Influence of Daily SNS Usage on the Collection of Disaster Information and Inhabitants' Behavior during Flood

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Abstract: Social Networking Service (SNS) attracts much attention as one of the media for collecting the disaster information. Many studies have been conducted about the effect of SNS on people's behavior during disaster. However, there are few studies that deal with the relationship between the daily SNS usage and people's behavior during disaster. Based on the questionnaire survey in Bangkok, the relationship was analyzed using Structural Equation Modeling and Theory of Planned Behavior. It was found that the attitude toward the collection of information in daily life had some influence on the intention to collect disaster information. Also, the confidence of being able to select correct information had crucial influence on whether or not to increase SNS usage. It was concluded that SNS has some potential as interactive media. That is, it should be used not only for collecting but also providing the information.

Keywords: Social Networking Service (SNS), Disaster Information, Theory of Planned Behavior, Structural Equation Modeling, Multi-Group Path Analysis

1. INTRODUCTION

Recently, it has been recognized that the enhancement of people's perception of disaster is important to prevent the damage by natural disaster. Such non-structural measures are expected to work well together with the structural measures, such as the construction of dams and dykes. The collection and provision of the disaster information is one of such non-structural measures. TV, radio and administrative radio system are used to collect and provide the disaster information in a passive manner. However, due to the development of internet technology, lots of information is available in various media wherever we are and whenever we want. Especially, Social Networking Service (SNS), such as Facebook and Twitter, attracts much attention as one of the useful media for collecting and providing the

disaster information. The users of SNS are expanding all over the world. Hence, central and local governments pay much attention to the role of SNS during disaster.

Some studies have conducted so far about the SNS usage in emergency situations. However, they focused on the effect of SNS only in emergency situations.

Taniguchi (2012) showed the effectiveness of Twitter during heavy rainfall by typhoon. He validated the possibility of Twitter as tool for collection and provision of disaster information.

Lindsay (2011) discussed the role of SNS in each process of disaster, such as notification and emergency warnings. She summarized how social media have been used by emergency management officials and agencies. It also examined the potential benefits, as well as the implications, of using social media in the context of emergencies and disaster.

In addition, Kruthern (2012) identified the reasons for Facebook use during Thailand floods using online semi-structured interviews with the people who experienced the disaster. In addition, the study described and analyzed the patterns of communication on Facebook related to this crisis and the role of Facebook in this context by analyzing the Wall posts related to Thailand floods using Activity Based Communication analysis. Findings indicated that Facebook functioned as a citizen's mouthpiece during floods in Thailand last year. Ordinary people used Facebook to communicate with the public, offer and ask for help, broadcast their views on certain issues and to disclose suspicious activity in the society. Furthermore, the study revealed that information generated by citizens shared on Facebook is relatively specific, accurate, updated and easier to comprehend compared with the messages sent from the authorities or mainstream media.

Thus, many studies were interested only in the relationship between the SNS usage and the inhabitants' behavior during disaster, including collecting the disaster information. However as daily SNS usage increases, people's interest in collection of the information grows. Therefore, revealing the influence of daily SNS usage on inhabitants' behavior is very important.

This study aimed to identify the relationship between SNS usage during disaster and the intention to collect the disaster information and inhabitants' behavior against disaster. In order to collect the relevant data, we conducted a questionnaire survey in Bangkok for both Thai inhabitants and Japanese residents.

At the beginning, we hypothesized that people who use SNS actively in daily life tend to collect the information actively also in emergency situations. Soon later, the hypothesis was rejected by the analysis using Structural Equation Modeling (SEM) and Theory of Planned Behavior (TPB).The elaborative SEM analysis by separating the respondents into several sets of group justified that the confidence of being able to select correct information has some crucial impact on the attitude toward the collection of information in daily life.

This paper is organized as follows; Section 1 addresses the introduction as stated in the above. The next section briefly explains the methodology and the hypothesis. The hypothesis based on the Theory of Planned Behavior (TPB) is proposed. Section 3 describes the detail of data collection in Bangkok, Thailand and the process of data analysis. In Section 4, the latent variables and combination of observed variables are justified with the confirmation of Cronbach's alpha index and Confirmatory Factor Analysis (CFA). Then, Section 5 analyzes the relationship between the collection of disaster information and the behavior against flood, being followed by the analysis of the influence of the reliability and psychological factor. Section 6 discusses the relationship between the daily SNS usage and the intention to collect the disaster information using the multi-group path analysis. Section 7 is the conclusion and discussion of the study and suggestions for further study in the future.

2. METHODOLOGY

2.1 Mathematical Backgrounds

2.1.1 Structural equation modeling (SEM)

Structural Equation Modeling (SEM) is one of the statistical methods to examine the relationship between cause and effect. In other words, SEM is a technique to identify the relationship between the latent variables that cannot be observed directly and the observed variables that can be measured by questionnaire survey and so on. SEM is widely used in engineering fields to examine the hypothesis associated with latent variables.

2.1.2 The theory of planned behavior (TPB)

The early studies on human being behavior focused on only the relationship between "*Behavior*" and "*Attitude*". However, the successive studies revealed that "*Attitude*" is not enough to explain "*Behavior*". Therefore, Ajzen worked out "*Theory of Reasoned Action* (TRA)" (Ajzen and Fshbein, 1980) and "*Theory of Planned Behavior* (TPB)" (Ajzen, 1991). "*Behavioral Intention*" was treated as more important, instead of "*Attitude*".

