Survey on Sense of Security for Registering Privacy Information to Return Refugee Supporting System

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ABSTRACT
In Japan, occasionally public transportation is temporarily suspended because of typhoons or torrential downpour. Hence, it becomes difficult for many people to return to their homes. Systems for returning refugees have been proposed. However, such systems do not necessarily give Anshin to the people. Anshin is a Japanese noun which stands for sense of security. In this research, we identify the factors that make up the sense of security in people when they register their privacy information with a return refugee supporting system. We conducted a survey by asking two hundred college students and by using exploratory factor analysis. We have found five major factors which are "Capability and Knowledge", "Usability and Preference", "Close People", "Unfounded Confidence" and "Safety". By using structural equation modeling (SEM) sense of security can be divided into two parts: cognitive and emotional. Finally, we discuss what kind of a system gives Anshin to people. An event for disaster prevention and letting users know about provider's effort are both important for Anshin.

Categories and Subject Descriptors
K.4.m [**COMPUTERS AND SOCIETY**]: Miscellaneous
K.6.m [**MANAGEMENT OF COMPUTING AND INFORMATION SYSTEMS**]: Miscellaneous—*Security*

General Terms
Security

Keywords
Sense of security, Subjective assessment, Explanatory factor analysis, Return refugee, Privacy information, Disaster mitigation

Symposium on Usable Privacy and Security (SOUPS) 2013, July 24–26, 2013, Newcastle, UK.

1. INTRODUCTION
In Japan, floods occur quite frequently because of typhoons and torrential downpour. In recent years, the causes and effects of floods have been changing and a new term, urban type flood, has appeared. In this type of flood the usage of not only traditional flood control measures, but a combination with "Soft measures" is regarded to be more effective. "Soft measures" provide people with the necessary information for further action at the time of a disaster.

When typhoon 15 came to Japan in 2011, the torrential downpour stopped the transportation. It became difficult for many people to get home. The information provided by the official web sites of public transportation companies were unsatisfactory not being updated in real time [1]. Despite social network systems being a faster way of information transfer, the information could not be fully trusted since some of it was just rumors. Getting correct information instantly was difficult for the returning refugee.

In a situation like the above mentioned one, a return refugee supporting system is necessarily. A system like that would provide the returning refugee with proper information about transportation instantly. Prior to the use of the system registration of user's privacy information would be needed. That is why such a system would require strong security measures.

Anshin is a Japanese noun that stands for sense of security. Conventional research on information security continues to be conducted as it assumes that secure systems is what gives Anshin to users. But, such systems do not necessarily provide Anshin, because Anshin includes emotional elements [2]. A study of Anshin is expected to help service providers to develop and provide the user a system giving Anshin. Security can be assessed by an objective analysis. However, assessing Anshin is more difficult than assessing security.

Human's subjectivity and sensibility are assessed by Subjective assessment. It is mainly used in psychological studies, but has also been used in engineering science for assessment of human interfaces. It is conducted using a questionnaire. If the result has appropriateness and credibility, it is objective.

Current information security measures can be seen from the point of IT technology and management, but the two elements are not necessarily for the purpose of getting new knowledge. If knowledge of psychological studies is combined with the information security measures, more development is expected [3].

Hence, in our study, we investigated the level of people's Anshin when registering their privacy information onto the return refugee supporting system, and analyzed it by using subjective assessment. Finally, we discussed about a secure system providing Anshin to users.

2. BACK GROUND

2.1 Flood Damage of Japan

Japan is a country with many floods from old days. Generally, the rivers of Japan are sharper than those of the other countries. If it rains heavily in the upper stream of a Japanese river, the river is swollen immediately. Many banks have been constructed as river improvement measures. But in 2000, the heavy rain called "Tokai-downpour" has damaged seriously. Damage more than 280 billion yen was given. Roughly fifty thousand people got home difficultly and seven people died. In 2008, it was the rain of the maximum amount in history of observation. In 2011, many people were return refugee [4]. In the year, the damage caused by flood was approximately 1 trillion yen [5].

Damage caused/brought by floods has changed as the urbanization from 1900's. The urbanization has lowered the function of water retention and draining. If the amount of rain is over the permissible amount, the inundation damage to a house crowd place, facilities under the ground and the paralysis of the city function (traffic and lifeline) is given. These floods is called urban type flood [6].

2.2 Disaster Prevention and Disaster Mitigation

In traditional Japanese flood-control measures, "Hard measure" as building banks and dams has been thought important. However, "Hard measure" is not sufficient to reduce damage of heavy rain beyond expectations. Therefore, "Synthetic flood-control measure" is considered that it reduces damage to the minimum. "Synthetic flood-control measure" includes "Hard measure" and "Soft measure". "Soft measure" is actions for disaster mitigation. For example, hazard maps, disaster drills, provision of information at the time of disaster, and so on. There are people's actions on the assumption that disasters have occurred. These are people's actions on the assumption that disasters occur.

At the time of the typhoon in 2011, people were not satisfied with the official web sites of public transportation, compared with the other sites [1]. Because the information of the sites was not updated in real time. The other sites, like SNS, provide information of transportation. But some of that was a just false rumor. This context is seen to be insufficiency of "Soft measure". It is difficult for flood victims to get correct information. A supporting system for giving correct information to victims immediately is necessary.

There are supporting systems for disaster victims. For instance, "Victims Support System" by Nihon Unisys, Ltd [7] , "General Disaster Prevention Information System" by NTT East [8], and so on. Both of them help communication in a self-governing body at the time of disaster or the after. Therefore, these systems can't help the commuters who go to the other self-governing bodies. To support such people, cooperation of self-governing body or new system not depending on organizations is necessary. The privacy information of users is passed to plural self-governing bodies or organizations of providing the system. Hence, the risk of privacy invasion becomes increase. Anshin is needed for people registering privacy information with a system.

3. RELATED WORK

3.1 Related Work on Trust

"Anshin" is related to trust which has been studied in various disciplines such as sociology, psychology and economics. In late years, trust has been used for studies of the trust formation in the electronic commerce, and indicated its importance.

