

Trust in User-Generated Information on Social Media during Crises: An Elaboration Likelihood Perspective

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ABSTRACT

Social media is increasingly being used as a source of information during crises, such as natural disasters and civil unrests. However, the quality and truthfulness of user-generated information on social media have been a cause of concern. Many users find distinguishing between true and false information on social media difficult. Basing on the elaboration likelihood model and the motivation, opportunity, and ability framework, this study proposes and empirically tests a model that identifies the information processing routes through which users develop trust, as well as the factors that influence the use of these routes. The findings from a survey of Twitter users seeking information about the Fukushima Daiichi nuclear crisis indicate that individuals evaluate information quality more when the crisis information has strong personal relevance or when individuals have low anxiety about the crisis. By contrast, they rely on majority influence more when the crisis information has less personal relevance or when these individuals have high anxiety about the crisis. Prior knowledge does not have significant moderating effects on the use of information quality and majority influence in forming trust. This study extends the theorization of trust in user-generated information by focusing on the process through which users form trust. The findings also highlight the need to alleviate anxiety and manage non-victims in controlling the spread of false information on social media during crises.

Keywords: User-Generated Information, Trust, Elaboration Likelihood Model, Social Media, Crisis Information

I . Introduction

Social media are increasingly being used as a source of up-to-the-minute information about what is hap-

pening on the ground during large-scale crises (Westerman et al., 2014) such as natural disasters and civil unrests (e.g., street riot, political reform). The user-generated information can help to improve

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situation awareness, which is the perception of elements in a crisis, the comprehension of their meaning, and the projection of their status in the near future (Yin et al., 2012). For instance, during the Oklahoma Grassfires and the Red River Floods that occurred in the United States in 2009, millions of messages containing information about the geo-location of people, affected sites, and evacuation sites, as well as information about damages and injuries were shared by Twitter users (Vieweg et al., 2010). The information can be used by individuals to assess their personal situation or gain a broader understanding of the crisis as a whole. Researchers have even begun to suggest using social media as a fairly accurate source of information to detect crises. For instance, in Japan, a pilot earthquake reporting system based on information retrieved from Twitter was found to detect 96% of the earthquakes (with seismic intensity exceeding three) identified by the Japan Meteorological Agency and could notified registered users earlier than the broadcasts by the agency (Sakaki et al., 2010).

The use of social media as an information source and communication platform sometimes surpass other media because Internet access often remains robust when landlines, base stations of mobile phones, and power lines become congested or damaged. For instance, during the 2011 Tohoku earthquake and tsunami disaster in Japan, communication cables and mobile base stations were destroyed and power outages occurred. In areas where communication facilities were not damaged, the lines were too congested and became practically unusable. In contrast, Internet connections were available as usual and people turned to social networking sites and web-based communication tools such as Twitter, Facebook, and Skype to exchange information (Ichiguchi, 2011). Due to its availability and reach, many governments and public organizations began to use Twitter to disseminate

information about the disaster, such as the Prime Minister Office's "@Kantei_Saigai" and "@JPN_PMO", Fire and Disaster Management Agency's "@FDMA_JAPAN", and the Japan Ground Self-Defense Forces' "@JGSDF_pr" (Ichiguchi, 2011).

Despite the informational uses and benefits of social media during crises, there have been concerns about the quality and truthfulness of user-generated information on social media. Social media often contains fabricated content, unverified events, lies, and misinterpretation. It is often considered as a collective rumor mill that propagate misinformation, gossip, and, in extreme cases, propaganda (Mendoza et al., 2010; Oh et al., 2010). Many users find it difficult to distinguish between true and false information on social media (Acar and Muraki, 2011). Trusting false information not only leads users to make wrong decisions, it can also have dire social consequences such as fueling mass panic. For instance, in the 2011 England Riots, it is widely believed that rumors spread through social media such as Twitter and Facebook triggered the mass unrest (Grimmer, 2011). It is therefore important to understand how users evaluate and develop trust in information on social media (Mendoza et al., 2010). The objective of this study is to propose and empirically test a model that identifies the information processing routes through which individuals develop trust, based on the elaboration likelihood model (Petty and Cacioppo, 1986). More importantly, drawing on the motivation, opportunity, and ability framework, we propose that individuals use of the information processing routes are affected by the personal relevance of information, level of anxiety, and prior knowledge.

Prior studies have improved our understanding of users' motivation to create user-generated content (e.g., Chai, 2011; Kim et al., 2009). This study focuses on the other end - the consumers of user-generated

information. As will be detailed in our literature review, prior studies have shed light on the issue by examining trust as an antecedent of social media use (e.g., Anish et al., 2014; Chu and Kim, 2011). However, there is still a lack of understanding of how users *form* trust in user-generated information. This study seeks to address the gap by identifying the informational processes through which trust is determined. Although the elaboration likelihood model is widely used to study individuals' trust in electronic words of mouth generated by consumers (Cheung and Thadani, 2012), the model's applicability to understand trust in user-generated crisis information has not been examined. As discussed earlier, the use of social media is prevalent in the crisis context, in which people often frantically seek information from all available sources to inform their actions and false information can be especially dangerous. This study is therefore practically relevant. Based on the motivation, opportunity, and ability framework, our proposed model considers the moderating effect of anxiety, which is a theoretical concept that is especially prominent in the crisis context. In short, the proposed model focuses on a novel and practically critical context, and at the same time is theoretically grounded.