Figure 1 depicts the schematic concept of TPB. "*Behavioral Intention*" means that the intention, such as "*I want to use a car today*", would happen before using a car. "*Behavioral Intention*" is influenced by "*Attitude*" and "*Subjective Norm*", as well as "*Perceived Behavioral Control*" in TPB. "*Attitude*" is defined as the psychological factor that is reflected by private and egocentric motives. On the other hand, "*Subjective Norm*" is defined as the psychological factor that is reflected by some social motives, that is, "*Subjective Norm*" means in the above example "*what your family and friends think that you usually use a car*". "*Perceived Behavioral Control*" is defined as the prospect of whether you can do easily or not, just like whether or not you can stop the usage of a car in the example. The higher "*Perceived Behavioral Control*" becomes, the easier "*Behavioral Intention*" becomes. Also, generally speaking, "*Perceived Behavioral Control*" would directly influence "*Behavior*".
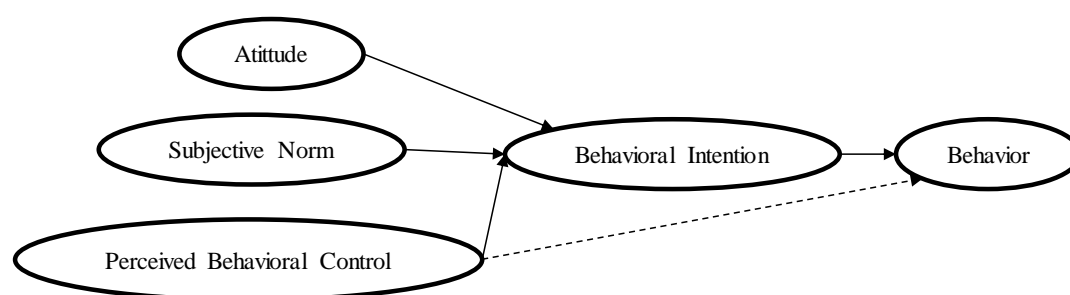

Figure 1. The concept of the Theory of Planned Behavior

Same as SEM, TPB applies to many studies in civil engineering field. Long *et al*. (2011) applied Theory Planned Behavior (TPB) to investigate the commuter's behavioral intention toward future sky train usage in Phnom Penh. They found that main TPB constructs significantly influence the behavioral intention of using future sky train. A further investigation revealed the relationship between moral obligation and the behavioral intention. In addition, to some degrees, socioeconomic variables can also be used for explaining the intention.

2.2 Framework of the Study

2.2.1 Hypothesis

Katada *et al*. (2005) pointed out that people's attitude toward the collection of disaster information influences the speed of making crisis awareness and the human behavior against disaster. Also, they ascertained that people who would contact the news and information about the disaster in daily life would collect the information actively during the flood.

In this study, in order to consider the relationship between the daily SNS usage and the intention of collecting disaster information more elaborately, we make a hypothesis on the relationship as shown in Figure 2. Firstly, it is assumed that daily SNS usage would influence the attitude toward collecting and sharing of the information in daily life. Then, the improvement on the attitude in daily life would encourage people to collect the disaster information in earnest. Moreover, the intention of taking some behavior against flood would be enhanced by collection of the disaster information.
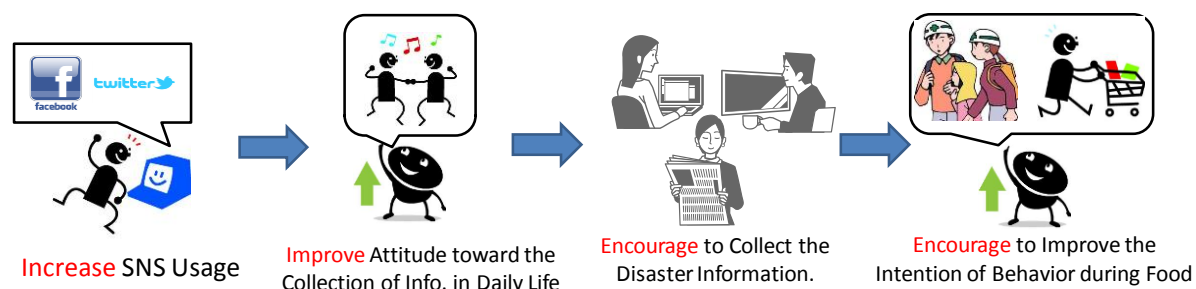

Figure 2. Hypothesis on the relationship between the SNS usage and the intention of behavior

2.2.2 Adjusted hypothesis based on TPB

Two behaviors were defined in this study. One was "to collect the disaster information". Another was "to do some against flood". These two behaviors apply to Theory of Planned Behavior and are analyzed by Structural Equation Modeling.

As shown in Figure 3, we adjusted the hypothesis in Figure 2 based on TPB. Firstly, it was assumed that "*Behavioral Intention to Collect the Disaster Information* (ITc)" occurs before "*Behavior of Collecting the Disaster Information* (Bc)".Then "*Attitude toward the Collection of Disaster Information* (ATc)", "*Subjective Norm* (SN)" and "*Perceived Behavioral Control* (PBC)" was supposed to influence ITc. Those relationships are defined in TPB. In addition, in order to validate the relationship between SNS usage and ITc, "*Daily SNS Usage*" assumed to effect on ITc through "*Attitude toward the Collection and Share of Information in Daily Life* (ATn)"

Finally, it was assumed that improvement on ITc and Bc makes "*Behavioral Intention to Do Some against Flood* (ITb)" higher. There were many behaviors against flood. For example, buy a water and food, move a car to safer place, evacuate and so on. On the other hand, some people would not do anything even if flood comes. In flood situation, Disaster information is one of the most important factors for people to decide the behavior against flood. ITb was defined to analyze this relationship.

ITb is also influenced by many factors, for instance, "Subjective Norm" and "Perceived Behavioral Control" defined in TPB same as ITc. However, only "*Attitude toward Behavior against Flood (ATb)*" was regarded as the factor influence on ITb in this study, in order to avoid complicated questionnaire sheet and model.
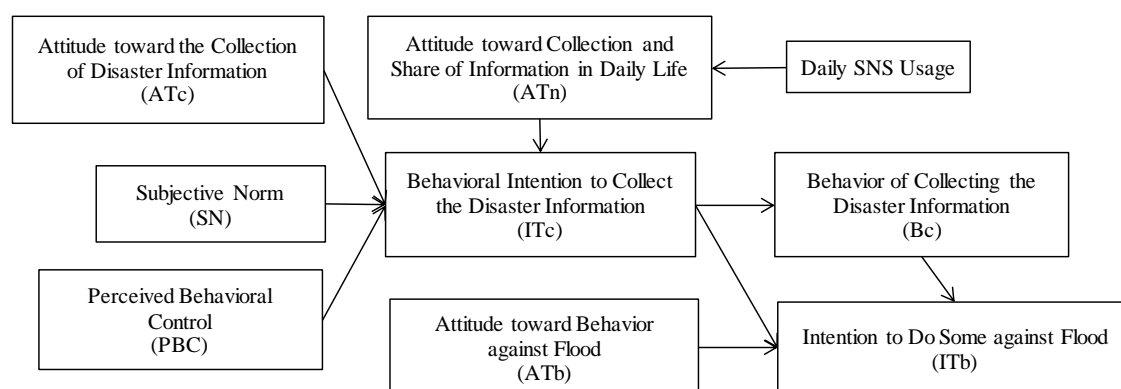
Figure 3. Hypothesis based on TPB

