

The Influence of Crisis Response on Social Interaction and Public Resilience Based on Importance-Performance Map Analysis (IPMA)

Umar Ali Bukar¹, Marzanah A. Jabar², Fatimah Sidi³, Rozi Nor Haizan binti Nor⁴ and Salfarina Abdullah⁵

^{1,2,4,5}Department of Software Engineering and Information System, Faculty of Computer Science and Information Technology, Universiti Putra Malaysia (UPM), Serdang 43400, 9, Malaysia, {umarfalmata@gmail.com, marzanah@upm.edu.my, rozinor@upm.edu.my, salfarina@upm.edu.my}

³Department of Computer Science, Faculty of Computer Science and Information Technology, Universiti Putra Malaysia (UPM), Serdang 43400, Malaysia, {fatimah@upm.edu.my}

ABSTRACT

This study aimed to investigate the influence of crisis, crisis response, and social media interaction on public resilience by using the importance-performance map analysis (IPMA) method. Data collected through empirical study consists of 167 observations; comprising Malaysians that have experienced Covid-19 lockdown. The reliability and validity of the measurement models were assessed by Cronbach's alpha, coefficients rho A, composite reliability, and discriminant validity values. The IPMA compares the constructs and indicators level from the performance scale mean value against the importance. The result shows that all the constructs and most of the indicators are important and reveal good performance. Thus, future research activity should be focusing on maintaining the constructs and indicators' at the performance level. Therefore, our findings revealed that the overall constructs and indicators' should be having high priority by crisis management and communication authorities and researchers.

Keywords: Crisis communication, crisis response, social media, social interaction, resilience, and IPMA.

I INTRODUCTION

The emergence of Coronavirus (Covid-19) has made people exposed to digital interaction through social media platforms worldwide. Physical interactions have been difficult and challenging due to contaminations. The condition deteriorates as experts and authorities encourage and force residents to reduce movement for several weeks to contain the virus from spreading. Public resilience to avoid panicking due to the crisis has become very important, while social media provides the environment where people communicate, help the affected citizens, and an information source (Groen et al., 2017). Despite its importance, Moller et al. (2018) is only the study that investigated how social media usage could improve community resilience

after a crisis. Therefore, this study intends to add to the literature on the discussion of resilience-building through social media usage and social media-based crisis communication.

Therefore, this research endeavor aims to analyze the influence of crisis, social media interaction, and crisis response on community resilience based on the importance-performance map analysis (IPMA) used in previous studies (Rosenbusch et al., 2018; García-Fernández et al., 2020). The study presents as follows; section II discussed the theoretical framework, section III discussed the study design and data measures, section IV presents the assessment of the results, section V discusses the implications of the findings, and section V concludes the study.

II THEORETICAL FRAMEWORK

Crisis informatics is a term used to show the application of technology (information systems, social media, etc.) in crisis management and communication which is founded by Hargar (2006; 2007) (Sigala, 2012; Hagar, 2013; Pipek et al., 2014; Palen & Anderson, 2016; Tan et al., 2017; Reuter & Kaufhold, 2018). The field explained the overlapping factors of social, technical, and information in disaster/crises (Hagar, 2013). Crisis management relied on effective communication (Gascó et al., 2017) that described how strategic communications are applied to limit the negatives effects of crisis (Coombs, 2018). The advent of social media tool has presented new ways in which communications take place (Liu et al., 2011; Graham et al., 2015; Gerken et al., 2016) by offering people the ability to engage in crisis response and communication (Liu et al., 2011; Fortunato et al., 2018). The crisis communication matrix distinguishes between four patterns of interactions and communication on social media (Reuter et al., 2012). It shows that communication took place between authorities (A) and citizens (C) comprising A2A, A2C, C2C, and C2A.

Several crisis communication models existed in the literature. The introduction of social media as a crisis

communication medium forced researchers to review the traditional models to address the dynamic nature of social media (Liu et al., 2011; Stewart and Wilson, 2016; Panagiotopoulos et al., 2016; Moller et al., 2018; Lambret & Barki, 2018; Sjöberg, 2018; Cheng, 2018; Grover et al., 2018). Nevertheless, the traditional SCCT remained the most dominant theory (Bukar et al., 2020), while SMCC, STREMI model, ICCM, and SMDR as emergent social media-based models.