Data for assessing the proposed model were collected in a survey of 198 Twitter users during the 2011 Fukushima Daiichi nuclear crisis following the Tohoku earthquake and tsunami disaster in Japan. The findings indicate that individuals' use of different information processing routes to determine trust in user-generated crisis information is moderated by the personal relevance of the information and the level of anxiety. In contrast, their prior knowledge related to the topic did not have a significant moderating effect. We also observed that social media users tend to be more affected by majority influence (a

peripheral cue or heuristic) than by information quality. In the following sections, the conceptual background for the proposed model as well as the study and findings will be detailed.

II. Conceptual Background

We will first review prior studies of trust in user-generated information to identify gaps in research. This is followed by a discussion of the information processing routes suggested by the elaboration likelihood model. The motivation, opportunity, and ability framework is then described and the crisis-related factors based on the framework are then identified and explained. (e.g., informativeness, quality, volume; Flanagin and Metzger, 2013; Lucassen et al., 2013), and recipient of information (e.g., topic familiarity; Lucassen et al., 2013). Another stream of research has proposed methods for quantifying the trustworthiness of user-generated information (Lenders et al., 2008; Moturu and Liu, 2011).

2.1. Trust in User-Generated Information on the Internet

In this study, trust is defined as the extent to which one feels secure and comfortable about relying on the information on social media (Komiak and Benbasat, 2006). This differs from trust in technologies or websites (e.g., e-commerce, blogs; Chai, 2011; Lee, 2014) in terms of the object of trust. Our review of research on trust in user-generated information (see <Table 1>) shows that prior studies have examined the effect of trust on factors such as social media use (Anish et al., 2014; Chu and Kim, 2011) and attitude (Bartle et al., 2013). Prior studies have also found that trust is affected by the source of information

<Table 1> Studies of Trust in User-Generated Information on the Internet

Source	Key Findings	Method and Sample
Anish et al. (2014)	Trust did not play a role in the amount usage of user-generated review platforms	Survey of 72 users of Yelp.com
Bartle et al. (2013)	Trust were associated with strong positive attitudes towards cycling as a commuter mode Information shared within the group inspired greater trust amongst participants than “official” information, largely because it was seen as emanating from the experience of “real people”. There was both calculus trust, arising from the intrinsic quality of the information, and relational trust, associated with the relationship between information-giver and -receiver	Case study of a map-based website in the United Kingdom
Burgess et al. (2011)	Respondents tended to agree that they trusted information provided by travel agents, information from commercial operators and comments made by travellers on third-party websites The highest level of trust was afforded to information provided on State government websites Greater trust was placed in online travel comments when they were on a specific travel website than when they were on a more generic social networking website	Survey of 12,000 Australian travel consumers
Chu and Kim (2011)	Trust influenced a) opinion seeking, b) opinion giving, and c) opinion passing of electronic word of mouth (eWOM) on social networking sites (SNS)	Survey of 400 undergraduate students who used SNS
Dickinger (2011)	a) Informativeness, b) integrity, c) benevolence, and d) ability had a direct positive effect on overall trust of online channels	Survey of 453 tourists in Vietnam who were also Internet users
Flanagin and Metzger (2013)	Information volume acted as a signal or warrant, or as an indicator of subjective reality, such that as it increased a) perceived information credibility, b) reliance on the information, c) confidence in accuracy, and d) congruence with others’ evaluation of the information	Experiment involving 1207 Internet users who viewed a fictitious movie rating website
Kim and Ahmad (2013)	Proposed a framework for predicting trust and distrust from a content consumer to a content provider, using transaction history among users Distrust was subjective and based on direct experience rather than statements from others Trust needed strong evidence like a cumulative history of positive direct experience or a high public reputation in order to distinguish from lack of confidence interactions	Analyses of 1,560,144 reviews and 12,668,319 ratings for reviews provided by 326,983 users on Epinions
Lenders et al. (2008)	Proposed a secure localization and certification service in order for content consumers to establish the trust level of contents	Geotagging service
Lucassen et al. (2013)	High school, undergraduate, and postgraduate students had similar trust in Wikipedia Topic familiarity had no effect on trust Article quality had a significant positive effect on trust	Experiment in which 40 high school, undergraduate, and postgraduate students evaluated Wikipedia articles
Moturu and Liu (2011)	Proposed an approach to quantify the trustworthiness of shared content on social media, based on factors such as author reputation, content performance (e.g., number of edits, number of references), and appearance	Content on Wikipedia and Daily Strength (a health social network)

(e.g., authority, reputation, integrity; Burgess et al., 2011; Dickinger, 2011), history of interactions with source (Kim and Ahmad, 2013), content characteristics (e.g., informativeness, information volume; Dickinger, 2011; Flanagin and Metzger, 2013) and the information seeker (e.g., Kim and Ahmad, 2013; Lucassen et al., 2013).

It can be observed from the review that trust in user-generated information is gaining research attention and various antecedents and effects of trust have been identified. Nevertheless, there is a paucity of studies on how social media users form trust. Most prior studies have examined trust among users engaging in social networking and trust in less critical information such as consumers' electronic word of mouth, travel information, movie ratings, and maps. This study seeks to extend research on the topic by identifying the information processing routes used to determine trust in user-generated information during crises, based on the elaboration likelihood model.