3. DATA COLLECTION

3.1 SNS and the Collection of Information in Bangkok during the Flood in 2011

According to the investigation by Assumption University in Bangkok, nearly 90% of people in Bangkok join a SNS and half of them use it more than twice a day. In terms of Facebook users, Bangkok is top ranking all over the world (Socialbakers, 2012). Also, it is reported that people in Bangkok accessed "Chula-flood.org" more than 10,000 times a day during flood in 2011. In addition, many people tweeted so often about the flood. In this way, the information was shared among the people in Bangkok using SNS during the flood. The number of SNS users in Bangkok is much more than that in Japan. Also, they have experienced serious flood disaster many times. That is why Bangkok was chosen as the data collection site for this study.

3.2 Respondents

The questionnaire survey was conducted in Bangkok from 13th October to 10th November in 2012. The questionnaire sheets were distributed at several sites, including Chulalongkorn University, King Mongkut's University, some large department stores and several buildings for Thai people and the service center for Japanese people. Respondents were randomly selected. Table 1 summarizes the questionnaire survey. Finally, 230 of Thai sample and 72 of Japanese sample were usable for data analysis.

Approximately 90% of Thai and 70% of Japanese respondents were using SNS at that time. This supported the research of Assumption University. About 50% of Thai got some damage by the flood. However, very few Japanese residents got any damage.

Table 1. Number of samples of the questionnaire survey in Bangkok

	Thai	Japanese in BKK
Distribution	Direct Distribution and Collection	
Collection		
Respondents	254	80
Valid Sample	230	72
Valid Rate	90.6%	90.0%

3.3 Measurements

The questionnaire sheet consisted of five sections. The first section asked about the daily SNS usage. The second section was about the behavior during flood in the 2011. The third section asked about personal attribute, including age, sex, income and educational background. Section 4 was the questions about the collection of information in daily life and during flood. The last section inquired respondents about the behavior during flood.

The respondents were required to choose an appropriate alternative for each question. As for the questions associated with the perception, they are required to choose suitable rating among seven alternatives from "*Strongly Disagree*" to "*Strongly Agree*". Table 2 shows all of questions and latent variables that were assumed. The Questionnaire sheet was organized following the suggestions by Francis *et al* (2004) about how to organize questionnaire sheet based on TPB.

Table 2. Questions and latent variables

Latent Variables	Observed Variable	Questions
SNS Usage	SNS	Using SNS or not
	Read	The number of checking Time Line.
	Post	The number of posting your states.
ATc	ATc1	Collecting disaster information during flood is good.
	ATc2	Collecting disaster information during flood is necessity.
SN	SN1	Most people who are important to me want me to collect the disaster information during the flood.
	SN2	It is expected of me that I collect the disaster information during the flood.
PBC	PBC1	For me to collect the disaster information is possible.
ITc	ITc1	My intention to collect disaster information during flood is strong.
	ITc2	I want to collect the disaster information during the flood.
	ITc3	I intend to collect the disaster information during the flood.
Bc	BC1	Collect the disaster information from a TV.
	BC2	Collect the disaster information from a radio
	BC3	See a news about disaster in internet.
	BC4	Collect the disaster information from SNS.
	BC5	Use official website or call center to collect the information from government
	BC6	Ask friends or neighbors about the disaster.
Atn	Atn	Collecting and Sharing information in daily life is pleasant.
ATb	ATb1	Doing behavior against flood is good.
	ATb2	Doing behavior against flood is necessary.
ITb	ITb1	I intend to do something against the flood.
	ITb2	My intention to do something against flood is strong.

3.4 Data Analysis

This study used four steps to analyze each relationship. At beginning, the assumed combination of observed variables in Table 2 was confirmed by Cronbach's alpha index and Confirmatory Factor Analysis. After confirming latent variables and observed variables, the hypothesis in Figure 3 was validated by SEM. The hypothesis was divided two parts. One was relationship between collection of disaster information (ITc and Bc) and "Intention to Do Some against Flood (ITb)". It was analyzed by only SEM to make sure their relationship.

Another one was the relationship between daily SNS usage and collection of disaster information (ITc and Bc). Three models, which were "Basic model", "SNS usage model", and "Personal attribute model", were made. Then, they were compared by goodness of fit to analyze. This result suggested whether SNS usage influences on intention to collect the disaster information during flood. Finally, the influence from daily SNS usage to collection of disaster information was described by SEM model focusing on the relationship.

4. CONFIRMATION OF THE LATENT VARIABLES

4.1 Cronbach's Alpha Index

Internal consistency is an important measure to evaluate the correlation coefficient among the different questions on the same questionnaire sheet. That is, if the internal consistency is high enough, the combination of the observed variables with the latent variable is justified.

Cronbach's alpha index is usually used for measuring the internal consistency.

$$\alpha = \frac{N\bar{\rho}}{1 + \bar{\rho}(N-1)} \tag{1}$$

where N is the number of questions and $\bar{\rho}$ is the average of correlation coefficient among the questions. Generally, it is said that if the alpha index is over 0.7, their internal consistency is high enough. If it is below 0.5, the combination of the observed variables must be re-considered.

Table 3 indicates the Cronbach's alpha index of each latent variable in Table 2 for the mixed sample data of Thai and Japanese sample (N=302). It can be seen the factors related to the collection of disaster information, "*Attitude toward the Collection of Disaster Information* (ATc)", "*Perceived Behavioral Control* (PBC)", "*Subjective Norm* (SN)", "*Behavioral Intention to Collect the Disaster Information* (ITc)" and "*Behavior of Collecting the Disaster Information* (Bc)", have a good alpha index. All of them are over 0.7. Therefore, their combinations of the observed variables were reliable.

On the other hand, alpha indexes of factors related to the behavior against flood, which were "*Attitude toward Behavior against Flood* (ATb)" and "Behavioral *Intention to Do Some against Flood* (ITb)", were 0.646 and 0.618, respectively. However, some existing researches accept 0.6 of Cronbach's alpha index. Although they were not high enough, we accepted them since they were not low to reject.

