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Questionnaire Testing: Identifying Twitter User's Information Sharing Behavior during Disasters

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Abstract: The use of Twitter by citizens during catastrophic events is increasing with the availability of Internet services and the use of smartphones during disasters. After the Great East Japan Earthquake on 2011, Twitter was flooded with lots of disaster information, including misinformation that have been widely spread by retweet. Accordingly, we developed a questionnaire to investigate factors influenced people decision making to retweet disaster information they read from Twitter in disaster situations. We developed a questionnaire using brainstorming and KJ method and conducted a user survey (n = 57) to test the questionnaire items. Then, we analyzed using exploratory factor analysis and as a result, five factors derived from 38 question items which are: 1) Trustworthy information, 2) Relevance of the information during disasters, 3) Willingness to supply the information, 4) Importance of the information, and 5) Self Interest. However, there are 7 question items that need revision based on the results of the factor analysis. In this paper, we discuss the method we used to design the questionnaire and the result of the factor analyses of the questionnaire testing.

Keywords: questionnaire testing, information sharing, Twitter, disaster

1. Introduction

The utilization of social media such as Twitter during disasters allows everybody involved in reporting news and become citizen reporter. In an uncertain situation during disasters, not knowing whom and which information to trust raised an issue of information overload. Information credibility [1], [2], [3] and the spread of misinformation [4], [5], [6] are the problems of social media used during emergencies. Just after the Great East Japan Earthquake in 2011, Twitter is flooded with various information reporting self-experience, safety status, warning, fact, and also hoax messages [7], [8], [9]. On Twitter, information can continuously change from correct to incorrect due to retweeting timing [10]. Several studies in the literature highlight the potential of social media on misinformation and rumor transmission during emergencies [5], [6], [7], [11]. Misinformation may not only cause a delay in response and effort for emergency management rescue, but it also affect the public who want to know how they should prepare and react to the ambiguous situation happen around them. Thus, this research is motivated by the need to understand user behavior of information diffusion on Twitter during disasters. Few research from psychology viewpoint investigated the relationship between anxiety, importance, distance and feelings with rumor transmission and crisis information sharing behavior in disaster situations [5], [12], [13]. However, several aspects such as the Twitter features, cognitive and trust factors which may influence one decision to spread disaster information are still vague. Therefore, this research bridges this knowledge gap.

Our research target is towards developing the human information sharing decision-making model in disaster situation. We aim to gain insight to answer the following general research question: "*Why people decide to retweet disaster information during disasters?*" In our study, we focus on the scenario when a Twitter user reads disaster-related information in a disaster situation, and investigate the factors that influence the user's decision to spread by retweet this information. To the best of our knowledge, there is no related work to support our research questions. Therefore, we conducted an exploratory study by brainstorming to understand users' behavior of disaster information diffusion in disaster situations. Previous study [14] investigates one action after they read the retweeted message, and what factors contribute to user decision making to perform retweet. However, the retweet model did not focus on retweet behavior in the disaster situations. Thus, we created new questionnaire by collecting opinions from brainstorming sessions and sort the ideas using the KJ method. We integrated the question items from our previous work and combine with the question items generated from brainstorming. The purpose of brainstorming session is to collect ideas from targeted group and combine the ideas with question items from previous study to develop the questionnaire. Then, we created a questionnaire and conducted a user survey to test the proposed questionnaire. The purpose of the questionnaire development is to identify factors related to individual decision-making to spread disaster information by using a retweet function on Twitter which may cause both information and misinformation to circulate in social media. Next, we conduct a user survey to test the questionnaire proposed and we perform exploratory factor analysis to check and correct the problem question items. In this paper, we

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report the results of the factor analysis and the new construct of the questionnaire to be used for the main survey with larger sample size in future. Our research focus is to understand human decision making factors to spread disaster information on Twitter during disasters. The focus is on the citizen, who utilized Twitter as disaster communication tool.