2.2. Elaboration Likelihood Model (ELM)

ELM posits that information can change individuals' attitude through the central and peripheral routes of information processing (Petty and Cacioppo, 1986). The *central* route of information processing involves scrutinizing the content of information to determine its inherent merits prior to forming an attitude. That is, information quality is the main determinant of individuals' attitude. High-quality information is likely to be perceived as more trustworthy because it can better support sense making and leads to more correct decisions (O'Reilly, 1982). In line with this, it has been found that users feel that it is less risky to trust high-quality information on health information websites (Koo et al., 2014; Luo and Najdawi, 2004). The other route

of information is the *peripheral* route, which involves the use of peripheral cues or heuristics (e.g., characteristics of the information source, opinion of the majority; Diane, 1987) to form an attitude and it therefore requires less cognitive effort than the central route.

ELM has often been assessed in social psychology and marketing research and is increasingly being applied in information systems (IS) research (Bhattacharjee and Sanford, 2006). The model has been adapted to explain how individuals form attitudes towards IS which in turn influence their adoption of IS (Angst and Agarwal, 2009) and intention to continue using IS (Kim et al., 2007). It has also served as the basis for understanding the factors influencing individuals' acceptance and use of information accessed through information technologies such as expert systems (Dijkstra, 1999; Mak et al., 1997) and websites (Tam and Ho, 2005). This indicates that ELM can potentially offer insights into individuals' trust in information on social media.

Although ELM has identified the opinion of others as an important heuristic for processing information and forming attitude (Petty and Cacioppo, 1986), the effect of this heuristic is seldom examined in IS studies applying ELM. The opinion of others represents social influence and is especially relevant in the context of social media whose key feature is enabling socialization. Therefore, this study considers the opinion of others in terms of *majority influence*, which reflects the extent to which most people in a social group hold similar view about an issue (Nemeth, 1986). On social media, majority influence may manifest in terms of the extent of agreement (e.g., number of readers expressing support) or the spread of the information among different users (e.g., number of times a piece of information is forwarded or reposted). When a piece of information is sup-

ported by many people, it may be perceived as having been endorsed and validated by many people and therefore more trustworthy (Chaiken and Maheswaran, 1994). This is in line with the concept of social proof, where individuals facing uncertainties determine what is correct based on what others think is correct (Cialdini, 1993).

ELM proposes that the extent to which individuals use the central route (i.e., evaluate information quality) and the peripheral route (i.e., use the heuristic of majority influence) to process information depends on their elaboration likelihood, which is influenced by their motivation and ability to evaluate information. Individuals with strong motivation and ability are likely to expend more cognitive resources to evaluate the quality of information and rely less on peripheral heuristics. It is necessary to conceptualize motivation and ability in terms of constructs that are relevant to the context under investigation. Motivation and ability are detailed next, in relation to the motivation, opportunity and ability framework.

2.3. Motivation, Opportunity and Ability (MOA) Framework

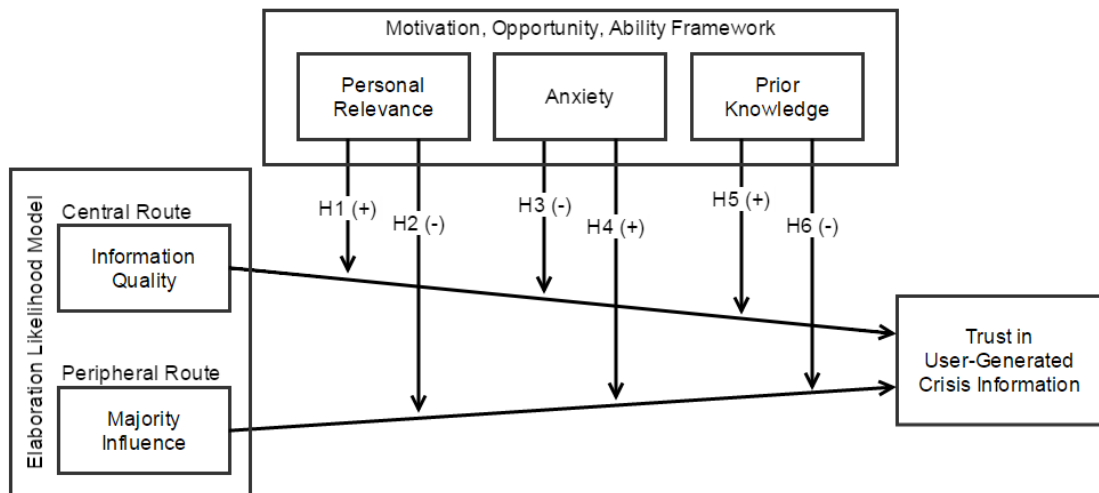
The MOA framework was proposed by MacInnis et al. (1991) to explain consumers' processing of advertising information. *Motivation* refers to the driving force that generates desire and increases willingness to process information; *opportunity* is the extent to which distractions or limited exposure time affect individuals' attention to process information; *ability* is the individual's knowledge or skills relevant to the information to be processed. The MOA framework has been adapted to study many different behaviors, including travellers' use of hotels' social networking sites (e.g., Leung and Bai, 2013).

In ELM, motivation is conceptualized in terms of *personal relevance* and ability is based on one's *prior knowledge* (Petty and Cacioppo, 1986). Prior IS studies applying ELM have predominantly conceptualized motivation and ability in terms of these constructs (Angst and Agarwal, 2009; Bhattacharjee and Sanford, 2006). Accordingly, we examine personal relevance and prior knowledge in this study.