Table 3. Cronbach's alpha index

Latent Variables	Cronbach's α index
Daily SNS Usage	0.751
Attitude toward Collection of Disaster Info. (ATc)	0.707
Perceived Behavioral Control (PBC)	n/a
Subjective Norm (SN)	0.821
Intention to Collect Disaster Info. (ITc)	0.804
Behavior of Collecting Disaster Info. (Bc)	0.729
Attitude toward Behavior against Flood (ATb)	0.646
Intention to Do Some against Flood (ITb)	0.618

4.2 Confirmatory Factor Analysis (CFA)

CFA is a special form of factor analyses most commonly used in social research, particularly for testing whether measures of a construct are consistent with a researcher's understanding. In this study, similar to the Cronbach's alpha index, CFA was used for confirming the reliability of the combination among the observed variables. Figure 4 depicts the result of CFA for the collection of disaster information under the hypothesis in Figure 3, assuming the latent variables and the observed variables in Table 2. The values along arrows indicate the path index between the connecting variables. The ones with the superscript of "***" mean that the p-value is less than 0.01. As shown in Figure 4, the model fit of CFA was summarized as GFI=0.913, AGFI=0.873, RMSEA=0.069 and all p-values were below 0.001, except for the correlation coefficient between "*SNS Usage*" and some other latent variables. Hence, the model was acceptable.
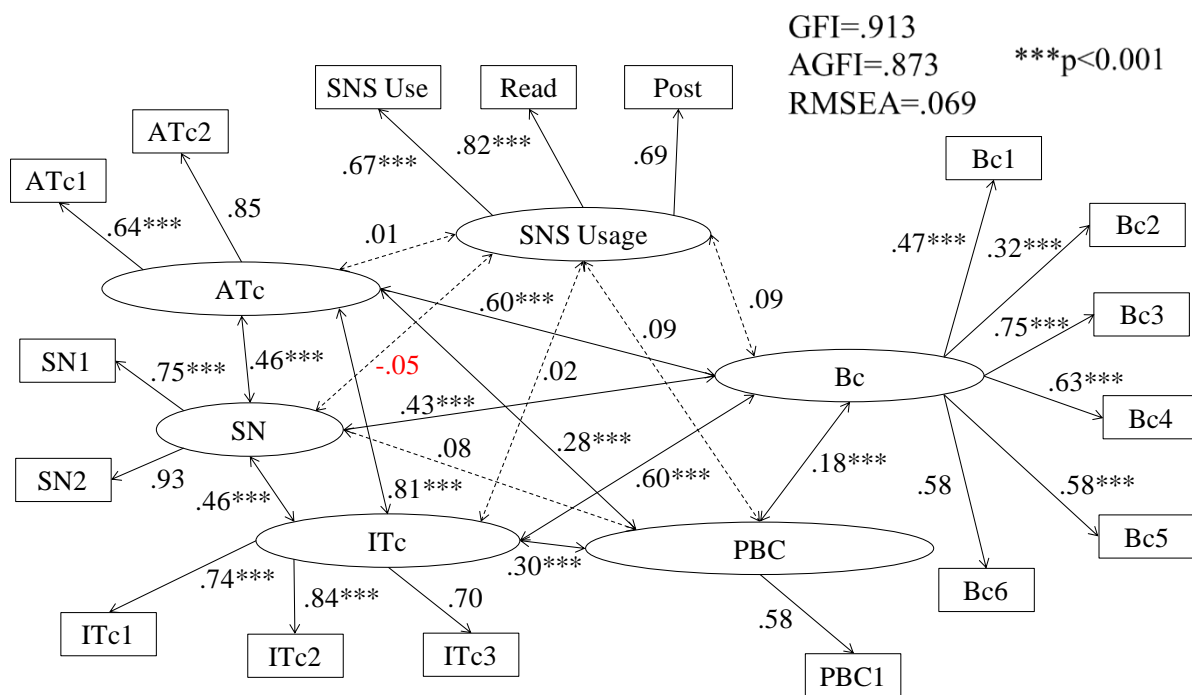

Figure 4. CFA model about collection of the disaster information

Similarly, Figure 5 exhibits the CFA model for the behavior against flood. The model fit was GFI=0.993, AGFI=0.925, RMSEA=0.109. Also all p-values were less than 0.001. Although RMSEA was somewhat larger than 0.100, the model was considered as well performed by the other indexes. As the results of Cronbach's alpha index and CFA, combinations of observed variables were justified. That is, the latent variables were also reasonable for expressing the behavior of collecting the disaster information and inhabitants' behavior during flood.
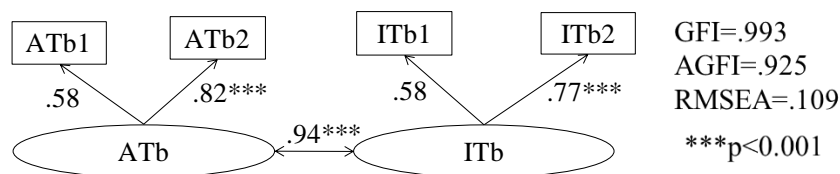

Figure 5. CFA model about behavior against flood

5. DISASTER INFORMATION AND INHABITANTS' BEHAVIOR

5.1 Collecting Disaster Information and Behavior against Flood

At beginning, we investigated the relationship between the collection of disaster information and inhabitants' behavior against flood. Figure 6 presents the results of the SEM. The numbers along arrows mean the path indexes. The dashed arrow indicates that it was not significant with the 5% level. The p-values of the path coefficient were classified into three categories depending on how large they were. For example, the superscript "**" means that p-value was less than 0.01, as shown in the legend of Figure 6. The model fit was summarized as GFI=0.932, AGFI=0.887 and RMSEA=0.080. Thus, the model was also acceptable.