The rest of the paper is organized as follows. Section 2 discusses the background of the study. In Section 3, we describe our approach of creating the questionnaire. Meanwhile, Section 4 presents the preliminary survey and factor analysis results. Section 5 describes the discussion of findings and the new questionnaire construct. Finally, we conclude the work and future work plan in Section 6.

2. Background of the Study

Social media have been used extensively by citizens and organizations to generate and supply disaster information during catastrophic events such as: Haiti Earthquake [15], The Great East Japan Earthquake [7], [16], [17] and Hurricane Sandy [4]. In Japan, Twitter is utilized more than Facebook and Mixi during and after the earthquakes with 63.9 percent of surveyed users agree Twitter helps them to gather information about the disaster [18]. Hence, there is no doubt that social media has become one of the most dependable disaster communication tools for citizens and authorities to engage with the public during a disaster. However, in ambiguous situation during disasters, and the need of updated information is crucial, people will accept any information which could help them to make sense of the situation. From the classical literature of rumor, Allport and Postman state two basic conditions for rumor, which are the story theme is important to the speaker and listener, and surrounded by some kind of ambiguity [19]. The definition of rumor by DiFonzo and Bordia [20] on rumor psychology is: "*Unverified and instrumentally relevant information statements in circulation that arise in contexts of ambiguity, danger or potential threat and that function to help people make sense and manage risk*." Shibutani [21] state that rumor is generated if the demand for news is high, but the information supply is low. With social media, everybody can generate and disseminate information because they are the real first respondents in the event [22]. According to analysis by Fukushima [9], most of the tweets during The Great East Japan Earthquake were accurate and highly reliable, but among them contained noise particularly in the disaster affected area. At the time where people need the information, with a bundle of information from social media, one needs to decide on accepting or not the available information. Thus, our research focus is to investigate factors related to individual decision-making to spread disaster-related information on Twitter during disasters.

2.1 Individual Decision-making

Few researches from psychology areas investigate the relationship between importance, anxiety, feelings, distance, fluency, and people's perception on how it affects disaster-related information sharing in the social media environment [6], [12], [13], [23]. According to Chen [5], when people have negative feelings such as angry, nervous or worried, they tend to spread crisis information. Tanaka et al. [6] stated that individual intends to transmit the tweet that they evaluate as more important regardless of the tweet type during disasters. Furthermore, Li et al. [23] stated that the ease of processing, or fluency of the information influence people's decision to spread the information. However, these studies investigation did not concerned with the nature of Twitter features such as how the number of retweets, followers influence, credibility of information, trust and cognitive aspects of an individual which may influence their decision-making to spread disaster information online.

Meanwhile, the research from emergency management indicated that judgment and decision-making of emergency managers under stress is an influence of analytical or cognitive factors such as knowledge one possessed, experience and the emotional part [24]. Dugdale et al. [15] stated that the emotional state of the citizens affects texting behavior during the 2010 Haiti Earthquake. In recent years, research in the emergency management area focuses on the utilization of social media for mass collaboration in response and rescue for emergency professional [1], [2], [4]. With citizen participation in supplying disaster information through their own social network, trustworthiness, information overload and privacy issues raised the barrier for emergency managers in utilizing the social media during emergencies [25]. Hence, as the information supplied from citizens in social media are also beneficial during emergency preparedness and response, we aim to gain insights on what makes the Twitter users spread the disaster information during disasters. Compared to Facebook and other social media platforms, citizens in Japan utilized Twitter more to gather disaster information during the 2011 Great East Japan Earthquake [17], [18]. Our research focus is on the citizens, who utilized Twitter as a disaster communication tool. Accordingly, we have created a questionnaire and conducted a user survey to test the questionnaire.

2.2 Development of a Questionnaire

The questionnaire is a survey instrument which consists of a set of questions that allows many variables to be measured [26]. In general, the questionnaire can be designed as: 1) The close-ended and open-ended questions, and 2) The close-ended questions and response categories, for example using the Likert-type questions to measure the response [26]. Close-ended questions are questions where the explicit response are provided, and the respondents should answer based on the response choice given. Meanwhile, open-ended questions are questions without explicit response choices, which allow the respondents to freely provide their own answers in their own words. The Likert-type response allows the respondents to select whether they agree or disagree with the statement, ranging from *strongly agree* to *strongly disagree*. The Likert scale is commonly used in questionnaire design to obtain the respondents' degree of agreement with a statement [27].

