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

Abstract

Social media are increasingly being used as a source of information during crises such as natural disasters and civil unrests. Nevertheless, there have been concerns about the quality and truthfulness of user-generated information. This study seeks to understand how users form trust in information on social media. Based 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, and the factors influencing the use of the routes. Findings from a survey of Twitter users seeking information about the Fukushima Daiichi nuclear crisis indicate that personal relevance and level of anxiety moderate individuals' use of information processing routes. This study extends the theorization of trust in user-generated information. The findings also suggest practical approaches for managing social media during crises.

Keywords: User-generated information; trust; elaboration likelihood model; motivation, opportunity, ability framework; crisis information

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1.   Introduction

Social media are increasingly being used as a source of up-to-the-minute information about what is happening on the ground during large-scale crises (Westerman et al. 2014) such as natural disasters and civil unrests (e.g., street riot, political reform). 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 location of affected areas, evacuation sites, damages, and injuries were shared on Twitter (Vieweg et al. 2010). User-generated information is seen as helpful for improving 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). Situation awareness helps individuals assess their personal situation or gain a broad understanding of the crisis. At times, the use of social media during crises even surpasses other media because Internet access often remains robust when landlines, base stations of mobile phones, and power lines become congested or damaged (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. Social media often contain unverified information, misinterpretations, and even fabricated content. It is sometimes considered as a collective rumor mill that propagates 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, it is widely believed that rumors spread through social media such as Twitter and Facebook triggered the mass unrest in the 2011 England Riots (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 assess a model that identifies two information processing routes through which individuals develop trust, based on the elaboration likelihood model (Petty and Cacioppo 1986). Further, drawing on the motivation, opportunity, ability (MOA)

framework, we propose that individuals' use of information processing routes depends on the personal relevance of information, level of anxiety, and prior knowledge.

The proposed model contributes to theoretical development and the management of social media in several ways. First, it focuses on the consumption of user-generated information and narrows a gap in research which has mainly focused on the motivation to generate content (e.g., Chai 2011; Kim et al. 2009). Second, it sheds light into the informational processes through which individuals form trust in user-generated information. Although the elaboration likelihood model has been applied to study trust in electronic words of mouth (Cheung and Thadani 2012), it is not clear whether the model is applicable to the crisis context, in which people often frantically seek information from all available sources to inform their actions and trusting false information can be especially dangerous. Our proposed model considers the effect of anxiety, which is particularly relevant in the crisis context. Third, this study focuses on the crisis context wherein information is critical yet understudied. The model was assessed with data collected from individuals who sought information about a real-life crisis. Overall, the proposed model is theoretically grounded and practically relevant. In the following sections, the conceptual background for the proposed model as well as the study and findings will be detailed.

2. Conceptual Background

This section first reviews prior studies on trust in user-generated information to identify gaps in research. This is followed by a discussion of the information processing routes according to the elaboration likelihood model. Individuals' motivation, opportunity, and ability affecting their use of the information processing routes are then described.

2.1. Trust in User-Generated Information

In this study, trust is defined as the extent to which one feels secure and comfortable about relying on the information on social media. Our review of studies on trust in user-generated information (see Table 1) shows that prior studies have examined the effect of trust on factors such as attitude (Bartle et al. 2013) and social media use (Anish et al. 2014; Chu and Kim 2011). Prior studies have also found that trust is affected by the source of information (e.g., authority, reputation, integrity; Burgess et al. 2011; Dickinger 2011), history of interactions with source (Kim and Ahmad 2013) and content characteristics (e.g., informativeness, quality, volume; Flanagin and Metzger 2013).

Another stream of research has proposed methods for quantifying the trustworthiness of user-generated information (Lenders et al. 2008; Moturu and Liu 2011).

The review shows that prior studies have mostly examined trust among users facing purchase decisions or seekers of travel, lifestyle, and health information. This study seeks to extend research on the topic by examining individuals' trust in crisis-related information, which is an important type of information that is increasingly sought and used during crises to cope with uncertainty.