Figure 6 exhibits that there was positive influence between "*Behavioral Intention to Collect the Disaster Information* (ITc)" and "*Behavioral Intention to Do Some against Flood* (ITb)". It means that the improvement on the intention to collect the disaster information encourages people to do some against flood. Also, the path index between "*Attitude toward Behavior against Flood* (ATb)" and ITc was positive. That is, people who have high awareness about the behavior against flood tend to collect the disaster information actively. In contrast, the path index between "*Behavior of Collecting the Disaster Information* (Bc)" and ITb was not significant. It indicates that people who collect the disaster information actually do not take any action against flood. There must be some hindering factor, such as the reliability and psychological factors, as discussed in the next part.
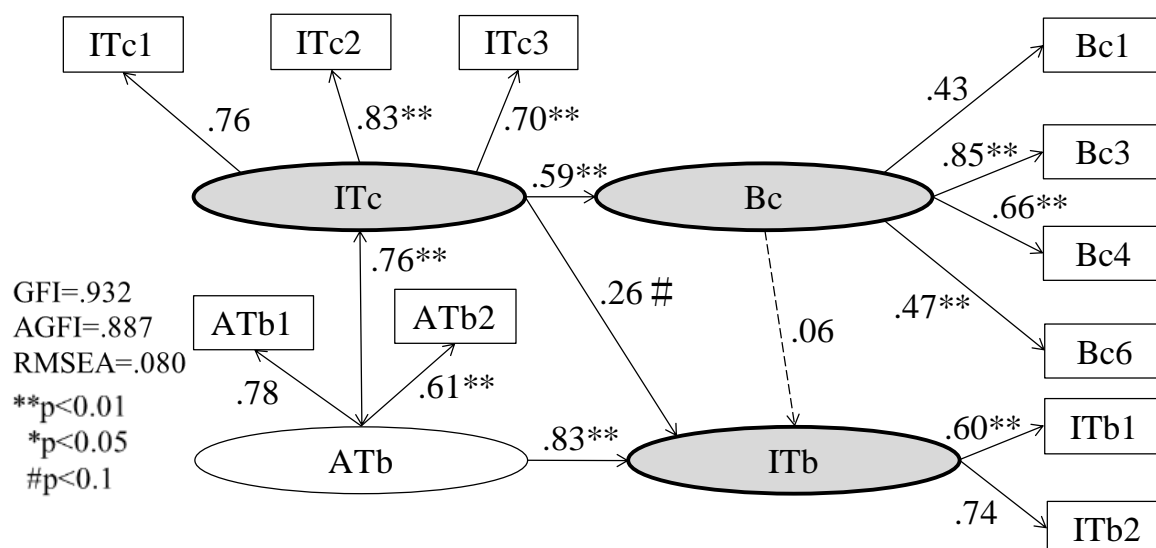

Figure 6. SEM analysis for the Collection of the disaster information and inhabitants' behavior

5.2 Hindering Factors

Figure 7 shows the influences of the psychological factor and the reliability, in which the Partial Least Square (PLS) model was combined with the causality model. The PLS model intended to describe the influence of "*Psychological Factor*" on "*Behavioral Intention to Collect the Disaster Information* (ITb)". The causality model intended to describe the influence of "*Reliability of Media*" on ITb. Figure 7 represents the influence of the psychological factor and the reliability on ITb. GFI, AGFI and RMSEA were 0.914, 0.962, and 0.082, respectively. The p-values were small enough with the significant level of 5%.

It indicates that "*Psychological Factor*" had fairly large influence on ITb. Furthermore,

all of path indexes between "*Psychological Factor*" and observed variables were positive. It means that people who can accept the risk of flood, people who are worried about their properties and people who have the confidence of being able to select correct information tend to do some against flood actively. In contrast, people who cannot accept the risk of flood, people who are not worried about their properties and people who do not have the confidence of being able to select correct information have negative feelings to do some actively against flood. In addition, "*Reliability of Media*" had larger influence than "*Reliability of Government*". That is, people think that the reliability of media is more important than the reliability of information sources. It suggests that it is required to improve the reliability of media to encourage inhabitants' behavior against flood.

On the other hand, the correlation coefficient between "*Selecting Correct Information*" and "*Reliability of Media*" was a positive. It can be concluded that improving the reliability of media is also important to reduce the psychological burden.
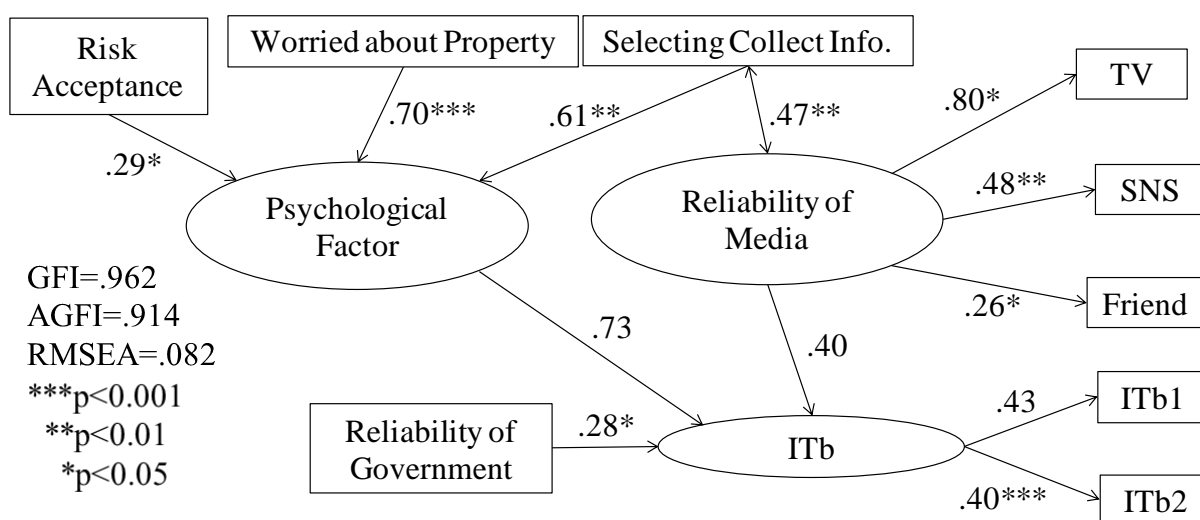

Figure 7. SEM analysis for the influence of hindering factors on inhabitants' behavior

6. SNS USAGE AND THE COLLECTION OF DISASTER INFORMATION

Starting with the basic model based on TPB. We extended the basic model in order to improve interpretability of the model. Components of the hypothesis were added to basic model step by step, in order to find the optimum model. Accordingly, three models, "Basic Model", "SNS Usage Model" and "Personal Attribute Model", were compared by goodness of fit. Long *et al.* (2011) also compared three models about intention toward future sky train usage and presented optimum model. In addition, multi–group path analysis was used for investigating the detail of the influence on ITc by SNS usage.