We propose that an important opportunity factor that is likely to distract individuals from processing information during crises is anxiety. Anxiety is common among individuals facing a crisis. The distracting quality of anxiety has been strongly established. For instance, anxiety can distract individuals from attending to their environment and cause them to rely more on available cognitive structures such as social stereotypes in making judgment of others (Sarason, 1988; Wilder, 1993). One potential source of distraction is an individual's level of arousal. There is evidence indicating that arousal leads to an increase in self-focused attention which may distract a person from a thorough processing of the external social environment (Wilder, 1993). A diminution of available attention *can be expected* when individuals are anxious and fearful since these negative emotions often require an immediate, active response.

III. Research Model and Hypotheses

Based on the elaboration likelihood model, our proposed model considers two routes of information processing through which individuals determine trust in user-generated information. The central route involves evaluating information quality and is specified in the model as the effect of information quality on trust. The peripheral route relies on majority influence and is specified as the effect of majority influence



<Figure 1> Model of Trust in User-Generated Crisis Information on Social Media

on trust. We hypothesize that during crises, individuals' use of the routes is determined by personal relevance of the information, level of anxiety, and prior knowledge. As discussed earlier, these factors correspond to individuals' motivation, opportunity, and ability to process information and they are strongly relevant to the crisis context. Specifically, we hypothesize that they moderate the effects of information quality and majority influence (see <Figure 1>). The moderating hypotheses are detailed next.

3.1. Moderating Effects of Personal Relevance

Personal relevance is the extent to which an issue is expected to have significant consequence on one's life (Apsler and Sears, 1968). When personal relevance is high, the consequence of being incorrect is experienced strongly and personally. For instance, for those who live within an area where a natural disaster has been forecasted, trusting false information that the disaster will not occur can endanger their lives directly. Personal relevance in-

creases individuals' sufficiency threshold in information processing (Chaiken et al., 1989) and motivates individuals to increase their judgmental confidence to avoid the dire consequence of trusting false information. They are therefore likely to allocate more cognitive resources to assess the validity of information and rely less on peripheral heuristics (Chaiken et al., 1989; Petty and Cacioppo, 1986). This suggests that when the personal relevance of crisis information is high, the effect of information quality on trust is stronger while the effect of majority influence (which is a peripheral heuristic) becomes weaker.

H1: As personal relevance increases, the effect of information quality on trust in user-generated crisis information increases.

H2: As personal relevance increases, the effect of majority influence on trust in user-generated crisis information decreases.

3.2. Moderating Effects of Anxiety

Anxiety involves the selective processing of information perceived as signifying a threat or danger to one's personal safety or security (Beck and Clark, 1997). At the cognitive level, anxiety involves: a) certain sensory-perceptual symptoms such as feelings of unreality, hypervigilance, and self-consciousness; b) thinking difficulties such as poor concentration, inability to control thinking, blocking, and difficulty reasoning; and c) conceptual symptoms like cognitive distortions, fear-related beliefs, frightening images and frequent automatic thoughts (Beck and Clark, 1997). In general, anxiety engages cognitive resources in mental activities such as worrying, thus leaving less capacity to tackle other cognitive tasks (Eysenck et al., 2007). Indeed, research on the effects of anxiety indicates that performance in tasks that demand cognitive resources is lower for individuals under high anxiety (e.g., Ashcraft, 2002). The reduced capacity that characterizes high anxiety is likely to have implications for the elaboration and processing of information, which can be viewed in terms of the amount of thought or scrutiny devoted to a piece of information (Petty and Cacioppo, 1986). With lowered cognitive capacity, anxious individuals are less likely to evaluate information quality and more likely to rely on peripheral cues instead, which demands less effort to process. In support, a study observed that high-trait-anxiety individuals are persuaded by the peripheral cue of source attractiveness regardless of argument quality, while low-anxiety individuals are persuaded by argument quality regardless of source attractiveness (DeBono and McDermott, 1994).

H3: As anxiety increases, the effect of information quality on trust in user-generated crisis information decreases.

H4: As anxiety increases, the effect of majority influence on trust in user-generated crisis information increases.

3.3. Moderating Effects of Prior Knowledge

Prior knowledge refers to one's familiarity, expertise, and experience with an issue (Kerstetter and Cho, 2004). Prior knowledge can serve to disambiguate information (Chaiken et al., 1989). When individuals have strong prior knowledge about an issue, they are better able to scrutinize the content of information and there is therefore less need to rely on peripheral heuristics (Bhattacharjee and Sanford, 2006). In contrast, individuals with little prior knowledge lack the ability to process information critically and they are therefore forced to rely more on peripheral heuristics (Petty and Cacioppo, 1986). Accordingly, we hypothesize that:

H5: As prior knowledge increases, the effect of information quality on trust in crisis user-generated information increases.

H6: As prior knowledge increases, the effect of majority influence on trust in user-generated crisis information decreases.