It can also be observed from the review that one important means through which individuals determine their trust in user-generated information is processing and evaluating the content of the information. This suggests that information processing theories may augment our understanding of the phenomenon. This study is one of the first to draw on one such theory, the elaboration likelihood model (ELM), to theorize trust in user-generated information by identifying two routes of information processing as well as the conditions affecting their use. ELM will be detailed next.

Table 1. Studies of Trust in User-Generated Information

Source	Key Findings and Key Constructs*	Method and Sample
Anish et al. (2014)	**Trust** did not influence the amount of **usage of user-generated review platforms**	Survey of 72 users of Yelp.com
Bartle et al. (2013)	- Trust was associated with strong positive attitude towards cycling as a commuter mode - Information shared within a group inspired greater trust amongst participants than "official" information, largely because it was seen as emanating from the experience of "real people" - There were 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)	- Greater **trust** was placed in online travel comments when they were on a specific travel **website** than when they were on a generic social networking website - The highest level of **trust** was afforded to information provided on state government **websites**	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** increased **overall trust** of online channels	Survey of 453 tourists in Vietnam who were also Internet users
Flanagin and Metzger (2013)	**Information volume** 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 1,207 Internet users who viewed a fictitious movie rating website
Kim and Ahmad (2013)	- **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)	The proposed secure localization and certification service helped content consumers to establish the trust level of contents	Geotagging service
Moturu and Liu (2011)	The proposed approach helped to quantify the trustworthiness of shared content on social media, based on aspects 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)
* Constructs in quantitative studies are indicated in bold font		

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 improve decision accuracy (O'Reilly 1982). In line with this, studies of health information websites observed that users find it less risky to trust high-quality information (Koo et al. 2014; Luo and Najdawi 2004). The other route of information processing is the *peripheral* route, which involves the use of cues or heuristics (e.g., source credibility, opinion of the majority; Diane 1987) to form an attitude and therefore requires less cognitive effort than the central route.

ELM is often studied in social psychology and marketing research and is increasingly being applied in information systems (IS) research (Bhattacherjee 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 (Li 2013). ELM has also served as the basis for understanding individuals' acceptance and use of information accessed through technologies such as expert systems (e.g., Dijkstra 1999; Mak et al. 1997) and e-commerce websites (e.g., Ho and Bodoff 2014; Yang et al. 2006; Zhou 2012). This indicates that ELM can potentially offer insights into individuals' trust in information on social media.

Although ELM identifies 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 socializing. Therefore, this study considers the opinion of others through the construct of *majority influence*, which reflects the extent to which most people in a social group hold similar opinion 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 supported by many people, it may be perceived as having been endorsed and validated by the majority and therefore more trustworthy (Chaiken and Maheswaran 1994). This is in line with the concept of social proof, which suggests that individuals facing uncertainties determine what is correct based on what others think is correct (Cialdini 1993).

In ELM, 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) depends on their elaboration likelihood, which is influenced by their motivation and ability to evaluate information (Petty and Cacioppo 1986). Individuals with strong motivation and ability to process information are likely to expend more cognitive resources to evaluate the quality of information and rely less on peripheral heuristics. Motivation and ability are also keys aspects of the MOA framework, which is originally proposed to explain consumers' processing of brand information in advertisements. In addition to motivation and ability, the MOA framework suggests that the *opportunity* to process information can influence the amount of attention allocated to a piece of information. Therefore, we extend ELM with the MOA framework by considering opportunity to process information in our proposed model. The MOA framework is detailed next.

2.3 Motivation, Opportunity, Ability (MOA) Framework

MacInnis et al. (1991) propose that consumers' processing of advertising information is influenced by their motivation and ability, as well as the opportunity to do so. *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* refers to the knowledge or skills relevant to the information to be processed. The MOA framework has been adapted to study many different behaviors beyond consumer research, including individuals' use of social networking sites (e.g., Leung and Bai 2013).