Constructs of trust are various in psychological view point. Camp [9] has considered that trust includes "Security", "Safety" "Reliability". Hoffman [10] has considered that trust includes "Security", "Safety", "Reliability", "Privacy", "Availability".

Traditional studies on trust were concerned primarily with cognitive trust [9]. Cognitive trust is defined as a trustor's rational expectation that a trustee will have the necessary competence, benevolence, and integrity to be relied upon [11]. On the other hand, the emotional trust is defined as an emotional security, or feeling secure, or comfortable [12]. Xiao says that emotional trust is feeling, while cognitive trust is cognition [12].

According to Hoffman, trust doesn't include knowledge [10]. He said that knowledge affects trust and include a reputation of trustee.

3.2 Related Work on Anshin

"Anshin" is a Japanese noun which is a sense of security. In Japan, there are studies of Anshin for information security.

Hikage [13] has made an investigation of Anshin. The respondents were primarily students majoring in software and information science. In the result, she has identified six factors: "Security technology", "Usability", "Experience", "Preference", "Knowledge" and "Assurance". And these factors were divided into two parts: "Environmental" and "Personal". "Environmental" includes "Security technology", "Usability" and "Preference". "Personal" includes "Experience", "Knowledge" and "Assurance". The structure of Anshin is shown in Figure 1. However, the path coefficient from "Personal" to "Knowledge" was lower than the other ones. Hikage has said that "Knowledge" is interpreted as the other model of their hypothesis. Furthermore, she has considered that knowledge of security technology affected Anshin. More investigation of people, who don't have knowledge of security technology, has been required.

Fujiwara [14] has made an investigation of Anshin to staffs of a city. He has regarded staffs of a city as not having knowledge of security technology. In the result, he has identified five factors: "Cognitive trust", "Kindness", "Understanding", "Preference" and "familiarity". Fujiwara says that knowledge of security technology more affected Anshin than the other attributes.

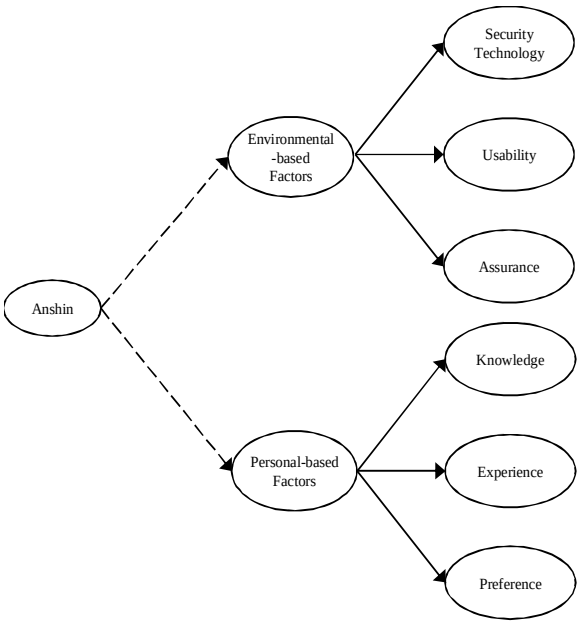

Figure 1 Structure of Anshin of the existing studies.

According to the above-mentioned studies, users not having knowledge of security technology tend to think that provider's conscience, benevolence and kindness are important. And further examination about knowledge is necessary.

Nishioka [15] has made an investigation of Anshin to various respondents groups. Group1 members have often used online shopping. In the result of investigation of Group1, factors of Anshin are "Subjective cognitive trust", "Preference" and "Reputation". Group2 members have never used online shopping. In the result of investigation to Group2, factors of Anshin are "Trust for a system", "Preference", "Reputation", "Interface" and "Personal information management". He has discovered that user's experience affects the factors of Anshin. Users having experiences of online shopping consider that provider's conscience and benevolence are important. On the other hand, users having no experience consider that provider's competence. Both of the results of the two groups had "Preference" and "Reputation" in common.

3.3 Related Work on Determinants of Disaster Preparedness

There are studies of determinants of disaster preparedness. Conventional studies have focused on household disaster preparedness. But, Motoyoshi, Takao and Ikeda's study [16] have taken up household and community disaster preparedness. They have conducted a questionnaire survey and have revealed that determinants of household and community disaster preparedness. The result is shown in Figure 2.

The study has revealed that both household and community disaster preparedness were affected by the individual's subjective norm regarding preparation, the perceived benefit of protective courses of action, general concern about natural disasters. Commitment to the community and concern about society were

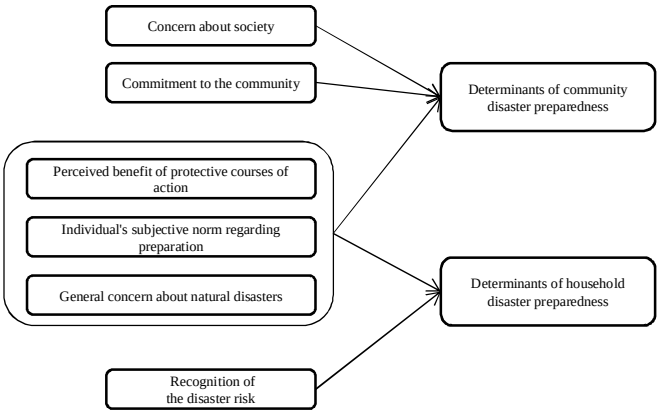

Figure 2 Causal relationship of determinants of disaster preparedness.

the only strong predictors of community-based disaster preparedness.

4. SURVEY ON ANSHIN

4.1 Hypothesis

Before we conduct a questionnaire survey, we build a hypothesis about the factor of Anshin when users register their privacy information to return refugee supporting system. Our hypothesis based on studies of Anshin.

First, based on [17], we expected that factor of Anshin is "Familiar people". The result of [17] is that college students think "family", "together somebody" and "friend" from Anshin. Therefore, we considered that "Familiar people" have related to Anshin. We consider that, if users register their privacy information with their family or friend, they feel Anshin.

