit and hypothesis testing results are shown in Table 2.

TABEL 2. STRUCTURAL MODELS FIT AND HYPOTHESIS TESTING RESULTS

Hypothesis	Relationship	Estimate	C.R	p-value	Supported
			>1,960	<0,05	
H1	PU ← PEOU	0.797	8.032	***	Yes
H2	PU ← FN	0.174	2.433	0.015	Yes
H3	PT ← PU	0.304	4.462	***	Yes
H4	PT ← PP	0.166	1.933	.053	No
H5	PT ← PS	0.502	6.304	***	Yes
H6	BI ← PS	0.020	-0.312	0.755	No
H7	BI ← PT	0.204	2.930	.003	Yes
H8	BI ← SN	0.127	1.860	0.063	No
H9	BI ← FN	0.109	1.825	0.068	No
H10	BI ← PU	0.245	3.370	***	Yes
H11	BI ← PEOU	0.426	4.477	***	Yes
H12	BI ← PP	-0.037	-0.772	0.440	No

IV. RESULT AND DISCUSSION

Hypothesis testing result of the proposed model is presented in Fig 2.

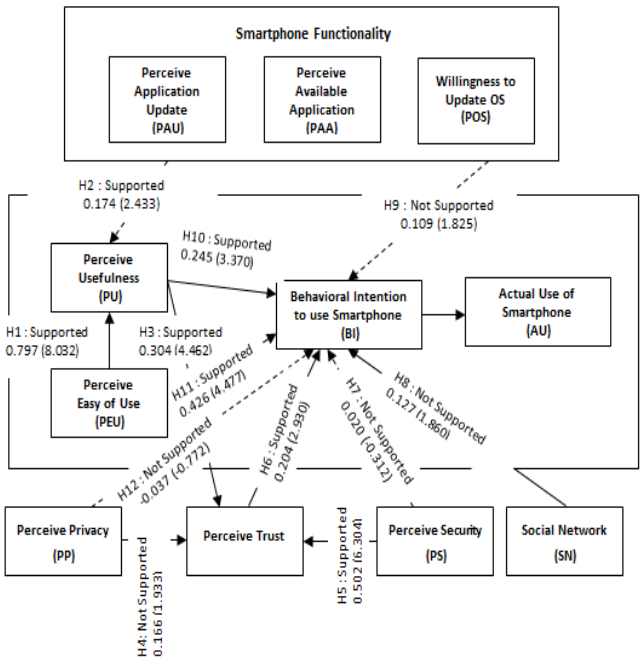

Fig. 2. Hypothesis Testing Result of the Proposed Research Model

This study aims to evaluate the factors that affecting user to use Smartphone. TAM model combined with Perceive Security, Perceive Privacy, Perceive Trust are used to investigate factors that affect the use of Smartphone.

The results confirm that Perceive Usefulness, Perceive Easy Of Use, Perceive Trust are the factors that affected user intention to use a smartphone. Perceive usefulness itself affected by Perceive Ease of Use. While Perceive Trust is affected by Perceive Security, Perceive Privacy and Perceive Usefulness.

1. *H1 Result Discussion*
   Perceive Ease of Use is one of the factors that influence whether technology is accepted or not [9]. Perceive Ease of Use have positive effect towards Perceive Usefulness. This study allign with Halim Mad Lazim and Sasitharan [14] states that Perceive Ease of Use increase respondents' effectiveness in completing the work by using a Smartphone.
2. *H2 Result Discussion*
   In previous study conducted by Dalsung Shung and Sun Gi Chun [7] shows that Functionality is one of the factors that influence Perceive Usefulness. In this study we also found that there is significant relationship between Functionality and Perceive Usefulness. This indicates that Functionality will increase usefulness of smartphone because Functionality can help respondents to accomplish their job and their daily life activity.
3. *H3 Result Discussion*
   Mohammed A. Al-Sharafi et al. [7] states that Perceive Usefulness has a positive effect on Perceive Trust. The hypothesis has been proved, because our study also showed a significant relationship between the two constructs. This result proves if respondents believe that Smartphones assist them in performing their daily life activity.
4. *H4 Result Discussion*
   Mohammed A. Al-Sharafi et al. [1] stated that there is positive effect between Perceive Privacy and Perceive Trust. However, in this study we found that there is no significant relationship between those two constructs. This indicates that respondents are not concerned about the loss of their data in Smartphone. Eventhough if there is data lost, respondents' trust toward Smartphone won't be reduced.
5. *H5 Result Discussion*
   Hypothesis result shows that there is significant relationship between Perceive Security and Perceive Trust. This indicates that the respondents believe if security on Smartphones can protect their data or their personal information from security problems that might occur.
6. *H6 Result Discussion*
   From the hypothesis can be concluded that Perceive Trust have positive effect towards Behavioral Intention. This indicates that the respondents believe that Smartphone is trustworthy and will keep its promise to protect their personal information on Smartphone. This will reduce their fear towards risk that associated with their personal information.
7. *H7 Result Discussion*
   From the hypothesis result can be concluded that the influence of Perceive Security towards Behavioral Intention is not supported. This indicates that respondents are not concerned with security-related issues of Smartphones.
8. *H8 Result Discussion*
   Dalsung Shung and Sun Gi Chun [7] states that Social Network have positive effect on the use of smartphones. They will select and use Smartphones that are widely used by people around them. This is because the user has been influenced by the thoughts, feeling, emotions and behavior of social groups around them [18]. However the result from this study found the contrary, that the respondents are not influenced by the people around them in using Smartphone.
9. *H9 Result Discussion*
   In previous study conducted by Dalsung Shung and Sun Gi Chun [7] shows that Functionality is one of the factors that influence the selection and use of smartphones. But in this study we found that there is no significant relationship between Functionality and Behavioral Intention.
10. *H10 Result Discussion*
    According to Davis F. D. [9], Perceive Usefulness is one of the factors that determine whether technology is accepted or not. Perceive Usefulness have positive effect on Behavioral Intention. Thomson [31] explains that individuals will use an information technology if they had known its positive benefits. So from this study the intention to use Smartphone influenced by positive benefits perceived by respondents when using a Smartphone, which is alligned with the previous studies.
11. *H11 Result Discussion*
    According to TAM, users evaluate a technology based on its ease of use and benefits. If the technology is easy to use and useful for its users, then intention to use the technology would be increasing [7]. Moreover, if users are more experience with mobile devices, then it will also affect user's perception in learning mobile devices [32]. This can be evidenced by supported hypothesis, which is Perceive Ease of Use have positive effect towards Behavioral Intention.
12. *H12 Result Discussion*
    The hypothesis shows that there is no significant effect between Perceive Privacy and Behavioral Intention. This indicates that the respondents do not care about issue of privacy on Smartphones.

V. CONCLUSION

This study shows that factors affecting user intention to use Smartphones which will directly influence actual use of Smartphones are Perceive Usefulness, Perceive Easy of Use, and Perceive Trust. Respondents of this study shows if they experienced positive benefits when using Smartphone,

they will find smartphone is usefull in performing their daily activities. Perceived Ease of Use also affect the intention to use Smartphones because the ease of use of Smartphone increases respondents' effectiveness in accomplishing their work by using a Smartphone. In addition, the trust level of respondents towards Smartphone also affect the intention to use Smartphones because respondents believe that Smartphones will keep its promise to protect their personal data.

This findings added more knowledge to the literature of technology acceptance by way of combining more variables which have effect on intention to use Smartphone. It has practical implications to all stakeholders of the need, with regard to Smartphone usage and also academics who want to observe study in related field and in another country to gain deeper insights.

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