As mentioned earlier, motivation and ability are expected to influence elaboration likelihood in ELM. Motivation is conceptualized in terms of *personal relevance* and ability is based on one's *prior knowledge* in ELM (Petty and Cacioppo 1986). Similarly, prior IS studies applying ELM have predominantly conceptualized motivation and ability

in terms of these constructs (Angst and Agarwal 2009; Bhattacherjee and Sanford 2006). Accordingly, we consider motivation and ability in terms of personal relevance and prior knowledge in our proposed model.

With regard to the opportunity to process information, an important source of distraction that can draw one's attention away from information processing during crises is anxiety. Anxiety is common among individuals facing a crisis. A diminution of available attention can be expected when individuals are anxious and fearful since these negative emotions often require an immediate, active response. As a form of arousal, anxiety also leads to an increase in self-focused attention which may distract a person from thoroughly processing the external social environment (Wilder 1993). 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).

3.   Research Model and Hypotheses

Based on ELM, 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 on trust. According to ELM, the use of the routes depends on elaboration likelihood, which is determined by personal relevance (a motivation factor) and prior knowledge (an ability factor). In terms of modeling, personal relevance and prior knowledge are expected to moderate the impact of information quality and majority influence on trust (e.g., information quality has a stronger impact on trust when personal relevance is high). As discussed earlier, we extend ELM with the MOA framework by considering anxiety as a distraction that reduces the opportunity to process information. Therefore, anxiety is also expected to moderate the impact of information quality and majority influence on trust (see Figure 1). The hypotheses in the moderated model are detailed next.

Figure 1: Model of Trust in User-Generated Crisis Information on Social Media
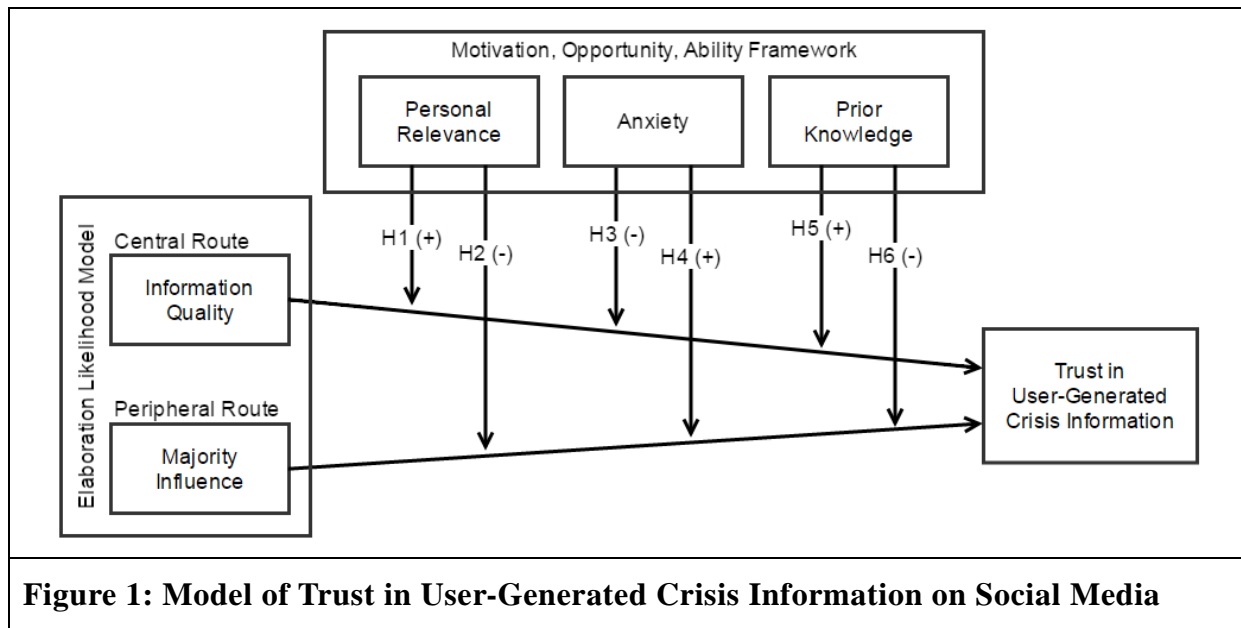
3.1 Moderating Effects of Personal Relevance