IV. Research Method

The target population of this study is individuals who sought crisis information on social media. The data for testing the proposed model were collected in a survey conducted in 2011, when the Fukushima Daiichi nuclear crisis started. On 11 March 2011, a tsunami triggered by the magnitude 9.0 Tohoku earthquake led to a nuclear meltdown involving three of the six nuclear reactors at a Fukushima nuclear plant, creating the largest nuclear incident since the

Chernobyl disaster in April 1986 and the only (after Chernobyl) to measure level 7 on the International Nuclear Event Scale. After the incident became known, many individuals within and outside Japan had turned to social media as an up-to-date source of information about the extent and effects of radiation on air quality and food sources (Acar and Muraki, 2011). Millions of messages containing information related to the nuclear crisis were posted on social networking sites, such as Twitter (Doan et al., 2012).

To control for the potential confounding effects of idiosyncratic website features such as user interface, we focused on users of Twitter in this study. Twitter users could acquire information by searching and reading “tweets”, which are text-based messages of up to 140 characters. Like the content on most traditional mass media, tweets were by default open to the public and there was no restriction on use (Shi et al., 2013). As of March 2011, the average number of tweets per day was about 140 million. On 11 March 2011, the day of the Tohoku earthquake, the average number of daily tweets increased to 177 million (Smith, 2011). Messages such as the following abounded Twitter (Zax, 2011):

“The specialists in the nuclear sites are getting less and less -- who will be left to work on them? Leave Tokio and go south for now -- at least and take the OLD People with you!”

“Luckily I have been able to get a seat on a flight to Okinawa today. I am catching the 2000 flight from Haneda. Those still around, be careful not to get rained on.”

“Don’t believe government reassurances radiation levels are safe -- get out of Japan now.”

“The situation at the nuclear plants in Fukushima is getting worse and worse, and I am getting very afraid of it. Now, I am going out for grocery shopping

with my sick child in search for more water and other supplies.”

Compared to other social networking sites such as Facebook, Twitter is quite open and loose. The relationship between the message poster and reader often cuts across long (real-world) social distances (Shi et al., 2013). It has been shown that any retweets (i.e., messages that are reposted) on Twitter reach an average of 1,000 users regardless of the number of subscribing followers in the original message and can be read by people who are four degrees of separation away from the source within minutes (Kwak et al., 2010). Twitter therefore more closely resembles an information broadcasting site than a traditional social network and is particularly relevant for testing our proposed model. The development of the survey instrument and data collection are described next.

4.1. Development of Survey Instrument

The constructs in the proposed model were operationalized based on instruments validated in prior studies as much as possible (see <Table 2>). The items measuring information quality, personal relevance, anxiety, and trust were adapted from validated scales while items measuring majority influence and prior knowledge were developed based on their conceptualizations. The items measuring information quality were scored on semantic-differential scales while the others were scored on five-point Likert scales.

4.2. Data Collection and Sample Demographics

The invitation to participate in the survey was posted in online forums that discussed topics related to the Fukushima nuclear crisis. Users of Twitter

<Table 2> Survey Instrument

Construct	Item and Source
Information quality	I think the information related to nuclear radiation on Twitter is generally ... subjective/objective unverifiable/verifiable has insufficient/sufficient breadth or coverage has insufficient/sufficient depth or detail outdated/up-to-date difficult/easy to understand (Scored on semantic-differential scales; All items adapted from Lee et al., 2002)
Majority influence	On Twitter, most people hold largely similar views about the effects of radiation On Twitter, most people share consensus about the effects of radiation On Twitter, there is general agreement about the effects of radiation (All items developed based on Martin et al., 2002)
Personal relevance (formative measure)	There is a high possibility that I will experience the negative effects of nuclear radiation in future My physical health makes it more likely that I will experience the negative effects of nuclear radiation My geographic location makes it more likely that I will experience the negative effects of nuclear radiation My occupation makes it more likely that I will experience the negative effects of nuclear radiation (All items adapted from Champion, 1984; Clarke, 1999)
Anxiety	I feel anxious (worrying, anticipation of the worst) about the Fukushima nuclear crisis. I feel tense (trembling, feeling of restlessness, unable to relax) due to the Fukushima nuclear crisis. I have difficulty falling asleep due to the Fukushima nuclear crisis. I feel depressed due to the Fukushima nuclear crisis (All items adapted from Hamilton, 1959)
Prior knowledge	I have professional expertise in the effects of nuclear radiation I had personally experienced the effects of nuclear radiation I had spent a lot of time reading about nuclear radiation on sources other than Twitter (All items developed based on Kerstetter and Cho, 2004)
Trust in user-generated crisis information	In general, I trust the information related to nuclear radiation on Twitter I feel secure using the information related to nuclear radiation on Twitter in decision making I feel comfortable using the information related to nuclear radiation on Twitter in decision making (All items developed based on Komiak and Benbasat, 2006)

who sought information about the Fukushima crisis were invited to complete a web-based survey. As an incentive for participation, respondents had the option of entering a lucky draw of vouchers for an international shopping website. The survey was open to individuals residing within as well as outside of Japan to ensure sufficient variance in personal relevance, which is one of the constructs of interest in our study. We received a total of 198 responses. Most of the respondents were residing in Japan (34.4

percent; see <Table 3>) and the United States (25.3 percent). Male respondents constituted 53 percent and 77.9 percent of the respondents aged from 21 to 39. Most respondents had one to two years of experience using Twitter (70.1 percent) and more than five years of experience using the Internet (70.8 percent).