And, based on [13], [14] and [15], we expected that factors of Anshin are "Preference", "Usability", "Reputation of the provider", "Knowledge about the information technology and the structure of the system", "Cognitive trust". Especially, Anshin of various people is affected by "Preference". We considered that these factors are related to Anshin for registering privacy information system to return refugee supporting system. Here is the summary of the hypothesis of factor of Anshin.

- Familiar people
- Preference
- Usability
- Reputation of the provider
- Knowledge about the information technology and the structure of the system
- Cognitive trust

4.2 Questionnaire Survey

Based on the hypothesis, we conducted a questionnaire survey on Anshin. We used [18] as a reference. Our survey include the following question: "Do you feel that the following thirty eight items account for sense of security when you register your privacy information to return refugee supporting system?" We used seven-point Likert scale system ranging from strongly disagree (1) to strongly agree (7). Many such surveys have used this scale.

Table 1 Amount of descriptive statistics (N=207).

items	Average	Standard deviation	Skewness	Kurtosis
A1 I am confident in the competence of the provider and its owner.	5.005	0.694	-0.863	0.524
A2 I know the provider and its owner.	4.314	0.460	-0.213	-0.812
A3 Personal information which I input is managed carefully and it will not be leaked to the outside.	4.478	1.196	-0.356	-1.071
A4 The design of the system is attractive.	3.783	1.330	0.059	-0.422
A5 At first glance, I receive the impression that there is enough explanation and information present.	4.512	1.757	-0.273	-0.080
A6 Many people use the system.	4.884	2.123	-0.418	-0.392
A7 I feel Anshin when register my information to the system with my friend.	3.372	1.826	0.191	-0.777
A8 The provider and its owner have social credibility.	5.058	2.079	-0.683	0.136
A9 I know the structure of the system	4.498	1.684	-0.416	-0.436
A10 The personal information is managed severely.	5.072	1.883	-0.707	-0.323
A11 The layout and color of the system design are attractive.	3.686	1.944	0.074	-0.500
A12 It is easy to use the system or service.	4.440	1.290	-0.213	-0.076
A13 Since I frequently use the system or service, I am used to it.	4.266	1.340	-0.509	-0.483
A14 I feel Anshin when register my information to the system with my friend.	3.599	1.329	-0.010	-0.385
A15 The provider and its owner have enough ability and achieve.	4.860	1.077	-0.742	0.499
A16 I know the risks and security threats when I use the system or service.	4.802	1.617	-0.430	-0.410
A17 Even if I had a trouble, I would be protected by a guarantee.	4.531	1.813	-0.285	-0.736
A18 I feel familiar about the system design.	3.575	1.507	-0.061	-0.310
A19 The usability of system is excellent.	4.237	1.537	-0.251	-0.241
A20 I feel secure without any specific reason.	3.280	1.410	0.093	-1.109
A21 I feel Anshin when register my information to the system with my family.	3.464	1.574	0.239	-0.370
A22 The systems and services provided by a large company are secure.	4.493	1.494	-0.418	-0.095
A23 I know quite a lot about information technology.	4.126	1.436	-0.295	-0.516
A24 I feel secure when I use the system or service.	4.488	1.421	-0.365	-0.262
A25 The system or service is just according to my taste.	3.604	1.299	-0.081	-0.466
A26 Since the system or service provides deliberate explanation on how to use it, I get the impression that I am treated well.	4.449	1.718	-0.343	-0.064
A27 I like the system or service without any specific reason.	3.459	2.251	0.045	-0.544
A28 The service provider and its owner company act based on benevolence.	4.005	1.384	-0.284	-0.258
A29 Even if I had a trouble, the system would assist me to solve it.	4.213	1.356	-0.273	-0.549
A30 Compared to other systems, we need only a few cumbersome operations and it is easy to use the system or service.	4.227	1.951	-0.373	-0.144
A31 The service provider and its owner company would never deceive their customers.	3.314	1.457	0.347	-0.669
A32 I feel confident that my systems have security protection.	4.333	1.569	-0.235	0.142
A33 Even if I had a trouble, I feel secure when the system recover.	3.377	1.545	0.125	-0.804
A34 The system or service has enough security.	4.787	1.543	-0.543	-0.018
A35 Companies care about security.	4.952	1.400	-0.712	0.359
A36 Since I frequently use the system or service, I am not worried about its security.	3.696	1.862	0.030	-0.311
A37 Since my family or friends use the system or service, I feel secure when I use it.	3.614	1.327	0.043	-0.558
A38 I am favorably impressed by the helpful reply or service provided.	4.348	1.466	-0.351	-0.111

Table 2 Factor pattern matrix (N=207).