Thus, referring to the discussion available from the literature (Bukar et al., 2020), this study adopted the favorable variables identified from the previous research toward the introduction of social media crisis communication and its impact on community resilience. When a crisis occurs, the crisis information initiate and encourages stakeholders to engage in crisis response as founded in the dominant theory of crisis communication, the situational crisis communication theory (SCCT) (Coombs, 2007) and supported by the social-mediated crisis communication model (SMCC) (Austin et al., 2012; Jin et al., 2014). Social media serve as a medium of communication that provides an environment where people gathered for a specific purpose. The two constructs (crisis, crisis response) are the main variables influencing public formations on social media. According to Goggins et al. (2013), the people formations on the social media platforms reveal the unsatisfactory issues and challenges of modeling qualitative and quantitative research data to recognize the stakeholders' interaction, stakeholders' leadership, and stakeholders' social structure are represented in digital trace data. Bukar et al. (2020) conceptualized the interactive crisis communication model (ICCM) (Cheng, 2018) to represents the online setting (social media) in which stakeholders interact as social interaction (social media interaction) as a result of crisis responses. The crisis respondents participate and work together as groups by pressuring the authorities to do more or enlighten the community. The ICCM emphasized the significance of the interaction between the organization and public stakeholders involved in crisis responses, while the social media disaster resilience (SMDR) model (Moller et al., 2018) has illustrated social media usage for building hotel resilience. Hence, Bukar et al. (2020) proposed constructs explain how social media interactions and social media crisis response can improve community resilience. The interactions between stakeholders (management and public) through social interaction or crisis responses can show the intensity of crisis communication and management effort toward managing the crisis. Figure 1 illustrates the constructs in the conceptual model under investigation.

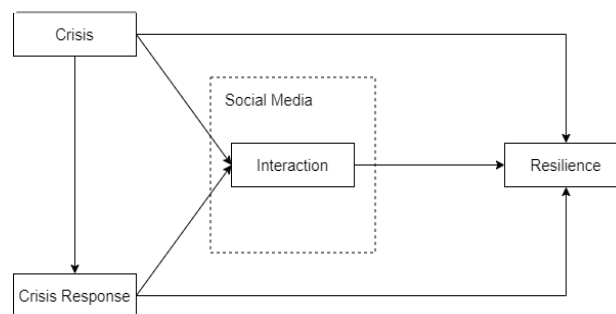


Figure 1. Theoretical Model

Therefore, this study is grounded upon SCCT, ICCM, and SMDR to evaluate the influence of crisis, social media interaction, and crisis response on resilience. Also, it illustrates the use of the IPMA procedure with empirical data. The goal of IPMA is to demonstrate the importance and performance of crisis, social media interaction, and crisis response on community resilience, and also to disclose the performance of the indicators adapted for the survey. The models include four constructs; crisis (CRISIS), crisis response (CRISISRES), social media interaction (SMI), resilience (RESILIENCE).

III STUDY DESIGN AND DATA MEASURES

The design and development of the research survey followed a series of steps and activities. These include an expert review by four experts in the field of crisis communication and information system. The expert's review was conducted to examine the validity of the research instrument during the initial stage of the study, after the early validation phase, a pilot test that consists of 32 participants was carried out to verify the reliability of the instrument to improve the items of the questionnaire, and partial least square structural equation modeling (PLS-SEM) approach was adopted to analyze the survey data. Moreover, the IPMA was applied to enrich the PLS-SEM analysis (Ringle & Sarstedt, 2016) and understand the influence of different variables. However, this study only reported the measurements model and was supported by the IPMA analysis. The IPMA analysis of the models was conducted based on the guidelines available from the literature implemented with SmartPLS 3 (Ringle et al., 2015 cited in Ringle & Sarstedt, 2016; García-Fernández et al., 2020).

The sample size was calculated on G*Power statistics that resulted in 119 sample sizes as the minimum sample required for the study (Faul et al., 2007; Faul et al., 2009). All the measurement items are reflective and were measured on a five-point Likert scale. The survey was conducted online through Google Form that resulted in 190 responses from people who

regularly used social media during a crisis such as a pandemic (covid-19). A total of 23 responses were discarded for further analysis due to straight-line issues, missing values, outliers, and multivariate normality in the data (Osborne, 2013). The final responses consist of 167 observations which primarily consist of Malaysians between 21 and 40 years, who have experience Covid-19 lockdown and are observing social distancing rules either to avoid a crowded area, self-isolate or quarantine. Most of the respondents used social media during the Covid-19 movement control order (MCO) to engage virtually with friends and relatives and also received updates from crisis management and communication authorities.