Meanwhile, for the development of the questionnaire, several research designed the questionnaire from various techniques such as brainstorming [28], adopted from the literature [29], definition of the variables from the literature [23] and conducting interviews [30]. Rashtian et al. [30] conducted interview as ex-

ploratory study to understand user's befriending behavior on Facebook and explore factors that influence their decision. The reason why they conducted an exploratory study is because there are no related works that support their research question. Choi and Chung [29] conducted a questionnaire survey based on question items adopted from several previous studies on the related topics. Research from psychology viewpoint on the use of social media created the questionnaire items based on the definition of proposed variables from the literature [13], [23]. As brainstorming can produce lots and creative ideas, instead of personal interviewing an individual in a different time, we choose brainstorming to collect ideas from targeted respondents by specific topic to brainstorm to create the questionnaire.

3. Creating the Questionnaire

3.1 Overview of Previous Work

We investigated action's user take towards retweeted messages they read on Twitter and extracted the factors on why people perform retweet on the retweet messages as reported in paper [14]. However, the problem of this work is the questionnaire design did not covered the retweeting behavior in disaster situations. Thus, in order to understand individual retweeting behavior, with the focus to spread disaster information during disasters, we proposed to create new questionnaire. There are few steps taken to create the new questionnaire using brainstorming and the KJ method. First, we conducted the brainstorming from the target groups to collect ideas on the topic. Secondly, we grouped similar ideas by grouping, and by using the ideas from brainstorming, we formed new question items. Thirdly, we incorporated the question items from previous questionnaire on the retweeting behavior in general situation. Fourthly, we came up with new questionnaire which focused on the retweeting behavior of disaster information in disaster situations.

3.2 Brainstorming and the KJ Method

We conducted the brainstorming sessions with 10 participants consist of 5 male, and 5 female students. The target group is the social media users, and since students are among the most active social media users, we conducted the brainstorming with the university students. Other study justified that all college students were using at least one form of social media [37]. For the brainstorming, there are 5 Japanese, 4 Malaysian and 1 Thailand citizens. This is because we want to collect the ideas not only from Japanese students, but also with English speakers, who currently live in Japan. There are 6 Computer Science students and the remaining are the Engineering students. The participations in these sessions are voluntary as they agreed to participate without incentive given. The mean age of the participants is 22.7 and they are familiar with various kinds of social media services such as Facebook, LINE, Google+ and Japan SNSs such as Pixiv, Niconico and Ameba. Most of the participants are the Twitter users and experienced different level of disasters such as an earthquake, tsunami, flood and storm. The brainstorming sessions were conducted twice in 14 and 19 of December, 2014 with each session's duration is between 60 to 135 minutes long. The purpose of brainstorming is to explore and gather as many ideas on the specific topic. First, the researcher explained about the brainstorming principles and the study purpose. Next, they were given a specific topic to brainstorm, which is: "*Why people spread (by using retweet) disaster-related information they read on Twitter in disaster situations?*." Each participant was provided with sticky note and pen to drop down their points and they need to elaborate their points for researcher to grasp their meaning and the point context. As a result of the brainstorming sessions, 81 ideas were collected. Next, we performed the KJ method to sort the ideas into several themes and groups. Previous work from the literature [28] used brainstorming to collect ideas, but they randomized the categorization of the question items to be tested in the questionnaire. However, in our work, we applied the KJ method to sort and categorized the bunch of ideas from brainstorming into several close groups and we named each group that served as the initial basis for the questionnaire construct.