6.1 Basic Model

Figure 8 shows the basic model about the collection of disaster information during flood. It was consisted only elementary five components of SEM. GFI was 0.914, AGFI was 0.872 and RMSEA was 0.088. Since the p-values of path index, the variance of endogenous variables and error variables were less than 0.002, the model could be accepted. Only the path index between "*Perceived Behavioral Control* (PBC)" and "*Behavior of Collecting the Disaster*

Information (Bc)" was removed, because p-value was not significant in 5% level.

Figure 8 shows that "*Attitude toward the Collection of Disaster Information* (ATc)" had the biggest path index. It means that ATc is the most important factor to improve "*Intention to Collect the Disaster Information* (ITc)". Also, the path index between "*Behavior of Collecting the Disaster Information* (Bc)" and "*Bc3* (Collect the Disaster Information by News in Internet)" was fairly large as well as the path index between Bc and "*Bc4* (Collect the Disaster Information by SNS)" was bigger than another index. That is, people who collect the disaster information actively tend to use internet and SNS.
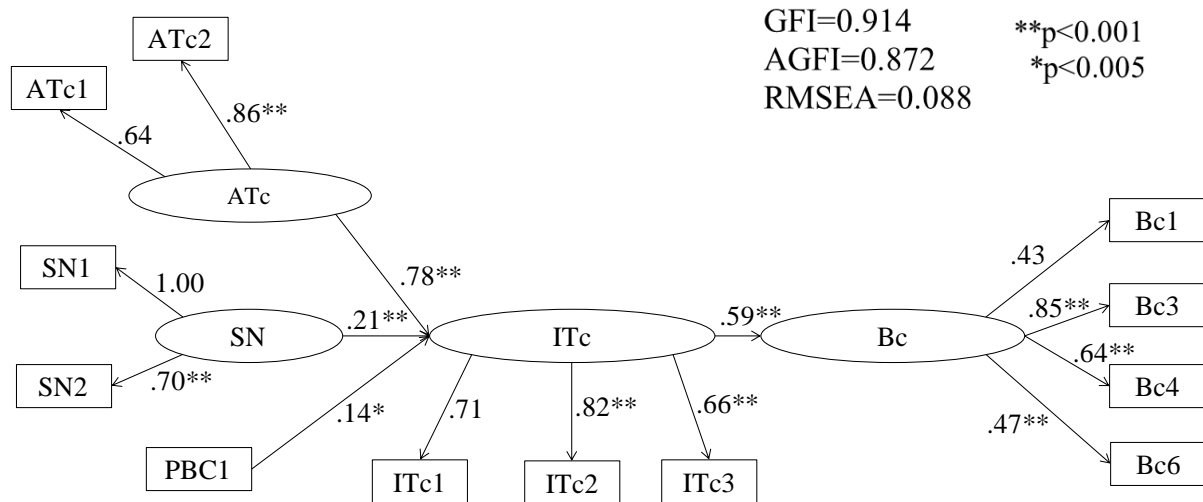

Figure 8. Basic model (Model 1)

6.2 SNS Usage Model

Figure 9 was the extended model adding "*SNS Usage*" to the basic model in Figure 8. Since GFI was 0.902, AGFI was 0.863 and RMSEA was 0.072, the model was also acceptable. The largest p-value of 0.016 between "*SNS Usage*" and "*Attitude toward the Collecting and Sharing of the Information in Daily Life* (ATn)" supported this acceptance.
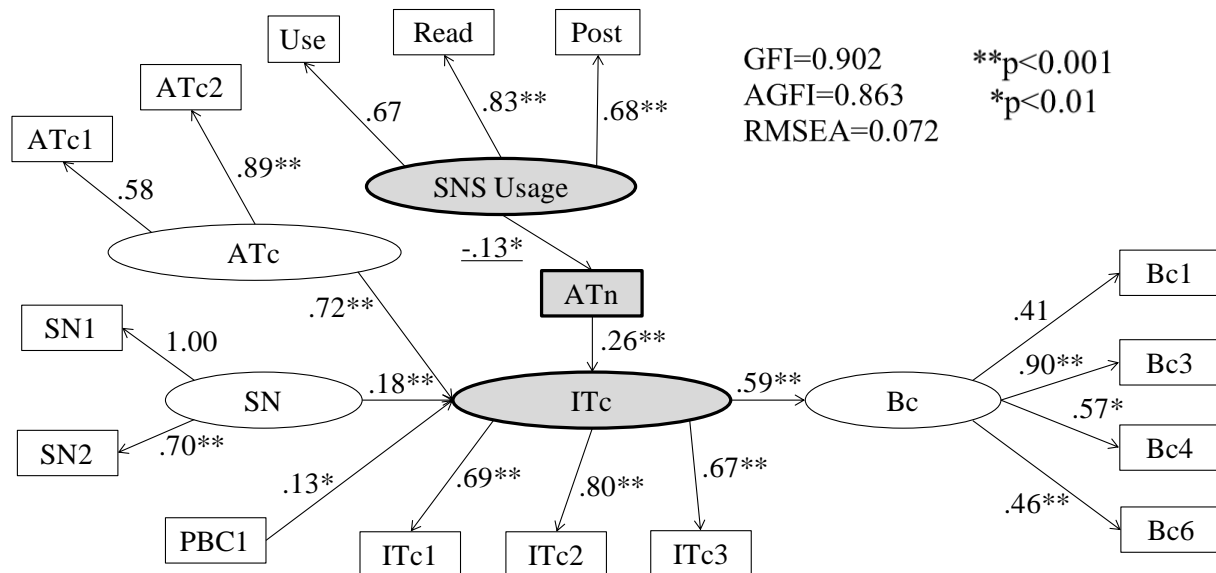

Figure 9. SNS usage model (Model 2)

Figure 9 shows that the path index between "*SNS Usage*" and ATn had negative value. It means that the more people use SNS in daily life, the less people have fun to collect the information in daily life. Moreover, "*SNS Usage*" was expected to have negative influence on "*Intention to Collect the Disaster Information* (ITc)" by multiplying the path indexes between them (-0.13*0.26). This contradicted the initial hypothesis in Figure 2 that assumed the positive influences between them. It required us to modify the structure of hypothesis.

On the other hand, ATn had the second largest value among the path indexes influencing on ITc (0.26, 0.72, 0.18, and 0.13). It suggests that the attitude not only during flood but also in daily life is important to improve the ITc. This result supported the findings by Katada *et al* (2005).