IV RESULTS ASSESSMENT

The assessment of the result was conducted in two folds. These include the analysis of the measurements model and evaluation of the IPMA results.

A. Analysis of the Measurement Model

The assessment of the reflective measurement models was conducted by following recommendations available from the literature (Hair et al., 2017; Chin, 2010). The result of the reflective measures is presented in Table 1 and Table 2. The result indicates that the measurements are reliable and valid. Specifically, all the Cronbach's alpha, coefficients rho A, and composite reliability (CR) have values above 0.7 (Sarstedt et al., 2017). Lastly, the assessment of the discriminant validity was conducted based on the study by Henseler et al. (2015) (heterotrait-monotrait ratio of correlations (HTMT)) and is supported. Hence the assessment indicated that the HTMT values are significant at < 0.85 (Franke and Sarstedt, 2019).

Table 1. Construct Reliability and Validity

Constructs	Cronbach's Alpha	rho_A	CR
CRISIS	0.743	0.763	0.824
CRISISRES	0.739	0.747	0.822
RESILIENCE	0.877	0.886	0.898
SMI	0.824	0.833	0.869

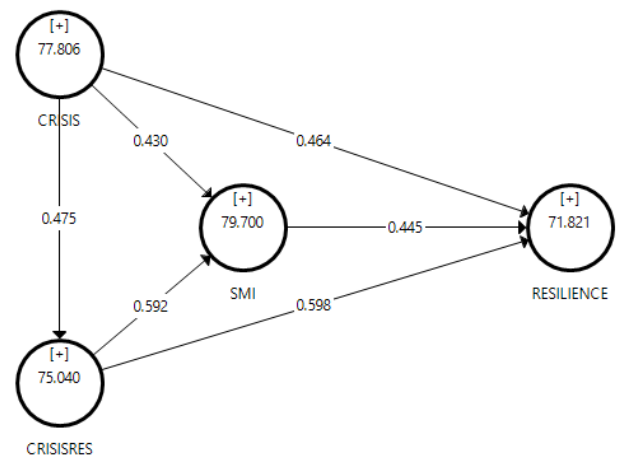
B. Importance-Performance Map Analysis

Since the main focus of this research is to evaluate the influence of the constructs and predictors under investigation, and to assist the researchers to learn the research data with a view to improved crisis management and communication decisions efforts during a crisis.

Table 2. Discriminant Validity

Constructs	CRISIS	CRISISRES	RESILIENCE	SMI
CRISIS	0.668			
CRISISRES	0.475	0.662		
RESILIENCE	0.464	0.684	0.610	
SMI	0.430	0.663	0.715	0.699

The independent variables' performance on public resilience has been presented in Figure 2. From the result obtained, social media interaction (SMI) constructs have a performance value of 79.7%, while it's rated below the crisis and crisis response constructs for the importance. These indicate that the crisis management and communication authorities should be giving much importance to social interaction on social media. Secondly, the crisis construct has a performance of 77.8%, while it's rated below SMI construct for the importance axis. Finally, the crisis response construct is the lowest-performing construct on resilience at 75.0% on a scale of 0 to 100. But the results indicated that it is the most important construct compared with crisis and SMI. The IPMA allows the researchers to examine the critical indicators (Hair et al., 2018; Ringle and Sarstedt, 2016) of the people's ability to quickly

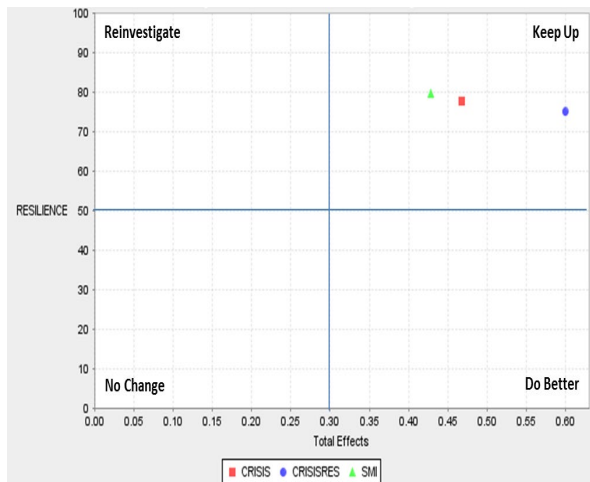


return to normal after crisis occurrence.