	items	I	II	III	IV	V
A3	Personal information which I input is managed carefully and it will not be leaked to the outside.	0.851	-0.222	-0.058	0.152	-0.035
A9	I know the structure of the system	0.774	0.006	0.082	-0.242	-0.174
A2	I know the provider and its owner.	0.761	-0.006	0.031	-0.044	-0.141
A10	The personal information is managed severely.	0.751	0.072	-0.109	0.125	0.128
A17	Even if I had a trouble, I would be protected by a guarantee.	0.735	-0.010	0.004	-0.123	0.094
A1	I am confident in the competence of the provider and its owner.	0.694	-0.101	0.118	0.102	-0.112
A8	The provider and its owner have social credibility.	0.660	0.035	0.010	0.068	0.168
A24	I feel secure when I use the system or service.	0.629	-0.001	0.099	0.004	0.163
A15	The provider and its owner have enough ability and achieve.	0.570	0.169	-0.006	-0.083	0.145
A16	I know the risks and security threats when I use the system or service.	0.493	0.128	0.035	-0.336	0.059
A29	Even if I had a trouble, the system would assist me to solve it.	0.437	0.236	0.155	0.143	0.076
A19	The usability of system is excellent.	-0.124	0.866	0.105	-0.083	0.073
A12	It is easy to use the system or service.	0.046	0.826	0.086	-0.092	0.061
A18	I feel familiar about the system design.	0.002	0.768	-0.053	0.255	-0.069
A11	The layout and color of the system design are attractive.	-0.115	0.749	-0.147	0.356	-0.067
A30	Compared to other systems, we need only a few cumbersome operations and it is easy to use the system or service.	-0.105	0.711	0.188	0.101	0.032
A4	The design of the system is attractive.	0.127	0.693	-0.167	0.417	-0.193
A26	Since the system or service provides deliberate explanation on how to use it, I get the impression that I am treated well.	0.120	0.622	0.256	-0.093	0.050
A5	At first glance, I receive the impression that there is enough explanation and information present.	0.346	0.614	-0.077	0.053	-0.047
A21	I feel Anshin when register my information to the system with my family.	-0.025	0.036	0.800	0.096	-0.008
A37	Since my family or friends use the system or service, I feel secure when I use it.	0.026	-0.065	0.796	0.192	-0.054
A7	I feel Anshin when register my information to the system with my friend.	-0.002	-0.016	0.702	0.286	-0.132
A14	I feel Anshin when register my information to the system with my friend.	0.079	0.014	0.688	0.078	-0.032
A13	Since I frequently use the system or service, I am used to it.	0.235	0.229	0.430	-0.142	-0.016
A20	I feel secure without any specific reason.	-0.178	0.044	0.336	0.589	0.019
A31	The service provider and its owner company would never deceive their customers.	0.158	0.008	0.253	0.525	0.118
A33	Even if I had a trouble, I feel secure when the system recover.	-0.011	0.081	0.279	0.449	0.172
A27	I like the system or service without any specific reason.	-0.162	0.243	0.374	0.443	-0.063
A34	The system or service has enough security.	0.369	-0.102	-0.046	0.092	0.748
A35	Companies care about security.	0.413	0.044	-0.092	0.046	0.653
	Eigenvalue	11.962	4.868	2.090	1.634	1.215
	Contribution(%)	36.249	14.752	6.334	4.951	3.682
	Cumulative(%)	36.249	51.001	57.335	62.287	65.969
	Cronbach's coefficient alpha	0.915	0.923	0.862	0.799	0.927

First, we conducted a preliminary investigation for verification of survey in Dec.30 2012. Seventy eight students of the engineering department answer the survey for about 10 minutes. And the respondent's opinion doesn't have a problem. Therefore, we adopted of the survey as the main investigation.

The main investigation was conducted from Nov.13 to Nov.14 in 2012. Two hundred and nineteen students of the engineering department joined in the survey. One hundred and eighty five were male, and twenty two were female. The average age was 19.4. We used the answer of two hundred and seven students for analysis with the exception of omitted answer. Average, standard deviation, skewness and kurtosis of all items are shown in Table 1. We used all items for analysis, because the skewness and kurtosis of all items are below 2 and not too big.

4.3 Factor Analysis Results

We analyzed the survey responses using exploratory factor analysis (EFA). EFA was conducted by JMP Pro 10.0.0 (SAS Institute Inc.). We used [19] and [20] as a reference. The main results are shown in Table 2. Five factors were founded by EFA using the maximum-likelihood method and promax rotation. We tried analysis several times to get effective items out of thirty eight and found that thirty one items would be feasible as contributing to the sense of security. They fell into the following factor structure.

Factor 1: Capability and Knowledge
Factor 2: Usability and Preference
Factor 3: Familiar People
Factor 4: Unfounded Confidence
Factor 5: Safety

All items have factor loading above 0.399. The five factors were explained by 65.969% (Cumulative).of the total. To confirm reliability of measurement, we confirmed Cronbach's coefficient alpha. The alpha about all factors shows reliability high value of alpha more than 0.699. Here is summary of each factor.

Factor 1: Capability and Knowledge
It is consists of 11 items (A3, A9, A2, A10, A17, A1, A8, A24, A15, A16, A29) about the provider's capability and user's knowledge. The provider's capability is consists of the provider's security technology and an assurance. User's knowledge is consists of about information technology, structure of the system and reputation of the provider.

Factor 2: Usability and Preference
It is consists of 8 items (A19, A12, A18, A11, A30, A4, A26, A5) about usability and preference of the system. Usability is consists of satisfaction with the user interface (UI). Preference is consists of interface design.

Factor 3: Familiar People
It is consists of 5 items (A21, A37, A7, A14, A13) about user's family or friends.

Factor 4: Unfounded Confidence
It is consists of 4 items (A20, A31, A33, A27) about user's unfounded sense of security and confidence in the provider.

Factor 5: Safety
It is consists of 2 items (A34, A35) about safety of the system.

The factor correlation matrix is shown in Table 3. All values of the matrix are plus and significant with the exception of two values. The one is the value between "Capability and Knowledge" and "Unfounded Confidence". The two is the value between "Unfounded Confidence" and "Safety". The highest correlation coefficient was calculated between "Capability and Knowledge" and "Familiar People". The second highest correlation coefficient was calculated between "Capability and Knowledge" and "Safety". Furthermore, "Capability and Knowledge", "Usability and Preference", "Familiar People" and "Safety" correlate to each other. "Usability and Preference", "Familiar People" and "Unfounded Confidence" correlate to each other. On the other hand, "Safety" and the other factors don't correlate much.

Table 3 Factor correlation matrix.

	Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ
Ⅰ	-	0.305*	0.383*	0.121	0.529*
Ⅱ		-	0.568*	0.276*	0.376*
Ⅲ			-	0.250*	0.336*
Ⅳ				-	0.007
Ⅴ					-

$p < 0.001^*$

4.4 Multiple Regression Analysis

We analyzed the survey responses using multiple regression analysis (MRA). MRA was conducted by JMP Pro 10.0.0 (SAS Institute Inc.).

We analyzed that Factor 1 is given an effect by the other factors. The results are shown in Figure 3. Factor 3 and Factor 5 give a significant effect to Factor 1 with significance level 0.1%. Each standardised partial regression coefficients are 0.217 and 0.458. According to the results, if the users think "Familiar People" or "Safety" as Anshin, they tend to think "Capability and Knowledge" as Anshin, too.

We analyzed that Factor 2 is given an effect by the other factors. The results are shown in Figure 4. Factor 3, Factor 4 and Factor 5 give a significant effect to Factor 2 with significance level 0.1%. Each standardised partial regression coefficients are 0.455, 0.161 and 0.226. According to the results, if the users think "Familiar People", "Unfounded Confidence" or "Safety" as Anshin, they tend to think "Usability and Preference" as Anshin, too.