Personal relevance is the extent to which an issue is expected to have a 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 would not occur can endanger their lives directly. Personal relevance increases individuals' sufficiency threshold in information processing (Chaiken et al. 1989). This prompts individuals to engage in more information processing to satisfy the increased need. Personal relevance also 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 quality and 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, individuals rely more on the central route of information processing and less on the peripheral route. In other words, the effect of information quality on trust is likely to strengthen while the effect of majority influence (which is a peripheral heuristic) is likely to weaken.

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 in 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, leaving less capacity for tackling other cognitive tasks (Eysenck et al. 2007). In support, studies have shown that individuals under high anxiety exhibit lower performance in tasks that demand cognitive resources (e.g., Ashcraft 2002). The reduced cognitive capacity 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 more likely to rely on peripheral cues which demand less effort to process and less likely to evaluate information quality. In support, a study observed that high-trait-anxiety individuals are often 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). Nevertheless, there has been a lack of study on the effect of state anxiety (how one feels in a particular situation) on the use of information processing routes during crises. The following hypotheses are assessed to narrow this gap:

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 (Bhattacherjee 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.

4.   Research Method

The target population of this study is individuals who sought crisis-related information on social media. Data were collected in a survey of individuals who sought information about the Fukushima Daiichi nuclear crisis on Twitter. 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, causing 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 publicly known, many individuals within and outside Japan turned to social media for up-to-date 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, including Twitter (Doan et al. 2012).

In Twitter, information on a topic can be accessed by searching "tweets", which are text-based messages of up to 140 characters. A message can include links to other webpages, which are typically used to provide further supporting information beyond the 140-character limit. Tweets are by default open to the public and can be retrieved by anyone with Internet access (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):

> *"Nuclear Ash Cloud Of Radiation Raining On Tokyo From Burning Of Radioactive Fukushima Sewage Sludge... http://fb.me/W3FIGu2C"*
> *"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 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 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 (26.8 percent; see Table 3) and the United States (19.7 percent). Male respondents constituted 53 percent and 69.2 percent of the respondents aged from 21 to 35. Most respondents had one to two years of experience using Twitter (54.6 percent) and more than five years of experience using the Internet (66.7 percent).

Table 2. Survey Instrument	
Construct	**Item and Source**
Information quality	I think the information related to nuclear radiation on Twitter is generally … 1. subjective/objective 2. unverifiable/verifiable 3. has insufficient/sufficient breadth or coverage 4. has insufficient/sufficient depth or detail 5. outdated/up-to-date 6. difficult/easy to understand (Scored on semantic-differential scales; All items adapted from Lee et al. 2002)
Majority influence	1. On Twitter, most people hold largely similar views about the effects of radiation 2. On Twitter, most people share consensus about the effects of radiation 3. On Twitter, there is general agreement about the effects of radiation (All items developed based on Martin et al. 2002)
Personal relevance (formative measure)	1. There is a high possibility that I will experience the negative effects of nuclear radiation in future 2. My physical health makes it more likely that I will experience the negative effects of nuclear radiation 3. My geographic location makes it more likely that I will experience the negative effects of nuclear radiation 4. 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	1. I feel anxious (worrying, anticipation of the worst) about the Fukushima nuclear crisis 2. I feel tense (trembling, feeling of restlessness, unable to relax) due to the Fukushima nuclear crisis 3. I have difficulty falling asleep due to the Fukushima nuclear crisis 4. I feel depressed due to the Fukushima nuclear crisis (All items adapted from Hamilton 1959)
Prior knowledge	1. I have professional expertise in domains related to nuclear radiation 2. I had personally experienced the effects of nuclear radiation 3. 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	1. In general, I trust the information related to nuclear radiation on Twitter 2. I feel secure using the information related to nuclear radiation on Twitter in decision making 3. I feel comfortable using the information related to nuclear radiation on Twitter in decision making (All items developed based on Komiak and Benbasat 2006)