The KJ method process as follows [31]: 1) Idea generation from brainstorming, 2) Form close ideas group, 3) Label each group name, 4) Form relationship diagram, and 5) Describe the meaning of the diagram. The purpose of why we applied the KJ method is to organize the bunch of ideas from brainstorming into several initial groups that served as construct in this questionnaire. Next, to specify these question items belongs to each group, we performed exploratory factor analyses after the preliminary survey was conducted. We discuss the results of the factor analyses in Sections 4 and 5. From the brainstorm and the KJ method, the 81 items were sorted into 31 close groups. Each group consists of 1 to 5 items with the same meaning. Then, we organized the groups into 6 themes and finally into 4 main groups.

3.3 The New Questionnaire

We integrated the question items from brainstorming with previous work questions and proposed the new set of the questionnaire to be tested in the preliminary survey. The purpose of creating the new questionnaire is to investigate what factors related to one decision making to spread disaster information in disaster situations. Previous work's questionnaire covers the retweeting behavior in general, because the survey did not mention the situation of the disaster. We proposed that there might be different reasons on why user decides to retweet disaster information during disasters compared to any information in general condition.

We integrated the 17 question items from previous work and finalized with 81 items generated from brainstorming. The 4 main groups formed by the KJ method are: 1) Individual factors (consist of 7 question items), 2) Willingness to supply information for personal and other people's benefits (consist of 23 question items), 3) Fast and updated information (consist of 10 question items), and 4) Environment condition (consist of 2 question items). There are 3 question items from previous work [14] which are not suit with the KJ method group, but it is included as the new questionnaire items. We finalized all items and as a result, the new questionnaire contains 45 question items in total. The first part of the questionnaire collects respondent's demographic information on their Twitter usage and disaster experience. The main part of the questionnaire is questions related to individual decision-making to perform retweet and factors in-

Table 1 Summary of the questionnaire construct.

Main group	Definition	The question item's code
Individual factors	Individual factors refer to individual`s motivation and characteristics. For example, self-belief, experience, knowledge and feeling.	P1, P2, P3, P4, P5, P6, P7
Willingness to supply information for personal and other people's benefits	This factor consists of 3 themes which are: 1) Information spreading purpose. 2) Beneficial to other people. 3) Relevant to self and followers.	1) S1, S2, S3, S4, S5, S6, S7, S8, S9, S10, S11. 2) B1, B2, B3, B4, B5, B6, B7, B8, B9 3) R1, R2, R3
Fast and updated information	This factor refers to fast and frequently updated disaster information on Twitter which is useful for disaster preparedness.	T1, T2, T3, T4, T5, T6, T7, T8, T9, T10
Environment condition	This factor refers to the environment factor, including what one feel from the changes of the environment around them.	E1, E2
Adapted from previous work	The question items related to the type of the information content.	C1, C2, C3

fluenced their decision to spread disaster-related information in disaster situation. The questions designed in 7-Likert scale ranging from strongly disagree to strongly agree. The last part of the questionnaire collects the respondent's information such as age and gender, and the respondents are free to drop down their comments regarding the survey. **Table 1** summarizes the questionnaire construct on the proposed new questionnaire.

4. Preliminary Survey

The questionnaire used in this survey is in Japanese language as our respondents for this survey are Japanese people. In this paper, we report the questionnaire items in English. We also collected the respondents' demographic information such as gender, age, their Twitter usage, other SNS used, and disaster experience. The next part of the questionnaire is the 7-Likert scale questions on retweeting behavior on disaster information during disasters. The user survey was held on 2nd of February 2015 with 86 questionnaire response received. However, we excluded 10 responses from users who are not a Twitter user and 19 incomplete and problems questionnaire answered. Thus, in total, there are 57 respondents for the questionnaire testing remained for the analyses. Next, we performed exploratory factor analyses (EFA) with maximum likelihood method to analyse the problem question items statistically, in order to test the initial questionnaire proposed. Factor analysis is a data reduction technique to group a large set of intercorrelated variables under a small set of underlying variables called factor. Then, we performed Cronbach alpha as the reliability test to measure the internal consistency and how closely related a set of items as a group.