We analyzed that Factor 3 is given an effect by the other factors. The results are shown in Figure 5. Factor 1 and Factor 2 give a significant effect to Factor 3 with significance level 0.1%. Each standardised partial regression coefficients are 0.217 and 0.458. According to the results, if the users think "Capability and Knowledge" or "Usability and Preference" as Anshin, they tend to think "Familiar People" as Anshin, too.

We analyzed that Factor 4 is given an effect by the other factors. The results are shown in Figure 6. Factor 2 and Factor 5 give a significant effect to Factor 4 with significance level 0.1%. Each standardised partial regression coefficients are 0.234 and -0.175. According to the results, if the users think "Usability and Preference" as Anshin, they tend to think "Unfounded Confidence" as Anshin, too.

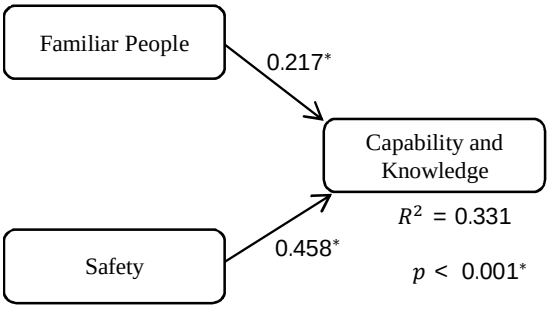

Figure 3 Causal relationship of Factor 1 from the other factor.

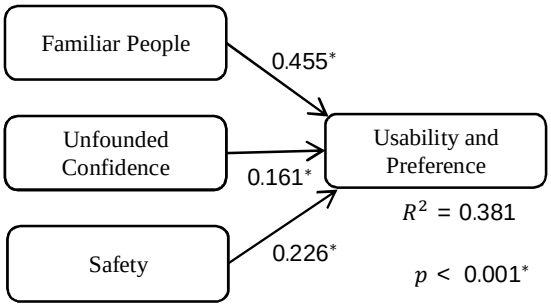

Figure 4 Causal relationship of Factor 2 from the other factor.

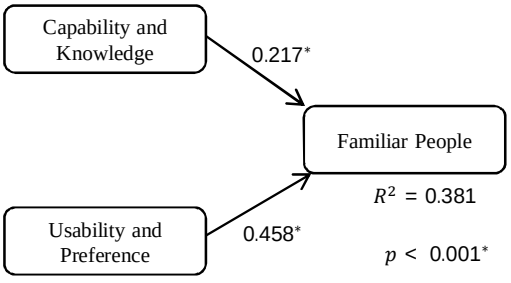

Figure 5 Causal relationship of Factor 3 from the other factor.

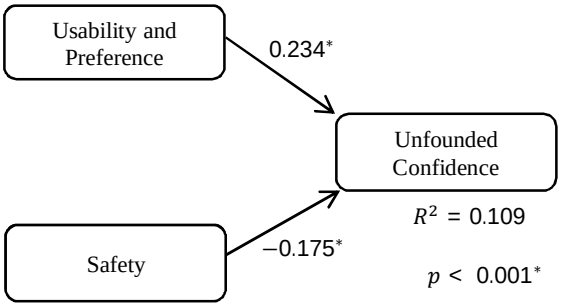

Figure 6 Causal relationship of Factor 4 from the other factor.

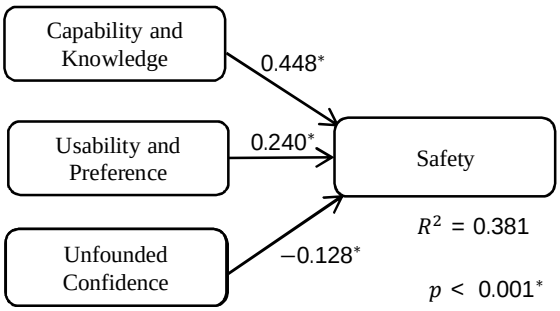

Figure 7 Causal relationship of Factor 5 from the other factor.

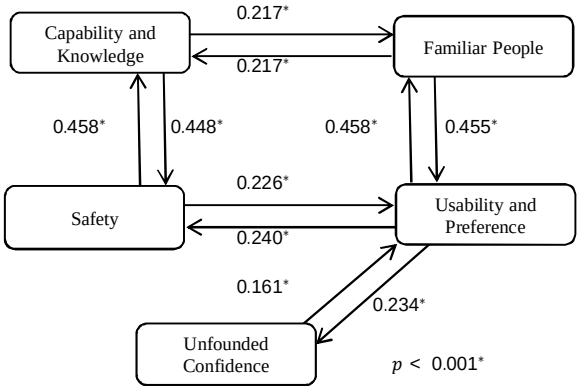

Figure 8 Causal relationship of factors.

We analyzed that Factor 5 is given an effect by the other factors. The results are shown in Figure 7. Factor 1, Factor 2 and Factor 4 give a significant effect to Factor 5 with significance level 0.1%. Each standardised partial regression coefficients are 0.488, 0.240 and -0.128. According to the results, if the users think "Capability and Knowledge" or "Usability and Preference" as Anshin, they tend to think "Safety" as Anshin, too.

The summary of the above-mentioned figures (Figure 2, 3, 4, 5, 6) is shown in Figure 8. If the sign of standardised partial regression coefficient is negative and the sign of correlation coefficient is positive, causal relationship is not considered between two factors. Accordingly, all five factors are affected with any other factors.

5. THE STRUCTURE OF ANSHIN

5.1 Hypothesis

In this subsection, we build a hypothesis about the structure of the five factors founded by factor analysis.

It would appear that the five factors have two aspects. For example, "Capability and Knowledge" and "Safety" are based on the user's logical ground. According to subsection 3.2, cognitive trust is defined as a trustor's rational expectation. Therefore, we consider that "Capability and Knowledge" and "Safety" are part of cognitive trust. On the other hand, "Usability and Preference", "Familiar People" and "Unfounded Confidence" are based on the user's emotion. According to subsection 3.2, emotional trust is defined as tending to trustor's emotion. Therefore, we consider that "Usability and Preference", "Familiar People" and "Unfounded Confidence" are part of emotional trust.