Table 3. Sample Demographics			
Variable	Value	Percentage	Count
Age	18 to 20	2.53%	5
	21 to 25	19.19%	38
	26 to 30	26.77%	53
	31 to 35	23.23%	46
	36 to 40	13.64%	27
	41 to 45	7.07%	14
	46 to 50	4.04%	8
	> 50	3.54%	7
Gender	Male	53.03%	105
	Female	46.97%	93
Country of Residence	Japan	26.77%	53
	US	19.70%	39
	Canada	9.60%	19
	Australia	8.59%	17
	China	12.12%	24
	Singapore	13.64%	27
	Malaysia	9.60%	19
Experience using Twitter	Less than 1 year	21.21%	42
	1 to 2 years	54.55%	108
	3 to 4 years	18.18%	36
	5 to 6 years	6.06%	12
Experience using Internet	Less than 1 year	0.00%	0
	1 to 2 years	1.52%	3
	3 to 4 years	31.82%	63
	5 to 10 years	53.54%	106
	>10 years	13.13%	26

5. 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 (second measurement item) and geographic location of a person (third item) 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 value of 0.70 (Hair et al. 2009). Convergent validity was assessed by examining composite reliability and average variance extracted (AVE) by each construct (see Table 4). All composite reliabilities and AVEs were above the recommended value of 0.70 (Hair et al. 2009), indicating that the instrument had satisfactory convergent validity.

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

Discriminant validity was assessed by factor analysis (see Table 5) and comparing construct correlations with square root of AVEs (see Table 6). 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).

Table 5. Item Loading in Factor Analysis						
Construct	**Item 1**	**Item 2**	**Item 3**	**Item 4**	**Item 5**	**Item 6**
Information Quality (IQ)	0.75	0.80	0.84	0.81	0.90	0.86
Majority Influence (MI)	0.92	0.92	0.86			
Anxiety (AX)	0.81	0.80	0.85	0.82		
Prior Knowledge (PK)	0.78	0.73	0.92			
Trust in User-Generated Information (TI)	0.82	0.84	0.92			

Table 6. Correlation and Square Root AVE					
Construct	**1**	**2**	**3**	**4**	**5**
1. Information Quality (IQ)	**0.82***				
2. Majority Influence (MI)	0.28	**0.90**			
3. Anxiety (AX)	0.25	0.28	**0.82**		
4. Prior Knowledge (PK)	0.30	0.34	0.34	**0.81**	
5. Trust in User-Generated Information (TI)	0.63	0.66	0.43	0.40	**0.80**
*Bold diagonal entries are square root of AVE					

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, as all item weights were significant at p<0.05. VIFs were also calculated and they were all 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 moderating hypotheses. The procedure involves computing interaction terms by multiplying the predicting and moderating constructs. For interaction terms involving the formative construct of personal relevance, the two-step score construction procedure suggested by Chin et al. (2003) was used to create underlying construct scores for the predictor and moderator variables before creating the interaction terms.

Our hypotheses specify the sign of path coefficients based on ELM and MOA framework and were thus assessed with one-tailed p-values (Kock 2015). Results of the structural model are shown in Table 7 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, but not the level of education, gender, number of years using Twitter, and number of years using the Internet. The proposed model explained 67.5% of the variance in trust.