Figure 2. Performance of the Constructs

Further, the performance of the constructs and indicators are shown in Figure 3 and Figure 4. The performance is presented on the horizontal line (x-axis) as labeled resilience, and the vertical line (y-axis) indicating importance is labeled total effects. The IPMA compares the construct indicator level from the performance scale mean value (i.e. resilience on a scale of 0 to 100) with the importance of the indicators (i.e. total effects). The resulting IPMA for the constructs and indicators is divided into

four parts; “keep up”, “do better”, “reinvestigate”, and “no change” (Rosenbusch et al., 2018; Hsu, 2008; Figure 3 and Figure 4). Rosenbusch et al. (2018) reiterate that the partition of the graph quadrants is dependent on the performance and importance of the mean values (Martilla and James, 1977). The constructs and indicators that are found in the “keep up” quadrant are essentially important and reveal good performance. Thus, any activity should be focusing on maintaining the constructs and indicator’s performance level. The “reinvestigate” quadrant emphasized the need for attention since they

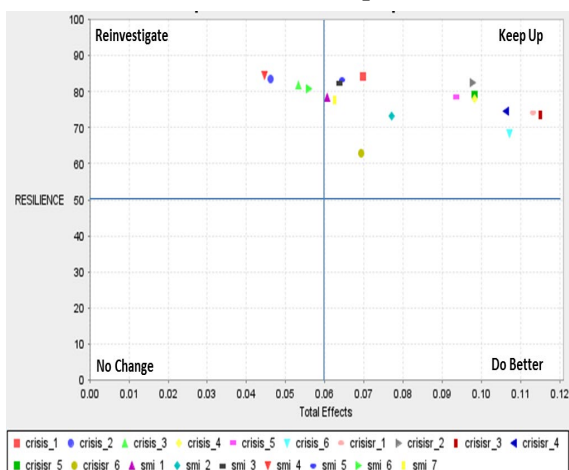


portray high performance but low importance.

Figure 3. Importance_Performance Map of Constructs

Figure 4. Importance_Performance Map of Constructs

Only a few indicators (crisis_2, crisis_3, smi_4, and smi_6) have appeared in this quadrant. Eliminating or reinvestigating the importance of these indicators for this research should be considered since the focus of this research to learn more about the data. The constructs and indicators that appeared in the “do better” section of the quadrant are averagely above both importance and less performance. In this case, the entire constructs and indicators are not found in the “do better” (Figure 3) section. Finally, no constructs or indicators are present in the “no



change” quadrant. This means that the overall constructs and indicators should be given high priority in the future.

V DISCUSSION

The usefulness of the model was assessed through IPMA. The results show that the measurement models are useful. Remarkably, the findings revealed the role of social media interaction, which supports the gratifications sort by people on social media use through social interaction during a crisis (Whiting & Williams, 2013; Li et al., 2019). Further, this study recognizes the comparative importance of crisis response that influences initial social media response during a crisis. The application of the IPMA method takes the opportunity to rank the constructs and indicators according to their corresponding performance towards the dependent variable. Initially, the primary role of crisis management is communication, which triggers social media usage, while providing the convenience and transfer of crisis response tasks to the public in a dynamic setting (Stewart & Wilson, 2016). The predictors of this study are significant empirically based on empirical data. Thus this study contributes to the existing literature by investigating their relative significance based on the IPMA approach, which was not investigated empirically by emerging social media-based crisis communication models such as STREMI and ICCM (Stewart & Wilson, 2016; Cheng, 2018), respectively. The study was validated through measurement model in PLS-SEM, and enriched with IPMA showing significant results to advance the use of social media in crisis communication and crisis informatics researches.

VI CONCLUSION

The study reported the influence of social media crisis communication and its impact on the public resilience model for constructs and indicators based on IPMA. The result indicates that all the constructs (crisis, crisis response, and social media interaction) are important and have a high-performance level. Although four indicators from crisis and social media indicators have not indicated good importance value, calling for additional investigation since their performance is relatively high. The study contributes to the advance in crisis management and communication for effective social media crisis communication. Therefore, stakeholders and policymakers in the crisis management and communication domain are equipped with empirical evidence about the constructs and indicator’s performance level and importance to public resilience.