Based on the above discussion, Figure 9 depicts our hypothesis of the structure of Anshin. Cognitive-based factors include "Capability and Knowledge" and "Safety". Emotional-based factors include "Usability and Preference", "Familiar People" and "Unfounded Confidence".

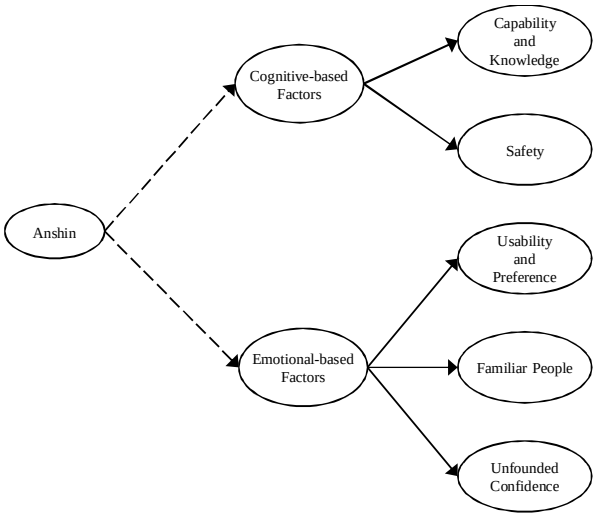

Figure 9 Hypothesis of structure of Anshin.

5.2 SEM Verification

In order to verify model, we conducted a confirmatory factor analysis (CFA) using Structural Equation Modeling (SEM). SEM is a statistical technique for verification of a hypothetical causal model. SEM was conducted by Microsoft Excel 2010 (Microsoft Japan). We used [21] as a reference. The results are shown in Figure 10 and Figure 11. The top 3 items having high factor loadings are selected to analyze as observed variables.

In the result, *e* is error and *d* is disturbance. The arrows are called paths and show the causal relationship of the two factors. The numbers of next to paths is path's coefficients. There show the size of the causal relationship of the two factors.

The models are acceptable with GFI (0.989 and 0.940) and RMSEA (0.072 and 0.084). GFI is shows goodness of fit. RMSEA is shows badness of fit. If GFI is above 0.9 and RMSEA is below 0.1, the model is good of fit. The path coefficient from high-order factors to low-order factors also is statistically-significant with significance level 0.1%. Therefore, Anshin has two dimensions; cognitive and emotional.

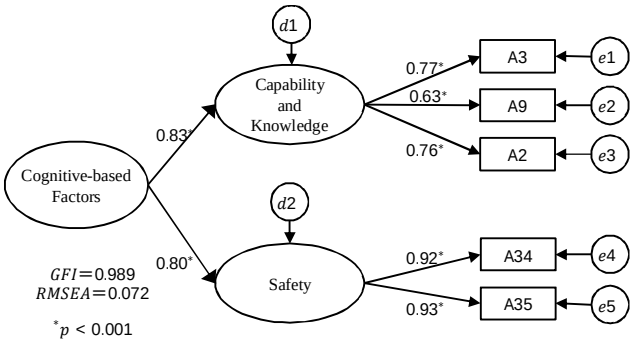

Figure 10 High-order factor model about a sense of security based on cognitive factors.

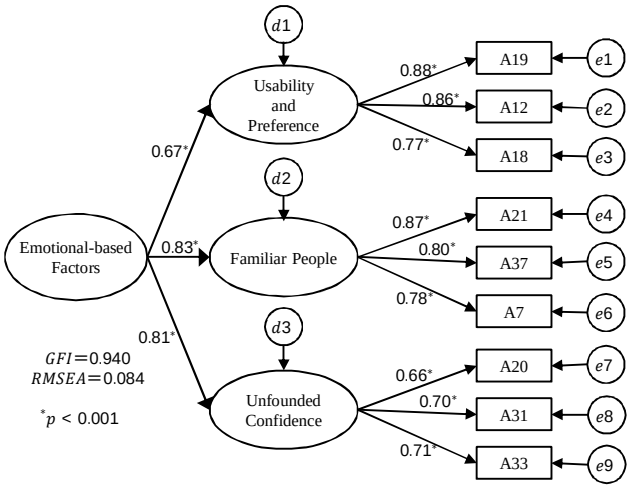

Figure 11 High-order factor model about a sense of security based on emotional factors.

6. DISCUSSION

6.1 Factor Correlation and Causal Relationship

In this subsection, we discuss the factor correlation and causal relationship. Factor correlation is showed in Table 3, and factor causal relationship is shown in Figure 8.

According to Table 3, the correlation coefficient between "Capability and Knowledge" and "Safety" is high comparatively. And it is significant with level 0.1%. We regarded the reason that these two factors connect with the company of the management of user's information.

The correlation coefficient between "Usability and Preference" and "Familiar People" is most high and it is significant with level 0.1%. "Usability and Preference" means good maneuverability and design of the system. "Familiar People" means input information with their family members or friends. We regard the reason of high correlation coefficient as that these two factors connect with user's emotional security and comfortableness.

According to Figure 8, all factors are affected by other factors. People, who think that one factor is important, think that the other factors are important to feel Anshin. Therefore, to provide a system giving Anshin to its users, all factors are needed. However, the size of the influence of each factor to Anshin may be different. To identify that, more investigation to various people and analysis of causal relationship between respondent's attribute and factors are necessary.

6.2 "Knowledge"

"Knowledge" including "Capability and Knowledge" is different from "Knowledge" of past study [11]. Existing "Knowledge" means knowledge of information technology, security measures and structure of the system. And "Personal based factor" is included in the model. The model is acceptable, but the path from high-order factor to "Knowledge" is low. On the other hands, in this study, "Knowledge" includes reputation of the provider. The model is acceptable, and the path from high-order factor to "Capability and Knowledge" is high sufficiently. Hence, "knowledge" as the one of factor of Anshin is considered including five elements. These are shown as following.