Table 7. 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			

*p<0.05; **p<0.01

Figure 2: Path Coefficients of Structural Model
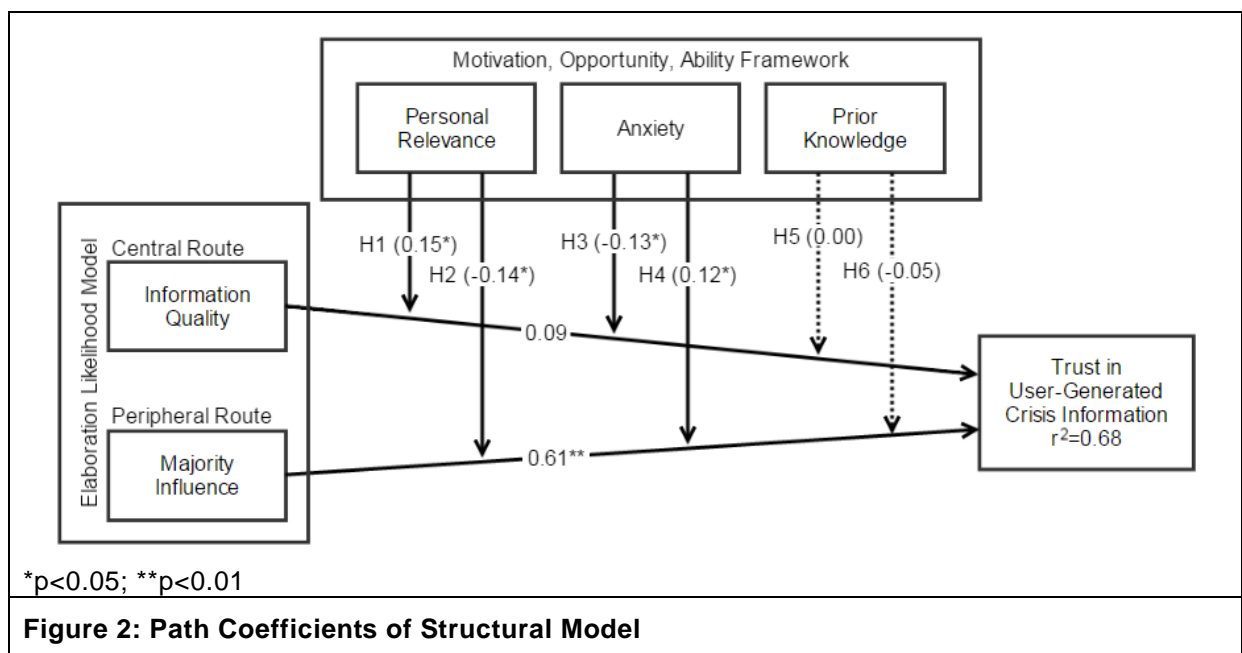
The significant moderating effects are plotted in Figure 3. It can be observed that for information with high personal relevance, the effect of information quality on trust strengthens (in Figure 3a, the solid-line slope is steeper than the broken line slope) while the effect of majority influence weakens (in Figure 3b, the solid-line slope is gentler). This provides support for hypotheses H1 and H2. For high-anxiety individuals, the opposite is observed – the effect of information quality on trust is weaker (in Figure 3c, the solid-line slope is gentler) while the effect of majority influence is stronger (in Figure 3d, the solid-line slope is steeper). Interestingly, all the slopes related to information

quality are much gentler (see Figure 3a and 3c) compared to the slopes related to majority influence (see Figure 3b and 3d), indicating that social media users tend to be more strongly affected by majority influence than information quality. The implications of this and other findings are discussed next.