4.1 The Demographic Information

The 57 respondents are students from Iwate Prefectural University, Japan. The respondents consisted of 40 Male, and 17 Female with mean age = 20.2. All of them are Twitter users and 98.2% of the respondents also have Facebook, LINE, Google+ and other social networking sites account. There are 80.7% of the respondents indicated that they experienced disaster and most of them experienced the Great East Japan Earthquake on 2011.

4.2 Descriptive Statistics

In this section, we described our factor analyses findings. We perform EFA with 45 question items in the questionnaire. **Table 2** shows the descriptive statistics with mean and standard deviation values for all question items analysed. The Cronbach alpha value of all items is 0.944. Out of 45 question items analysed, there is a 1 question (question E1) with a floor effect problem.

4.3 Factor Analysis

We perform EFA with 44 question items after removing the floor effect question. Based on the analyses, there are 3 items (question S4, B1 and T9) with low communalities and 3 items (question P2, S5, S6) problem with Cronbach alpha value during the reliability test in EFA.

Thus, these 7 items need to be revised and we performed EFA with 38 question items. The criteria we used to extract the factors structure is by using the scree plot. Factor analysis with the maximum-likelihood method and the promax rotation found that 5 factors are derived. The 5 factors were explained by 51.797% (Cumulative) as a total. The cumulative value describes how much the factors explained all the question items. For the reliability measure, the Cronbach's coefficient alpha for each factor subscale factor 1, factor 2, factor 3, factor 4, and factor 5 are 0.910, 0.829, 0.825, 0.773, and 0.669 respectively. For the reliability test, the value we got is an acceptable value. **Table 3** shows the factor loadings for each factor.

We identified the factors as factors related to user's decision making to spread the disaster information during disasters as follows:

Factor 1: Trustworthy information.
This factor consists of 15 items related to the trustworthiness of the information because of the information credibility (for example, it contains pictures, video, details of the information from affected people) of the disaster place, trust in the informer and the information come from reliable original authors. It also refers to individual evaluation to belief that the information is true and useful to be spread.

Factor 2: Relevance of the information during disasters.
This factor consists of 7 items related to the relevance of the information for oneself, followers or other people who may related to the disaster to disaster preparation. Besides, information from Twitter is helpful as early information before checking the safety status of family and friends thru telephone.

Factor 3: Willingness to supply the information.
This factor consists of 7 items regarding individual willingness to

Table 2 Descriptive statistics.