1. Knowledge of information technology
2. Knowledge of security measures
3. Knowledge of structure of the system
4. Knowledge of the provider
5. Reputation of the provider

4 and 5 are new elements of "Knowledge" as a factor of Anshin.

6.3 Event for Disaster Prevention

"Familiar People" is new factor compared with past study [11, 12, 13]. The factor means registering information with their family members or friends. Therefore, we consider that an event is important for Anshin. If the provider holds an event that people register their information to the system with their family or friends, increasing of the number of users is expected.

And, if the event includes giving information of disaster risks to participants, their intention of disaster preparedness is promoted. Because people who are interested in disaster or understand risks of it tends to have high intention of disaster preparedness [14]. Moreover, if the event is held for local people, their intention of disaster preparedness is promoted. Because people who have commitment to the community and concern about society tends to have high intention of disaster preparedness [14]. A local event is expected that people have more intention of disaster preparedness and feel Anshin to register information to the system.

6.4 Secure and Security System

In this subsection, we discuss a system and services giving Anshin to people from identified factors. We expected that if a system provider pays attention of the factors of Anshin, its system gives Anshin to users. First, we explain it from past study. Second, we explain it from this study. Finally, we compare these and show summary.

In existing study [11], six factors were identified. We consider traits of a system giving Anshin from the factors. These traits are shown as following. But, "Experience", "Knowledge" and "Assurance" don't have traits which a provider can apply to a system. "Experience" is based on user's own experience. "Knowledge" is based on user's knowledge of information technology or security measures. "Assurance" is based on feeling provider's confidence. It is conceivable that a provider can't affect the three factors directly. On the other hands, the traits of the other three factors can be affected by provider's actions. These system provider's actions to giving Anshin are shown as following.

Factor 1: Security Technology
- Safe management of the information
- Safe measures

Factor 2: Usability
- Improvement of the operability of the system

Factor 3: Preference
- Making the design of the screen of the system an attractive one

From each factor of this study, we consider system provider's actions giving Anshin. But, "Unfounded Confidence" is not considered. The factor is based on user's feeling of confidence. Therefore, it is conceivable that a provider can't affect the factor directly. System provider's actions for giving Anshin are shown as following.

Factor 1: Capability and Knowledge
- Safe management of the information
- Letting users know provider's capability

Factor 2: Usability and Preference
- Improvement of the operability of the system
- Making the design of the screen of the system an attractive one

Factor 3: Familiar People
- Holding an event that people register their information to the system with their family or friends

Factor 4: Safety
- Safe measures

We considered that the actions of the above mentioned are divided in two groups: the actions of system provider and service

provider. The role of system provider is building and providing systems. The role of service provider is providing services and support users. Actions of the two roles are shown as following.

System Provider's Actions

- Safe management of the information
- Safe measures
- Improvement of the operability of the system
- Making the design of the screen of the system an attractive one

Service Provider's Actions

- Letting users know provider's capability
- Holding an event that people register their information to the system with their family or friends

The above System Provider's Action is the same as the actions considered from existing study. The factors of existing study are capable of being reached the factors of existing study are capable of being reached by System Provider's Action. However, the factors of this study are not capable of being reached by only System Provider's Action. To provide the system giving Anshin to people, not only system provider also service provider.

7. CONCLUSIONS

This paper summarizes the results of our survey and the discussion about Anshin. We conducted a survey about the sense of security that people feel when they register their privacy information onto a return refugee supporting system. Out of this, five factors was identified by factor analysis: "Capability and Knowledge", "Usability and Preference", "Familiar People", "Unfounded Confidence", "Safety". These five factors are necessary for people to feel "Anshin". The results of multiple regression analysis showed that any other factor is affected by one of the five factors. Furthermore, validation results using SEM showed that the structure of the sense of security has both a cognitive dimension and an emotional dimension.

According to the result of factor analysis, "Knowledge" included in "Capability and Knowledge" is composed of not only the user's knowledge about information technology and structure of the system, but also the reputation of the provider. Also, the five factors indicate that the proper functioning of the following two parts is important in providing Anshin. These are: the system provider and the service provider that supplies the users with information on the event of an emergency by the means of the privacy information registered together with their family.

Our Anshin factors may be biased because of the properties of the sample group of people used for the questionnaire, which is why we would like to conduct the analysis on different groups as well. The feeling of security can be disrupted by contributing factors of phishing. That is why we would also like to look into this problem.

ACKNOWLEDGEMENTS

This work was supported in part by JSPS KAKENHI Grant-in-Aid for Scientific Research.

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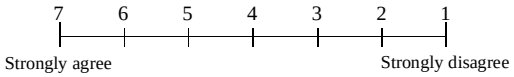
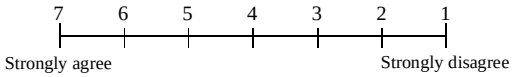
APPENDIX-Summary of the questionnaire survey

Do you feel that the following thirty eight items account for sense of security when you register your privacy information to return refugee supporting system? In the following items, please check a number to fulfill your feeling best.

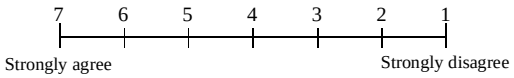
(1) I am confident in the competence of the provider and its owner.



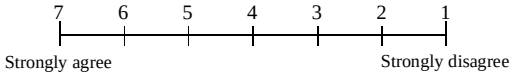
(2) I know the provider and its owner.



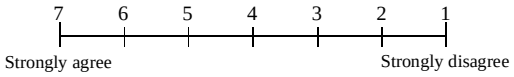
(3) Personal information which I input is managed carefully and it will not be leaked to the outside.



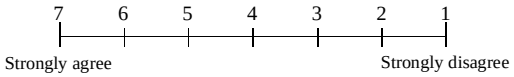
(4) The design of the system is attractive.



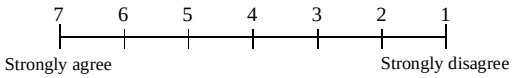
(5) At first glance, I receive the impression that there is enough explanation and information present.