<Table 3> Sample Demographics

Age	18 to 20	3.2%	5
	21 to 25	24.7%	38
	26 to 30	34.4%	53
	31 to 35	29.9%	46
	36 to 40	17.5%	27
	41 to 45	9.1%	14
	46 to 50	5.2%	8
	> 50	4.5%	7
Gender	Male	53.0%	105
	Female	60.4%	93
Country of Residence	Japan	34.4%	53
	US	25.3%	39
	Canada	12.3%	19
	Australia	11.0%	17
	China	15.6%	24
	Singapore	17.5%	27
	Malaysia	12.3%	19
Experience using Twitter	Less than 1 year	27.3%	42
	1 to 2 years	70.1%	108
	3 to 4 years	23.4%	36
	5 to 6 years	7.8%	12
Experience using Internet	Less than 1 year	0.0%	0
	1 to 2 years	1.9%	3
	3 to 4 years	40.9%	63
	5 to 10 years	68.8%	106
	>10 years	16.9%	26

V. Data Analysis and Results

The data were analyzed using Partial Least Squares (PLS), a structural equation modeling technique that concurrently tests the measurement model and structural model (Chin et al., 2003). PLS was used because it is able to account for formative and reflective constructs jointly occurring in a single structural model. A reflective construct has indicators that are affected by a single underlying latent construct and removing an indicator should not alter the conceptual domain of the construct (Jarvis et al., 2003). On the other

hand, a formative construct is a composite of multiple indicators and excluding an indicator may alter the conceptual domain of the construct (Jarvis et al., 2003). In this study, personal relevance is a formative construct because its items tap into different themes and the items are not interchangeable. For example, physical health and geographic location of a person may not always be correlated (see <Table 2>). The other constructs are considered reflective. All data were standardized prior to analyses.

5.1. Tests of Measurement Model

The survey instrument was tested for reliability, convergent validity, and discriminant validity. Reliability of each construct was assessed with Cronbach's alpha coefficient (see <Table 4>). All constructs achieved scores above the recommended 0.70 (Hair et al., 2009). Convergent validity was assessed by examining composite reliability and average variance extracted (AVE) by each construct. All composite reliabilities and AVEs were above the recommended level of 0.70 (Hair et al., 2009), indicating that the instrument had satisfactory convergent validity.

Discriminant validity was assessed by factor analysis and comparing construct correlations with square root of AVEs. The results indicated that all items loaded highly on their stipulated constructs (i.e., with value exceeding 0.70) but not highly on other constructs. All constructs correlated more highly with their own items than with items measuring other constructs (Fornell and Larcker, 1981). These indicate that discriminant validity was satisfactory. We also assessed multicollinearity by calculating variance inflation factor (VIF). The resultant values ranged from 1.02 to 2.98, which were below the threshold value of 3.33 (Diamantopoulos and Winklhofer, 2001).

For the formative construct of personal relevance, these tests are not applicable. Instead, significance

of item weights was examined to determine the contribution of items constituting the construct. The results were favorable, with all item weights significant at $p < 0.05$. Multi-collinearity among items was assessed using variance inflation factor (VIF). All VIFs were below the recommended threshold of 3.33, indicating that the items captured different aspects of personal relevance.

5.2. Tests of Structural Model

The PLS latent variable modeling approach for analyzing interaction effects (Chin et al., 2003) was used to test the hypotheses involving personal relevance and prior knowledge. The procedure involved computing interaction terms by multiplying the predicting and moderating constructs. For interaction terms involving the formative construct of personal relevance, the construct score procedure suggested by Chin et al. (2003) was used to create underlying construct scores before creating the interaction terms.

Results of the structural model are shown in <Table 5> and <Figure 2>. We found that all hypotheses were supported except for the moderating effects of prior knowledge. Prior knowledge also did not have a significant direct effect on trust. Among the control variables, age had a significant negative effect on trust, while the level of education, gender, and number of years using Twitter and the Internet did

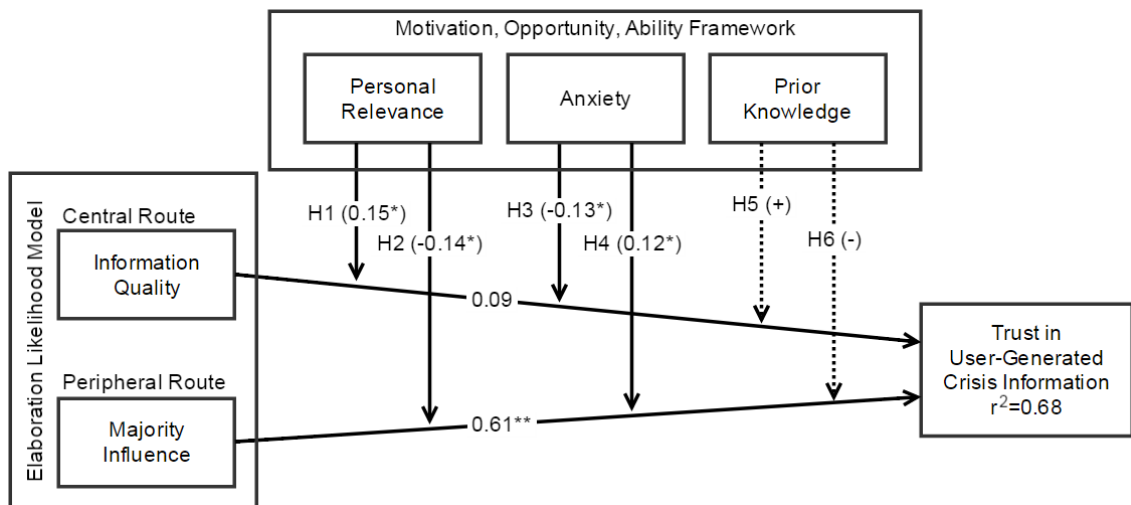
<Table 4> Tests of Measurement Model

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted	Mean	Standard Deviation
Information Quality (IQ)	0.91	0.93	0.68	3.50	0.60
Majority Influence (MI)	0.88	0.93	0.81	3.73	0.62
Anxiety (AX)	0.84	0.89	0.67	3.63	0.74
Prior Knowledge (PK)	0.74	0.85	0.66	4.25	0.54
Trust in User-Generated Information (TI)	0.71	0.84	0.64	3.80	0.70