6.3 Personal Attribute Model

As shown in Figure 10, we further modified the SEM model in Figure 9 by introducing the personal attributes, whose GFI was 0.894, AGFI was 0.860 and RMSEA was 0.065. All the p-values were less than 0.01. Therefore, the model was also acceptable.

Figure 10 shows that since the path index between sex and "*Behavior of Collecting the Disaster Information* (Bc)" was positive, female tended to collect the disaster information actively more than male. Also, people who had got damage a lot were more active to collect the disaster information. On the other hand, the negative path index between age and "*SNS Usage*" suggests that younger people use SNS more than elder people.
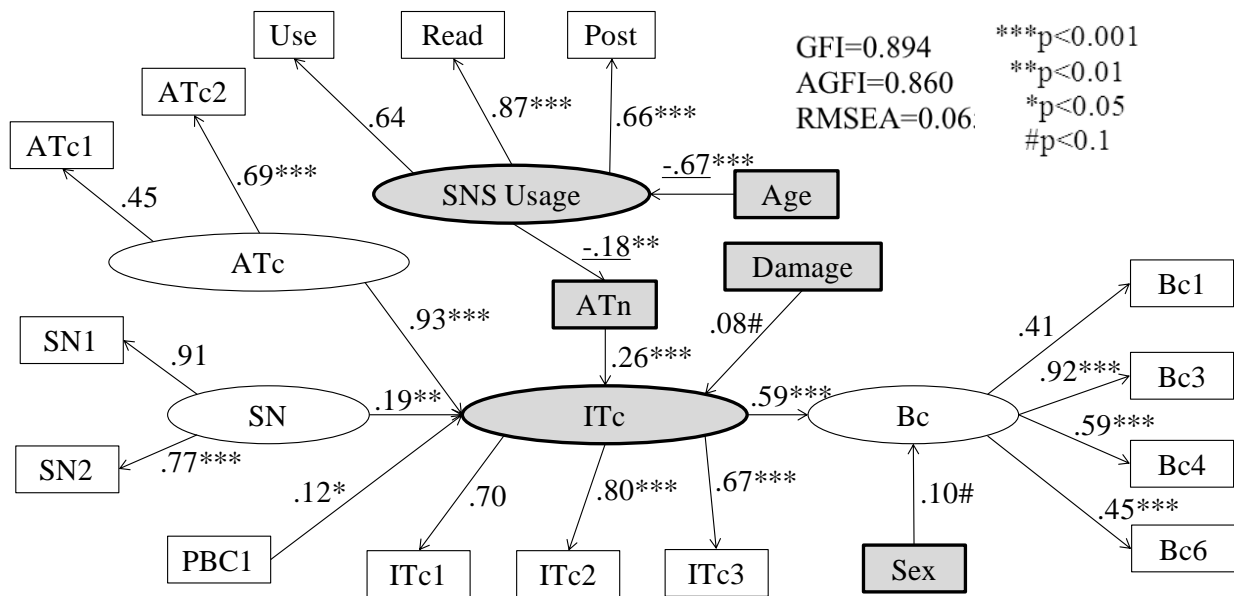

Figure 10. Personal attribute model (Model 3)

6.4 Model Comparison

Table 4 summarizes the results of the above three models by comparing RMSEA and chi-square divided by degree-of-freedom (x²/df). Model 3 covers both Model 1 and Model 2. The results of Table 4 suggests that ITc was influenced by not only three factors in TPB (Model 1), but also some other factors, such as "*SNS Usage*" and ATn.(Model 2) as well as the personal attributes (Model 3).

Table 4. Model comparison

Fit Index	Mosel1 Basic	Model2 SNS Usage	Model3 Personal Attribute
RMSEA	0.088	0.071	0.065
x²/df	3.420	2.574	2.275

6.5 Multi-Group Path Analysis

The results in Figure 9 and Figure 10 suggest that "*SNS Usage*" provides negative influence on "*Intention to Collect the Disaster Information* (ITc)" through "*Attitude toward the Collecting and Sharing of the Information in Daily Life* (ATn)". They contradicted the initial hypothesis stated in Figure 2. In order to identify the reason why it had negative influence, the relationship between "*SNS Usage*" and ITc was further analyzed by the multi-group path method.

6.5.1 Nationality

At first, we focused on nationality that was the most simple and biggest difference among the respondents. We applied the multi-group path analysis (Toyoda, 2007) to each group of Thai and Japanese. Figure 11 presents the relationship between "*SNS Usage*" and "*Intention to Collect the Disaster Information* (ITc)" of each nationality. It can be seen that both models still had the negative value from "*SNS Usage*" to ITc. This means that the nationality was not successful explaining the contradiction.
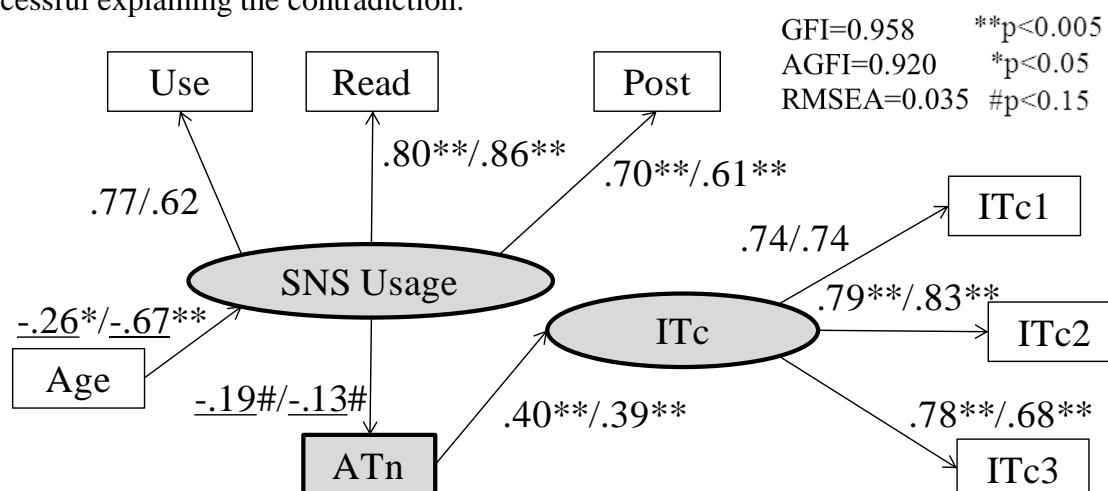

Figure 11. Multi-group path analysis by nationality

6.5.2 The confidence of being able to select correct information

The Confidence of being able to select correct information is one of the important skills. People must select appropriate and reliable information. Considering the results in Section 5 that the confidence influences the intention to do some against flood, we implemented the confidence into the multi-group path method. That is, all sample data were divided into two groups, "*No Confidence*" group who answered from "*Strongly Disagree*" to "*Neither*" and

"*Confidence*" group who answered from "*Slightly Agree*" to "*Strongly Agree*". Then, we applied the multi-group path analysis to each group.