Figure 3: Plots of Significant Moderating Effects
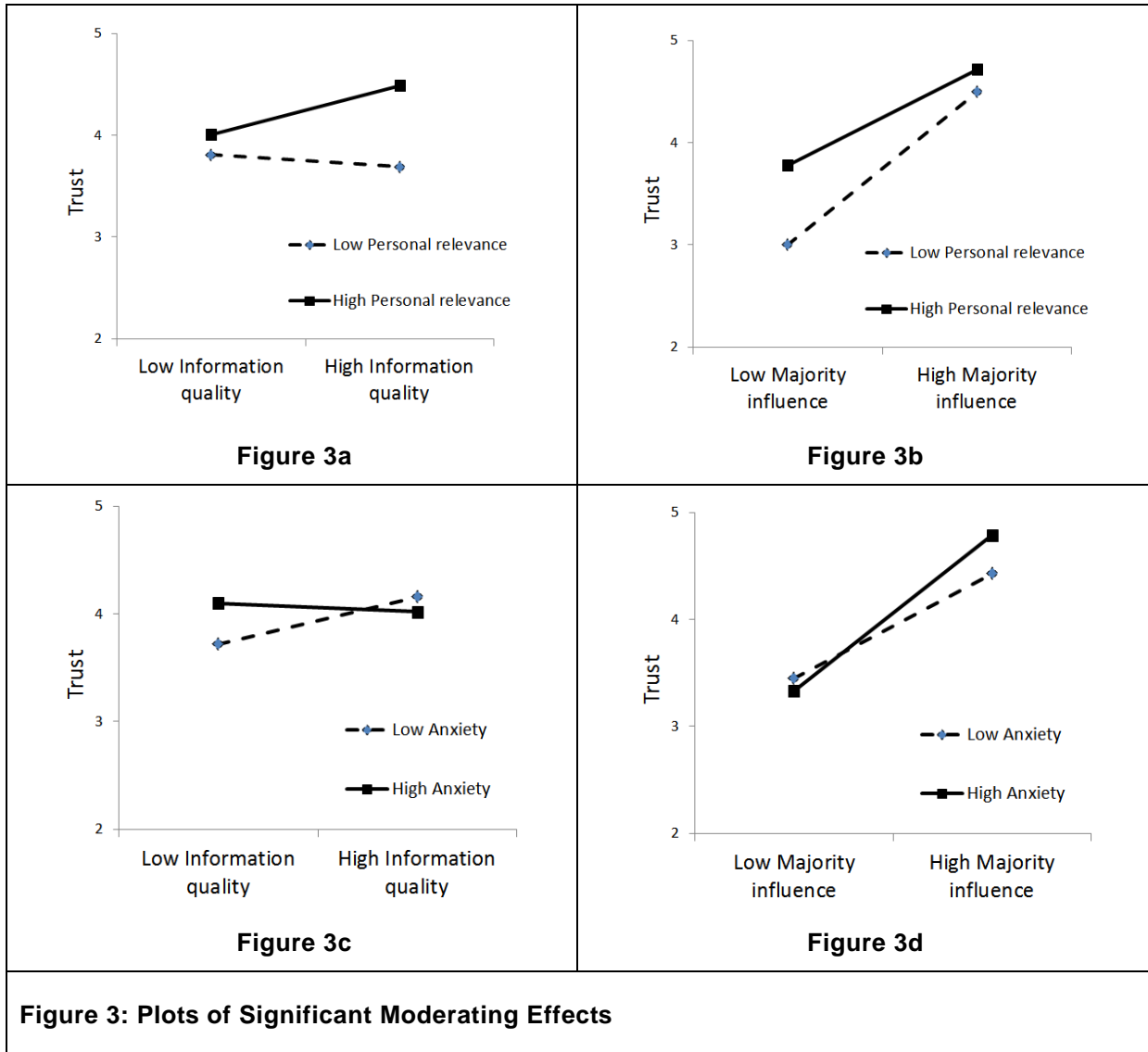
6. Discussion

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 individuals' use of the routes. Based on ELM, our proposed model considers two routes: central and peripheral. Extending ELM with the MOA framework, we hypothesize that the use of the routes is 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 their anxiety level is low. In contrast, individuals use the peripheral route more when the crisis information has less personal relevance or when their anxiety level is high. Contrary to our hypotheses, the moderating effects of prior knowledge were not significant.