<Table 5> Results of Hypothesis Testing

Relationship	Path Coefficient	T Value	Result
Information quality → Trust	0.09	0.73	Not significant
Majority influence → Trust	0.61***	4.59	Significant
Personal relevance → Trust	0.25**	2.60	Significant
Personal relevance * Information quality → Trust	0.15*	1.78	H1 is supported
Personal relevance * Majority influence → Trust	-0.14*	1.98	H2 is supported
Anxiety → Trust	0.06	0.97	Not significant
Anxiety * Information quality → Trust	-0.13*	1.81	H3 is supported
Anxiety * Majority influence → Trust	0.12*	1.75	H4 is supported
Prior knowledge → Trust	-0.07	1.43	Not significant
Prior knowledge * Information quality → Trust	0.00	0.05	H5 is not supported
Prior knowledge * Majority influence → Trust	-0.05	0.73	H6 is not supported

*p < 0.05; **p < 0.01; ***p < 0.001

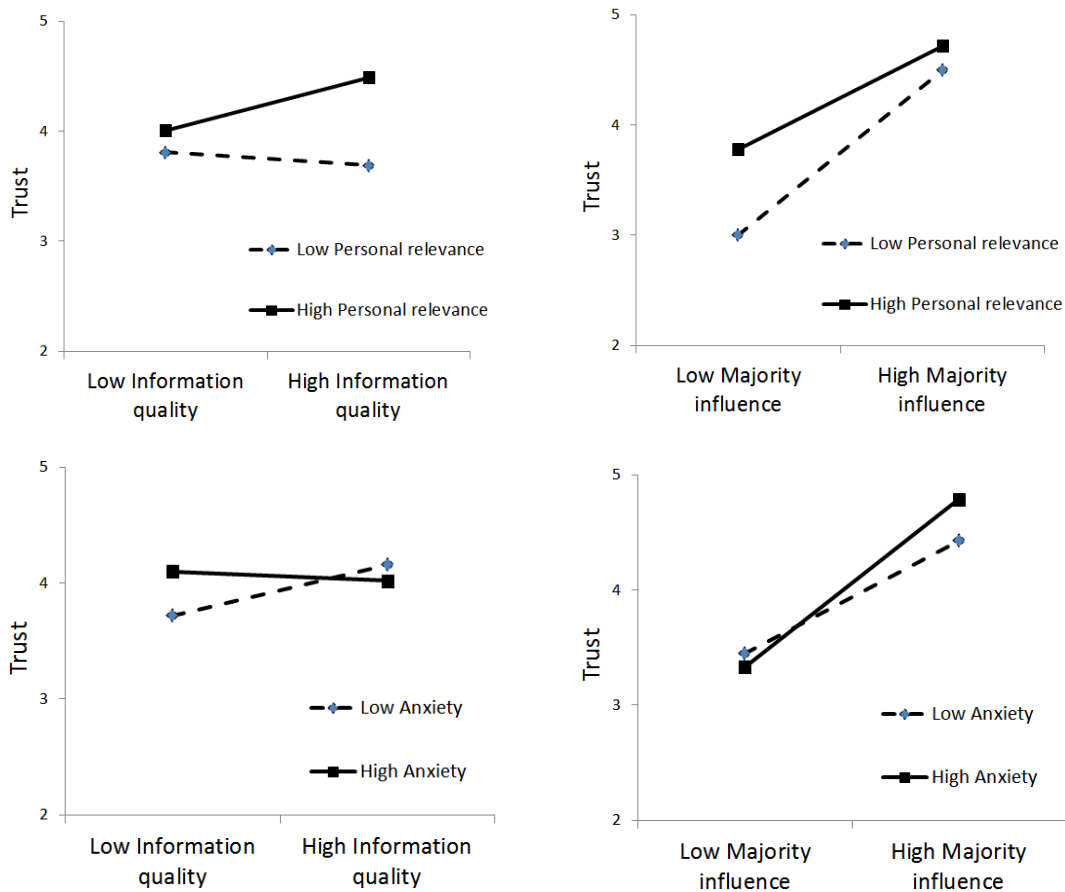


<Figure 2> Results of Structural Model Tests

not have a significant effect. The proposed model explained 67.5% of the variance in trust.

The significant moderating effects are plotted in <Figure 3>. It can be observed that when individuals read information that has high personal relevance, the effect of information quality on trust strengthens while the effect of majority influence weakens. This provides support to hypotheses H1 and H2. For

high-anxiety individuals, the opposite is observed - the effect of information quality on trust becomes weaker while the effect of majority influence becomes stronger. Interestingly, social media users tend to be more strongly affected by majority influence than information quality, as all the slopes related to information quality are much gentler compared to the slopes related to majority influence. This suggests



<Figure 3> Plots of Significant Moderating Effects

that the peripheral route is used more than the central route to determine trust in crisis information. The implications of these and other findings are discussed next.