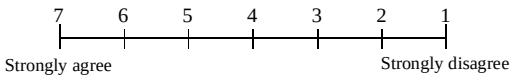
(6) Many people use the system.



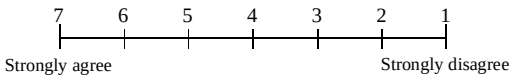
(7) I feel Anshin when register my information to the system with my friend.



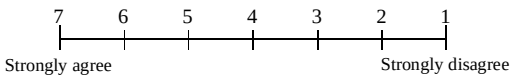
(8) The provider and its owner have social credibility.



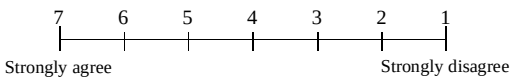
(9) I know the structure of the system



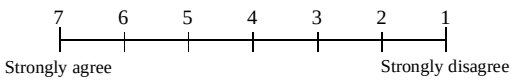
(10) The personal information is managed severely.



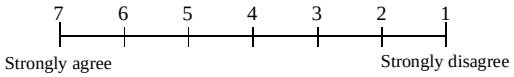
(11) The layout and color of the system design are attractive.



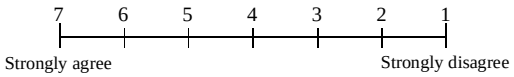
(12) It is easy to use the system or service.



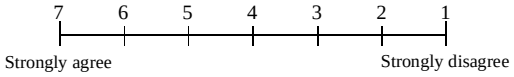
(13) Since I frequently use the system or service, I am used to it.



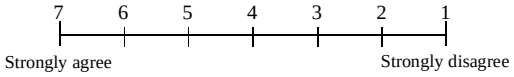
(14) I feel Anshin when register my information to the system with my friend.



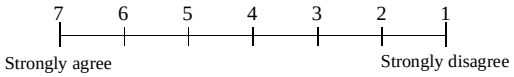
(15) The provider and its owner have enough ability and achieve.



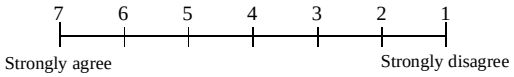
(16) I know the risks and security threats when I use the system or service.



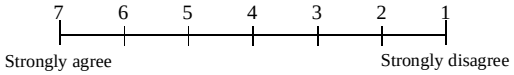
(17) Even if I had a trouble, I would be protected by a guarantee.



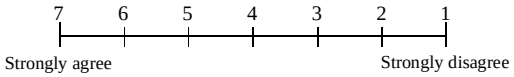
(18) I feel familiar about the system design.



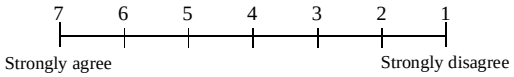
(19) The usability of system is excellent.



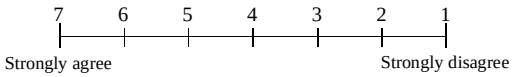
(20) I feel secure without any specific reason.



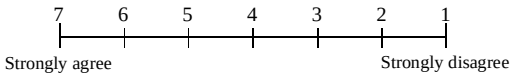
(21) I feel Anshin when register my information to the system with my family.



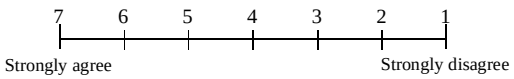
(22) The systems and services provided by a large company are secure.



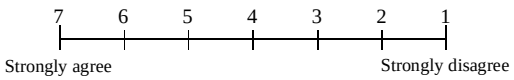
(23) I know quite a lot about information technology.



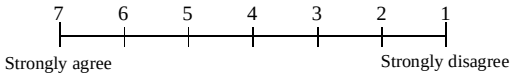
(24) I feel secure when I use the system or service.



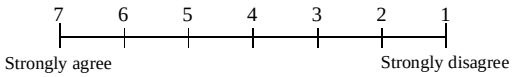
(25) The system or service is just according to my taste.



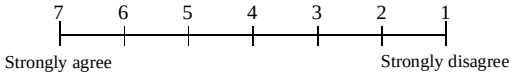
(26) Since the system or service provides deliberate explanation on how to use it, I get the impression



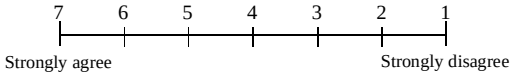
(27) I like the system or service without any specific reason.



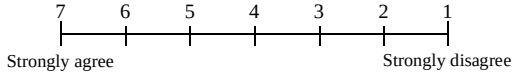
(28) The service provider and its owner company act based on benevolence.



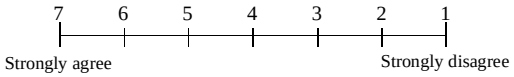
(29) Even if I had a trouble, the system would assist me to solve it.



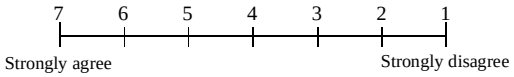
(30) Compared to other systems, we need only a few cumbersome operations and it is easy to use the system or service.



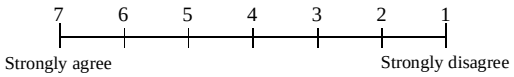
(31) The service provider and its owner company would never deceive their customers.



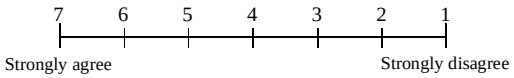
(32) I feel confident that my systems have security protection.



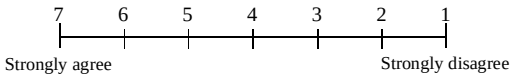
(33) Even if I had a trouble, I feel secure when the system recover.



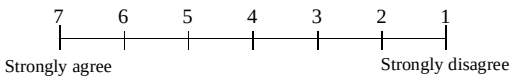
(34) The system or service has enough security.



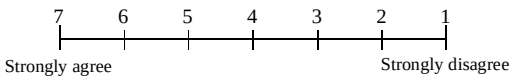
(35) Companies care about security.



(36) Since I frequently use the system or service, I am not worried about its security.



(37) Since my family or friends use the system or service, I feel secure when I use it.



(38) I am favorably impressed by the helpful reply or service provided.