REFERENCES

Austin, L., Fisher Liu, B., & Jin, Y. (2012). How audiences seek out crisis information: Exploring the social-mediated crisis communication model. *Journal of Applied Communication*

- Research, 40(2), 188-207.
- Bukar, U. A., Jabar, M. A., Sidi, F., Nor, R. N. H. B., Abdullah, S., & Othman, M. (2020). Crisis Informatics in the Context of Social Media Crisis Communication: Theoretical Models, Taxonomy, and Open Issues. *IEEE Access*, 8, 185842-185869.
- Cheng, Y., 2018. How Social Media Is Changing Crisis Communication Strategies: Evidence from the Updated Literature. *Journal of Contingencies and Crisis Management*, 26, 58-68.
- Chewning, L. V. "Multiple voices and multiple media: Co-constructing BP's crisis response," *Public Relations Review*, 41, 72-79, 2015.
- Chin, W. W. (2010). How to write up and report PLS analyses. In *Handbook of partial least squares*, 655-690. Springer, Berlin, Heidelberg.
- Coombs, W. T. (2007). Protecting organization reputations during a crisis: The development and application of situational crisis communication theory. *Corporate reputation review*, 10(3), 163-176.
- Coombs, W. T. (2018). *Crisis Communication: The Best Evidence from Research. The Routledge Companion to Risk, Crisis and Emergency Management*, 51-66. Routledge.
- Franke, G., & Sarstedt, M. (2019). Heuristics versus statistics in discriminant validity testing: a comparison of four procedures. *Internet Research*.
- Faul, F., Erdfelder, E., Lang, A. G., & Buchner, A. (2007). G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behavior research methods*, 39(2), 175-191.
- Faul, F., Erdfelder, E., Buchner, A., & Lang, A. G. (2009). Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior research methods*, 41(4), 1149-1160.
- Fortunato, J. A., Gigliotti, R. A., & Ruben, B. D. (2018). Analysing the dynamics of crisis leadership in higher education: A study of racial incidents at the University of Missouri. *Journal of Contingencies and Crisis Management*, 26(4), 510-518.
- Gascó, M., Bayerl, P. S., Deneff, S., & Akhgar, B. (2017). What do citizens communicate about during crises? Analyzing twitter use during the 2011 UK riots. *Government Information Quarterly*, 34(4), 635-645.
- García-Fernández, J., Fernández-Gavira, J., Sánchez-Oliver, A. J., Gálvez-Ruiz, P., Grimaldi-Puyana, M., & Cepeda-Carrion, G. (2020). Importance-Performance Matrix Analysis (IPMA) to Evaluate Servicescape Fitness Consumer by Gender and Age. *International Journal of Environmental Research and Public Health*, 17(18), 6562.
- Gerken, F., Van der Land, S. F., & van der Meer, T. G. (2016). Crisis in the air: An investigation of AirAsia's crisis-response effectiveness based on frame alignment. *Public Relations Review*, 42(5), 879-892.
- Graham, M. W., Avery, E. J., & Park, S. (2015). The role of social media in local government crisis communications. *Public Relations Review*, 41(3), 386-394.
- Goggins, S. P., Mascaro, C. & Valetto, G., 2013. Group Informatics: A Methodological Approach and Ontology for Sociotechnical Group Research. *Journal Of The American Society For Information Science And Technology*, 64(3), 516-539.
- Groen, Frans CA, et al. (2017) A hybrid approach to decision making and information fusion: combining humans and artificial agents. *Robotics and autonomous systems* 90 (2017), 71-85.
- Grover, P., Kar, A. K., & Davies, G. (2018). Technology enabled Health-Insights from twitter analytics with a socio-technical perspective. *International Journal of Information Management*, 43, 85-97.
- Hagar, C. (2013). Crisis informatics: Perspectives of trust—is social media a mixed blessing?. *School of Information Student Research Journal*, 2(2), 2.
- Hair Jr, J. F., Hult, G. T. M., Ringle, C., & Sarstedt, M. (2016). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage publications.
- Hair Jr, J. F., Sarstedt, M., Ringle, C. M., & Gudergan, S. P. (2017). *Advanced issues in partial least squares structural equation modeling*. saGe publications.
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the academy of marketing science*, 43(1), 115-135.
- Hsu, S. H. (2008). Developing an index for online customer satisfaction: Adaptation of American Customer Satisfaction Index. *Expert systems with Applications*, 34(4), 3033-3042.