Figure 12 exhibits the result of both groups. The values in the left indicate the path indexes for the "*No Confidence*" group and those in the right for the "Confidence" group. We accepted model the model since GFI was 0.943, AGFI was 0.892 and RMSEA was 0.058 and all p-values were below 0.05.

It can be seen that the path index between "*SNS Usage*" and ATn has different sign for both groups. The difference was justified by calculating the critical ratio for difference. That is, the "No Confidence" group has positive thinking about collection of the information in daily life. In contrast, the "Confidence" group has negative thinking about ATn. Therefore, the influence between "*SNS Usage*" and ITc is positive for the "No Confidence" group but negative for the "Confidence" group.

The result points out that SNS is an effective media for people who soon after use SNS to give an interest to collect and share the information in daily life and during flood. Nevertheless, effect of SNS usage has a limitation particularly for people who have the confidence of being able to select correct information.
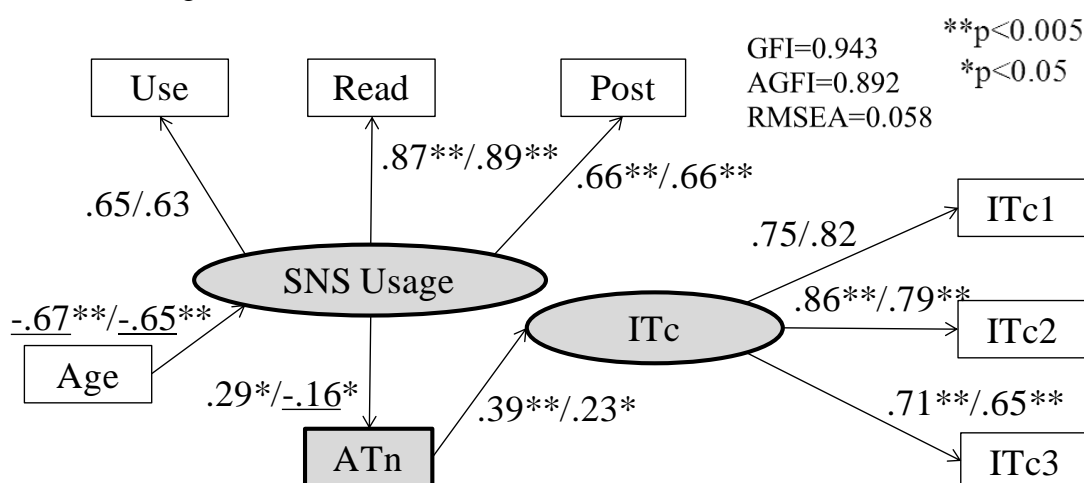

Figure 12. Multi-group path analysis by the confidence

7. CONCLUSION

The social network system, such as Facebook and Twitter, has a big potential in emergency situations. We could collect real-time information and provide some information freely. In order to identify the relationship between the daily SNS usage and the intention to collect the disaster information, the questionnaire survey was conducted in Bangkok for both Thai and Japanese. Starting with the basic Structure Equation Model (SEM) that is based on the Theory of Planned Behavior (TPB), we enhanced the model considering some other factors, such as the daily SNS usage, the attitude toward the collection of information in daily life and some personal attributes. Moreover, in order to justify the contradictory results in those models, we applied the multi-group path analysis by dividing the respondents into some groups. The major findings are summarized as follows:

1) It was revealed that the improvement on the intention to collect the disaster information has positive influence on inhabitants' behavior against flood.

2) The influence of hindering factors, such as psychological factors and the reliability was analyzed. It is found that the psychological factors are the most crucial factor to encourage people to behave actively against flood. The reliability of media is more important than the reliability of the government.

3) It was confirmed that the application of Theory of Planned Behavior is useful in describing the behavior of collecting the disaster information during flood.

4) It was identified that the attitude toward the collection of disaster information is the most important factor to improve the intention to collect the disaster information.

5) It was revealed that the increase daily SNS usage is closely correlated with the intention to collect the disaster information. The daily SNS usage influences the intention to collect the disaster information through the attitude toward collecting and sharing the information in daily life.

6) It was discovered that the behavioral intention to collect the disaster information is influenced by not only factors based on TPB but also some other factors, such as the daily SNS usage and the attitude toward collecting and sharing of the information in daily life as well as the personal attributes, such as age and sex.

7) It was justified that the confidence of being able to select correct information has large influence on the effect of increasing SNS usage by multi-group path analysis. People who have the confidence have negative thinking about the collection of information in daily life, whereas, people who do not have the confidence have positive thinking about the collection and sharing. It suggests that SNS has a possibility to give an interest to collect and share the information in daily life for people who soon after use SNS.

8) It is revealed that the people who tend to read time lines more than post their status have negative thinking to collect the information actively. That is, SNS is not useful only for collection of the information. This suggests that SNS should be interactive in daily life.

After the Great East Japan Earthquake in 2011, many official accounts of SNS accounts were opened by the central and local governments in Japan. Also, many official agencies have started to use the SNS to provide the information in not only daily but also emergency situation. Nevertheless, most of them remain one way communication, encouraging people to collect the information in which they are interested. As stated above, SNS should be interactive in daily life.

There are some limitations of the findings in this study. We evaluated the daily SNS usage only by the number of reading time lines and postings a day. The quality and contents of information should also be put into account in the future analyses. And the influence on change of inhabitants' behavior also unresolved. In addition, this study only focused on Thai and Japanese residents in Bangkok. Further study in another country is necessary to generalize the result. On the other hand, breach of privacy by internet and SNS has been serious and important more and more, these problems have to be considered in future research.

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