The insignificance of prior knowledge is unexpected considering that there has been strong evidence for its role in information processing, as discussed in the hypothesis's justification. 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 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 this 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, the proposed model identifies two important information processing routes through which individuals form trust. Along with the central route which relies on information quality, the model accounts for the peripheral route which relies on majority influence and is clearly pertinent in the context of social media. According to our literature review, this is one of the earliest IS studies to consider social influence in the formation of trust in user-generated information. Second, our proposed model clarifies the factors moderating the use of different information processing routes. We found that their use depends on personal relevance and level of anxiety. This enhances our understanding of how the formation of trust is shaped by individual factors. Third, our proposed model focuses on a critical yet understudied context. Considering the prevalence of turning to social media for information during crises, studying the formation of trust in the context can inform the management of crises, such as the spread of false information on social media. Our model accounts for factors such as personal relevance, anxiety, and majority influence, which are highly relevant to the crisis context and medium. 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 the moderating effects of motivation and opportunity, 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 research opportunities. 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 social media users – they can be characterized as having stronger external locus of control and are therefore more easily swayed by social influence then 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 personal characteristics of social media users who are likely to be influenced? What are the informational characteristics of influential messages? What are the social mechanisms through which users are influenced by user-generated information? How do technological features (e.g., display of access statistics, naming and positioning of the repost button) affect the extent of social influence? Since social media can potentially spread false information and rumors during crises (Sutton et al. 2008), understanding the nature of social influence can help to identify ways to manage undesirable influences. This also narrows a gap in IS studies applying ELM, which often leave out the opinion of others even though ELM identifies it as an important heuristic for processing information (Petty and Cacioppo 1986).

6.2. Implications for Practice

Understanding the formation of trust has several practical implications for the management of social media during crises. Trust is likely to be more accurate if it is based on the central route of information processing (i.e., evaluation of information quality). Therefore, the use of the central route should be promoted to curb the spread of false information during crises. Our findings suggest that this can be achieved by

increasing personal relevance and reducing the level of anxiety.

With regard to personal relevance, social media websites can organize and present crisis information to users according to their proximity to the crisis. This can increase the relevance of information to individual users and entice them to assess information quality and thereby form a more accurate judgment of its trustworthiness. For instance, for users who are geographically close to the location of the crisis, information about evacuation should be emphasized; for users who are distant from the crisis, information about the crisis's broad and long-term implications could be highlighted. Information can be personalized based on users' personal profile (e.g., country of residence, occupation, education, and age), geographical location, as well as browsing history. A combination of expert recommendation, peer recommendation, and automated recommendation can be used to enhance accuracy of information personalization.

To a certain extent, the level of anxiety can be reduced by modifying website design in several ways. First, it has been observed that the color, background music, and layout of website content can reduce arousal levels and elicit emotions such as peacefulness, calmness, and hopefulness (e.g., Wu et al. 2008). During crises, these elements of social media websites may be temporarily adjusted to reduce anxiety among information seekers and thereby promote the use of the central route of information processing. Second, messages signaling social support can be displayed to reduce the level of anxiety. This is supported by studies that have observed a negative correlation between social support and the level of distress after natural disasters (e.g., Cook and Bickman 1990). Messages that convey information about emotional support (expressions of assurance, affection, closeness), informational support (verified situation updates, evacuation instructions), and tangible support (donation, shelter, transportation) can be displayed in the form of banners to enhanced the perceived social support among high-anxiety individuals.

7. Conclusion

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. This departs from prior IS studies which have mainly focused on increasing trust to promote IS behaviors (e.g., use of online shopping, adoption of new

technologies). The proposed model addresses a gap in our understanding by shedding light on the informational processes though which social media users form trust and how the use of the processes is affected by individuals' motivation and opportunity. This study serves as a step stone for further inquiry into the consumption of user-generated information and contributes to a more complete theorization of the phenomenon, which is imperative as social media have become integral and even critical to many aspects of our lives.

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