No	Item code	Questions	**Mean**	**S.D**
1	p1	I retweet because I believe true information is more than false information in Twitter. So we should spread it.	3.088	1.6067
2	p2	I retweet because I have experienced it before.	4.246	1.5843
3	p3	I will retweet the information that I know and have some knowledge on it.	3.561	1.7115
4	p4	I read the information now, and it captured my interest, so I retweet it.	4.456	1.6483
5	p5	I follow my instinct (or feeling) to spread the information.	3.053	1.6193
6	p6	I retweet the information to attract other people attention to get famous.	2.175	1.3110
7	p7	I retweet because I feel excited to share about the unusual situation topic emerged in disaster situation.	3.140	1.6523
8	s1	I retweet because I want to spread the warning information to other people.	4.667	1.5736
9	s2	I retweet because I want to remind other people so that they are alert about it.	3.719	1.6557
10	s3	I retweet because I believe my action could safe other people's life.	3.596	1.4983
11	s4	I will retweet the negative content because I can learn and alert other people of the bad example.	3.000	1.3628
12	s5	I retweet the information because I want to allow exchange of opinion and discussion on the specific disaster topic in timeline (TL).	3.263	1.6205
13	s6	When I retweet, I can confirm the information whether it is true or false.	2.877	1.6910
14	s7	I check the information if it is from a trusted source of information. For example, from televisions or newspaper, if the content is same, then I will retweet it.	4.386	1.5556
15	s8	I know the disaster information in the disaster area, so I decided to retweet it.	4.105	1.5081
16	s9	I retweet because I can confirm and verify about the disaster condition while I am not in that area.	3.491	1.7333
17	s10	I retweet because I think it is important to share the information I read.	4.912	1.6933
18	s11	I retweet because I want to inform the public who may not follow the specific Twitter account.	3.965	1.7317
19	b1	I retweet many tweets so that people can make summary of it, for example in their website.	3.386	1.5896
20	b2	Although I do not know about it, I retweet the information so that my followers and other people can give feedback and tell about it.	3.281	1.5440
21	b3	I do not know the retweet content in details. But if I think the information is important, I will retweet it.	3.982	1.5410
22	b4	I retweet because I want to allow my followers to add and tweet their opinion on this information.	3.351	1.6311
23	b5	I retweet because I want to get respond from disaster management professional who may read the information.	2.561	1.4883
24	b6	I retweet because I think it is good for every people to know about the disaster information.	3.368	1.8673
25	b7	I retweet because I feel anshin after I saw the high number of retweet on the information.	2.807	1.7468
26	b8	I will retweet if the one who retweeted the message has a good "follower" relation.	3.491	1.9191
27	b9	I retweet because I trust the informer (the people I follow).	4.000	1.8420
28	r1	I will retweet if the retweet content is related to my situation.	3.579	1.8121
29	r2	I retweet because the information may relate to my followers situation.	3.965	1.6793
30	r3	I retweet because by retweeting action, I can collect disaster information for other people's use and need.	3.807	1.6523
31	t1	I retweet because the information from retweet is faster and updated than information from TV and news.	3.474	1.5823
32	t2	I retweet because the information come from trusted source and highly believable site. For example from government website, NHK, CNN, BBC, NPR (local and foreign news).	4.158	1.5788
33	t3	I retweet because I can get detail disaster information from local people rather than in news and TV.	3.351	1.7778
34	t4	I retweet because there is a proof (for example, picture and Vine video) from the disaster place together with the information.	3.158	1.7907
35	t5	I retweet the information which contains facts in it.	2.667	1.6726
36	t6	I retweet the disaster information because I want to get advice on disaster preparation. For example, during flood, what I should prepare and do, etc.	2.860	1.4197

37	t7	I retweet because I can get early information from Twitter before I proceed with checking the safety status of my friend and family thru telephone.	3.368	1.6970
38	t8	I retweet because retweet and hashtag (#) function helps and ease me to gather many information about the disaster.	2.825	1.4531
39	t9	I will retweet if the retweet content was from the official Twitter account of an organization or company.	3.298	1.5920
40	t10	I will retweet if the retweet content was from reliable original author.	3.386	1.6340
41	e1	I retweet the information because I feel pressure and desperate in tense situation around me.	2.281	1.7500
42	e2	I retweet because of the environment condition factor. For example, the heavy rain will cause landslide to happen. So if I read the information about landslide at the time of heavy rain, I will retweet.	3.316	1.7025
43	c1	I will retweet if the information contains [Please spread] written in it.	2.614	1.6448
44	c2	I will retweet if the information is for fun or joke.	2.965	1.9269
45	c3	I will retweet if the information is a positive thing.	3.614	1.6448

Table 3 Factor loadings.