- Iannarino, N. T., Veil, S. R. & Cotton, A. J., 2015. Bringing Home the Crisis: How US Evening News Framed the 2011 Japan Nuclear Crisis. *Journal of Contingencies and Crisis Management*, 23(3), pp. pages 169-181.
- Jin, Y., Liu, B. F., & Austin, L. L. (2014). Examining the role of social media in effective crisis management: The effects of crisis origin, information form, and source on publics' crisis responses. *Communication research*, 41(1), 74-94.
- Kar, Bandana. (2016). *Citizen science in risk communication in the era of ICT. Concurrency and Computation: Practice and Experience* 28.7: 2005-2013.
- Li, Y., Yang, S., Zhang, S., & Zhang, W. (2019). Mobile social media use intention in emergencies among Gen Y in China: An integrative framework of gratifications, task-technology fit, and media dependency. *Telematics and Informatics*, 42, 101244.
- Liu, B. F., Austin, L. & Jin, Y., 2011. How publics respond to crisis communication strategies: The interplay of information form and source. *Public Relations Review*, 37, 345-353.
- Martilla, J. A., & James, J. C. (1977). Importance-performance analysis. *Journal of marketing*, 41(1), 77-79.
- Moller, C., Wang, J. & Nguyen, H.T., 2018. #Strongerthanwinston: Tourism crisis communication through Facebook following tropical cyclones in Fiji. *Tourism Management*, 69, pp. pages 272-284.
- Osborne, J. W. (2013). *Best practices in data cleaning: A complete guide to everything you need to do before and after collecting your data*. Sage.)
- Palen, L., & Anderson, K. M. (2016). Crisis informatics—New data for extraordinary times. *Science*, 353(6296), 224-225.
- Palttala, P. and Vos, M. (2012). Quality Indicators for Crisis Communication to Support Emergency Management by Public Authorities. *Journal of Contingencies and Crisis Management*, 20(1), 39-49, 2012.
- Panagiotopoulos, P., Barnett, J., Bigdeli, A. Z., & Sams, S. (2016). Social media in emergency management: Twitter as a tool for communicating risks to the public. *Technological Forecasting and Social Change*, 111, 86-96.
- Pipek, V., Liu, S. B., & Keme, A. (2014). Crisis informatics and collaboration: a brief introduction. *Computer Supported Cooperative Work (CSCW)*, 23(4-6), 339-345.
- Reuter, C. & Kaufhold, M.-A., 2018. Fifteen years of social media in emergencies: A retrospective review and future directions for crisis Informatics. *J Contingencies and Crisis Management.*, 26, 41–57.
- Reuter, C., Marx, A., & Pipek, V. (2012). Crisis management 2.0: Towards a systematization of social software use in crisis situations. *International Journal of Information Systems for Crisis Response and Management (IJISCRAM)*, 4(1), 1-16.
- Ringle, C.M., Wende, S. and Becker, J.-M. (2015), "SmartPLS 3", SmartPLS GmbH, Bönningstedt.
- Ringle, C. M., & Sarstedt, M. (2016). Gain more insight from your PLS-SEM results. *Industrial Management & Data Systems*.
- Rosenbusch, J., Ismail, I. R., & Ringle, C. M. (2018). The agony of choice for medical tourists: a patient satisfaction index model. *Journal of Hospitality and Tourism Technology*.
- Sarstedt, M., Ringle, C. M., & Hair, J. F. (2017). Partial least squares structural equation modeling. *Handbook of market research*, 26, 1-40.
- Sigala, M., 2012. Social media and crisis management in tourism: applications and implications for research. *Information Technology & Tourism*, 13, 1-000.
- Sjöberg, U. (2018). It is not about facts—it is about framing. The App Generation's information-seeking tactics: Proactive online crisis communication. *Journal of Contingencies and Crisis Management*, 26(1), 127-137.

Tan, M. L. et al., 2017. Mobile applications in crisis informatics literature: A systematic review. *International Journal of Disaster Risk Reduction*, 24, 297-311.

Valecha, Rohit. (2019). An investigation of interaction patterns in emergency management: A case study of the crash of continental flight 3407. *Information Systems Frontiers*: 1-13.

Vignal Lambret, C., & Barki, E. (2018). Social media crisis management: Aligning corporate response strategies with stakeholders' emotions online. *Journal of Contingencies and Crisis Management*, 26(2), 295-305.