VI. Discussion

This study set out to develop and empirically test a model that identifies (1) the different information processing routes through which social media users form trust in user-generated crisis information, and (2) the factors moderating the use of the routes.

As suggested by the elaboration likelihood model, our proposed model considers two routes: central and peripheral. Based on the motivation, opportunity, and ability framework, we hypothesize that the use of the routes are moderated by personal relevance, anxiety, and prior knowledge. Findings from a survey indicate that individuals use the central route more when the crisis information has strong personal relevance or when they have low anxiety about the crisis. In contrast, they use the peripheral route more when the crisis information has less personal relevance or when they have high anxiety about the crisis.

Contrary to our hypotheses, prior knowledge did not have significant moderating effects in our study.

The insignificance of prior knowledge is unexpected considering that there has been strong evidence for its role in information processing, as discussed earlier. In retrospect, the unusual scale of the nuclear crisis in our study might have led the respondents to believe that it could spin out of control and prior knowledge might not be applicable, thereby limiting the effect of prior knowledge. Rather than concluding that prior knowledge does not come into play when individuals assess their trust in crisis information on social media, we suggest that it is necessary to test the proposed model further in other types of crisis (e.g., flood, earthquake, civil unrest) and crises of different magnitude. The implications of these and other findings for research and practice are discussed next.

6.1. Implications for Research

This study contributes to theoretical development in several ways. First, examining the processes through which individuals form trust in user-generated information extends the theorization of the concept by looking beyond the effects and antecedents of trust to understand *how trust is formed*. According to our literature review, this is one of the earliest attempts to do so. Second, our proposed model clarifies the factors affecting the use of different information processing routes. We found that their use depends on individuals' motivation and opportunity to process the information. Third, our proposed model focuses on an understudied yet critical context, considering that individuals are increasingly turning to social media for information and social media's availability sometimes surpass other traditional media during crises. The moderating factors

corresponding to motivation and opportunity, namely personal relevance and anxiety, are highly relevant to the crisis context. Fourth, the proposed model was assessed in an empirical field survey set in a real crisis rather than a fictitious scenario and realism was thus maintained.

This study is limited in several ways that could be improved in future studies. First, a complete list of the population (i.e., individuals who sought crisis information on social media) was not available and random sampling was therefore not viable. The list is unlikely to become available in the foreseeable future but the generalizability of our findings can be enhanced by studying other samples, social media, and types of crisis. Second, our proposed model accounted for only one each of the motivation, opportunity, and ability factors. Since the findings largely support their moderating effects, future research can extend the model by considering other relevant factors such as curiosity (a source of motivation) and time pressure (which could limit the opportunity to process information).

The findings also suggest further opportunities for research. The observation that users tend to be more affected by majority influence (a peripheral route) is well-matched to the nature of social media. This may reflect the general personality of individuals who seek information on social media - they can be characterized as having stronger external locus of control and are therefore more easily swayed by social influences than those who seek information from other media. Since social influence is prevalent in social media, more research on the nature of the influence is needed. For example, some interesting questions include: what are the characteristics of social media users who are likely to be influenced? What are the informational characteristics of influential messages? What are the mechanisms through

which users are influenced by user-generated information? How do technological features (e.g., display of access statistics, naming and position of the repost button) affect the extent of influence? Since social media has a strong potential in spreading false information and rumors during crises (Sutton et al., 2008), understanding the nature of the influence can help to identify ways to manage undesirable influence. This also narrows a gap in IS studies applying the elaboration likelihood model, which often leave out the opinion of others even though the model identifies it as an important heuristic for processing information (Petty and Cacioppo, 1986), as discussed earlier.

6.2. Implications for Practice

Our findings have implications for limiting the spread of false information during crises. Compared to relying on peripheral heuristics, social media users are better able to avoid trusting false information if they engage in the evaluation of information quality. The results of our study suggest that they tend to do so when the information is of high personal relevance and their level of anxiety is low. While it may not be possible to influence personal relevance in practice, crisis management teams can alleviate some anxiety by increasing the *amount* of accurate information provided and their availability to the public.

We also found that the peripheral route is more likely to be used by those who find the information

to have low personal relevance. This includes those who are not victims and whose families and friends are not directly affected by the crisis. The increased reliance on majority influence may raise their chances of trusting false yet popular information. They may contribute to the spreading of such information by sharing with others what they thought was true. Therefore, it is especially important to manage this group of social media users as part of crisis management to ensure that they do not inadvertently help in spreading misleading information.

6.3. Conclusion

Unlike most prior IS studies of trust that focus on increasing trust to promote IS behaviors (e.g., use of online shopping, adoption of new technologies), this study recognizes the double-edged-sword quality of social media as an information source during crises and the importance of forming accurate trust in user-generated information. Understanding how social media users form trust and how it is affected by their motivation, opportunity, and ability is a necessary step towards a more complete theorization of trust in user-generated information that accounts for the process of trust formation. Our proposed model serves to augment theoretical and practical understanding of social media and as a basis for further inquiry, which is necessary as social media have become integral and even critical to many aspects of our lives.

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