Question item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
t8	.793	.146	-.189	-.162	-.073
c1	.716	-.108	.230	-.094	-.125
b7	.612	.022	.193	.146	.079
t10	.582	-.034	-.217	.247	.181
t4	.554	.161	.044	.227	-.015
p6	.550	-.050	.250	-.197	-.030
s3	.544	-.213	-.047	.155	.246
b8	.519	-.045	.015	.219	-.005
b9	.485	.111	-.011	.312	-.161
t3	.463	.151	.191	.145	.251
t1	.427	.175	.145	.188	-.016
p5	.421	.284	-.041	-.162	.069
t5	.395	.182	.172	.013	.228
c2	.374	.321	.145	-.218	.045
p1	.276	.270	-.096	.126	.213
c3	-.199	.745	-.075	-.015	.224
t7	.337	.651	-.150	-.075	.051
r3	.190	.629	-.067	.194	.011
r2	.061	.576	-.112	-.007	.054
t6	.207	.499	.417	-.422	.011
r1	.412	.457	-.039	.063	-.186
p7	.192	.424	.080	-.157	.140
b4	-.062	-.056	.820	.034	.025
b5	.233	-.337	.798	-.013	.147
b6	-.072	.091	.588	.291	.061
s11	-.190	.370	.522	.143	-.128
s9	.391	-.225	.477	.009	.070
p3	-.044	.197	.414	.350	-.043
b3	.085	-.056	.390	.314	.264
s8	.164	-.175	-.093	.862	-.003
s7	.143	-.182	.119	.764	-.167
s1	-.394	.282	.123	.634	.147
s2	-.063	.348	.197	.435	-.296
t2	.160	-.011	.041	.369	.224
s10	-.102	.288	-.095	.367	.297
b2	-.123	.079	.503	-.225	.855
p4	.282	.272	-.244	-.035	.425
e2	.226	.247	-.090	.138	.381
Cumulative %	13.381	35.815	42.312	47.652	51.797
Crobnach's coefficient alpha	0.910	0.829	0.825	0.773	0.669

supply the information by retweeting it because they want to get responses from the audience, to validate the information they get and the act of informing others who may not follow the specific Twitter account.

Factor 4: Importance of the information.

This factor consists of 6 items related to individual evaluation as it is an important information to be shared. This is because they want to spread the warning and alert other people, with the intention to share what they know from TV, newspaper or websites.

Factor 5: Self Interest.

This factor consists of 3 items related to individual desire to perform retweet because the information captured their interest and based on what they feel from the changes of the environment around them.

5. Discussion

5.1 The Problem Question Items

The questionnaire is developed with 45 question items. The item analysis showed that 7 question items have problems. When there is a floor and ceiling effect, the absolute value with high skewness and kurtosis, it shows that the question items are problematic due to bias in response. From the analyses, there are no question items with ceiling effect and high in skewness and kurtosis value. However, 1 question (question E1) is a floor effect question. The floor effect problem means that there is a large concentration of the survey respondent's score at or near the lower limit, which is in our case, most of the respondents are disagree with the statement. The E1 question item is "I retweet the information because I feel pressure and desperate in tense situations around me." Despite the stress and time pressure may influence individual's information processing [32], most of the respondents disagreed with this statement. The floor effect value of this question is high and therefore, we decided that this question needs to be removed.

The other problem is the question items with low communalities. The communality value ranges from 0 to 1 and it does not have clear standards, typically requires more than 0.3. Communalities means how much the variance in each of the question items is explained by the extracted factors. Since this survey is intended to correct the question items, we set a standard with 0.3. Based on our analyses, there are 3 items (S4, B1 and T9) with low communalities and are loose from being explained by the extracted 5 factors. We revised each question items and for question S4, we noticed that the question might lose its meaning in terms of the context the negative content means. Thus, we need correct this question on specific content. The same goes to question B1, "I retweet many tweets so that people can make a summary of it, for example, in their website." and question T9, "I will retweet if the retweet content was from the official Twitter account of an

organization or company." A survey question should avoid confusing phrasing, vagueness and avoid double meaning in a question [26]. Hence, these questions need to be revised in terms of the consistent meaning of the question and the wording because the survey question should be simple and comprehensible.

There are 3 question items (P2, S5, S6) which have problems with Cronbach alpha. Cronbach alpha is a measure of internal consistency or reliability, which means, how closely related a set of items are as a group. The value would increase when we increase the number of question items, and vice versa. However, if the Cronbach alpha value increases when we eliminate a particular question item, it shows that the item does not correlate with the sum of other remaining items. Therefore, it is necessary to correct this item. As the individual experience influenced their ability to judge the information they received as relevant to understand the situation [33], we agreed that personal characteristics such as experience influenced one decision making to spread the information. As stated by Ref. [16], one of the social media user's motivations for using it during disasters is because of the desire to help. Thus, it seems that these question items, P2, S5, and S6 should be corrected in terms of specific meaning and question wording. After revising these question items, we found that question S5 and S6 meaning is slightly similar with another question item. That is why few respondents stated that they think some of the question items contained the same meaning. Thus, we need to change the wording of these items so that the respondents can understand the concise meaning of each question item.

5.2 Discussion of Factors

A good question is a pretested question and sorted into broad thematic categories and sections in the questionnaire [26]. The KJ method is used to arrange the subjective ideas from brainstorming into several groups so that we can get the initial picture of what factors may occur from the data. Based on the KJ method, the data are classified into 4 main groups as follows: 1) Individual factors, 2) Willingness to supply information for personal and other people's benefits, 3) Fast and updated information, and 4) Environment condition.

Then, after the preliminary survey to test the questionnaire, we conduct EFA and as a result of the analyses, we extracted 5 factors as follows: 1) Trustworthy information, 2) Relevance of the information during disasters, 3) Willingness to supply the information, 4) Importance of the information, and 5) Self Interest. Although the factors derived are different, several question items that we sorted together in the KJ method belongs to the same group after the factor analyses. The KJ method is proven to be effective to organize large data into groupings based on their natural relationship [31], [34]. With EFA, the intercorrelated items are grouped under a set of underlying factors statistically. So, there is the difference between the different techniques used to sort out the large ideas. However, since this paper focus is to present the questionnaire testing result and analyses of the question items, we will not emphasize on the comparison of factors derived.

As we can see from Table 3, few question items such as P1 and C2 are closely related to factor 1 and factor 2. It shows that the question items might slightly related to both factors. Hence, we need to revise these items and change the wording so that the meaning of the question on which factor it belongs is clear. In addition, the factors derived such as trustworthy information, relevance and importance of the information in a disaster situation, the Twitter user's willingness to supply the information and the individual interest provided the initial answer to our research question of why people retweet disaster information during disasters.

Previous study from the literature indicated that brainstorming can produce holistic and creative ideas [36]. In this research, we used brainstorming technique because brainstorming is one of the techniques to generate many ideas, which facilitated us to produce the new questionnaire. In addition, about 75% of the question items used in this survey derived from brainstorming. The 5 factors derived supported the findings from previous literature on reasons people spread crisis information such as trustworthiness of the tweet content [38], content relevant [38], the act of spreading trending topics [4], pro-social behaviour during disasters [39] and the desire to spread valuable, helpful, and important information to society [13], [38]. Thus, the questionnaire we produced is better to measure and useful for other researcher to understand user's information sharing behavior during disasters, since it is also consistent with the literature. However, this questionnaire needs to be validated and we will test again in the next survey.

5.3 Limitations

The sample size in this preliminary study is quite small. Besides, 19 respondents were omitted from the analysis because they are not a Twitter user and problematic answer. This might happened because we did not set the condition of only Twitter user are needed in the survey, and no incentive given to the participants. In addition, from 45 question items, we discovered 7 question items need to be excluded in the factor analysis due to the statistical problems. Although this is the research in progress and not yet complete, we reported our findings which are a part of our overall steps to produce and validate the questionnaire to measure user behavior of information diffusion during disasters. The findings in this paper served as the indication for our future work. Next, we will correct and validate the questionnaire with larger sample size survey and confirm the exploratory factors found in this present study.

6. Conclusion and Future Work

With the aim to develop human information sharing decision-making model in disaster situations, this paper described the initial steps of development and the questionnaire testing. In terms of method to create the questionnaire, we introduced brainstorming of target group and the KJ method technique to explore factors influencing individual decision making to spread disaster information during disasters. Brainstorming can produce large and creative ideas [36]. In this paper, we presented results of the factor analysis for the questionnaire testing. We conducted a user survey with the purpose to test the questionnaire and analysed it using exploratory factor analysis (EFA). As a result, there are 7 problem items with floor effect, low communalities and the problem with Cronbach alpha value. These items need to be revised

and corrected to produce a new set of questionnaire for future survey. For future work, we will conduct the web survey with greater number of respondents and confirm the factors found by using both exploratory and confirmatory factor analyses.

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