Analyzing Online Public Sentiment Toward Corporate Crisis in the Age of Big Data and Automation

Aqida Nuril Salma[1*]

[1]Telkom University, Bandung, Indonesia
Email: aqidasalma@telkomuniversity.ac.id

Abstract
The emergence of social media has created a new environment for digital communities to share their opinions and thoughts. Particularly in times of crisis where online platforms such as Facebook and Twitter have become the first destination for people to express their thoughts and share crucial information. On the other hand, social media and its algorithms have created very large amounts of data to enable Public Relations practitioners to access the data through data mining techniques. As such, this study aims to analyze online public sentiment toward a corporate crisis using big data and automation. Unlike research in the fields of information systems and computer science, which focuses on building methodology and tools, this study demonstrates the possibilities of basic big data utilization as well as linking the findings to the foundations of social theory and public relations crisis. To reach its aims, Twitter data has been collected, analyzed and visualized to perform a text mining and sentiment analysis for analyzing public sentiment about Garuda Indonesia crisis in 2019. Drawing on current literature on public relations and crisis management in digital world, the finding suggests the need of having big data skills for public relations practitioners if they wish to survive in a fully digitized society. Finally, I expect that this project will be important to draw in new discussion for scholars in a variety of area studies, such as strategic communication, corporate communication, digital public relations and even data science.

Keywords: big data, crisis communication, public relations, sentiment analysis, social media.

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INTRODUCTION

After 120 years since the phrase "public relations" first appeared, and as a formal profession that has always relied on the media and technology, the last several years have seen an irreversible transformation induced by the advancement of information and communication technology. Because the general public has already accepted new technology, it is critical for experts in the field of public relations to perform the same, and even to be one step ahead, in order to establish relationships more successfully. While the future of public relations will not be separated from digitalization and its highly sophisticated technologies, such as Artificial Intelligence, Big Data, and Internet of Things, which are recently entering a rapid transition from theory to reality. Digitalization has the ability to change the way we work by allowing more individuals from different backgrounds to find jobs, as well as utilizing technology to automate operations (Manyika, et al. 2011). At least 30% of tasks in 60% of all occupations are practically automatable, according to estimates (Manyika, et al. 2011). Insofar, big data is the most popular technology that increasingly deployed in the public relations and crisis communication sector.

The popularity of big data applications in the public relations process is a necessity. Big data technologies and approaches enable the development of innovations that can significantly boost a company's competitiveness (Christian & Ulrike 2019). According to Weiner and Kochhar, big data is altering the public relations industry because it allows them to have a deeper knowledge of their stakeholders and rivals, allowing them to maximize their own reputation and performance (Weiner & Kochhar 2016). Big data also assists communicators in optimizing analytical methods for strategy formulation based on online touch point analyses, as they can examine in greater detail how, when, and most importantly where - at which online touch points - the target group is interested in learning more about the firm or an issue, as well as the tone in which it conveys its perspective (Christian & Ulrike 2019).

Supported by the increasingly widespread of social media usage which automatically affects the increasing amount of data worldwide, where it is estimated to continue to grow 40% each year (Fan & Bifet 2013). Unfortunately,

only less than 3% of all data in the digital world is used by the public, stakeholders and academics to be analyzed (Fan & Bifet 2013). Therefore, it can be said that data literacy is now very important for Public Relations practitioners, especially in times of crisis where data can be used for many things, one of which is sentiment analysis. However, only a few Public Relations practitioners are known to be able to see the golden opportunity behind the large data generated by social media algorithms that can facilitate their work at the company.

Furthermore, scholarly research has largely overlooked the potentials and limitations of big data for strategic communication in general, and public relations in particular, thus far (Wiencierz & Röttger 2017). Although many researchers have investigated the use of Internet-based technologies or platforms for public relations efforts (Dozier et al. 2016; Scott 2010; Tankosic et al. 2016), and others have labeled this new trend as Digital, Online, or E-Public Relations (Gifford 2010; Philips & Young 2009; Vercic, et al. 2015). However, the topic of how big data may be used in public relations remains mainly unexplored. Because big data is becoming increasingly important, public relations must get more involved in this subject (Wiencierz & Röttger 2017) and they must be aware of the benefits and drawbacks of big data for their companies (Wiesenberg 2017).

Previous research into crisis communication and management in digital world have tended to use big data and computational approach (Fertier, et al. 2016; Qadir, et al. 2016; Reuter, et al. 2016), but most of them has been focused on how to harness big data for crisis management in information systems and computer science perspective. Although there are several articles that at least mention the possibilities of using big data to carry out issues management in crisis communication (Kent & Saffer 2014; Chen, et al. 2012), however, the study has not provided a comprehensive explanation of how big data with respect to sentiment analysis can be used in the whole crisis cycle.

Finally, this article aims to discuss big data in crisis communication and management from the perspective of social science and communication management, especially public relations crisis. A case study of a crisis encountered by one of Indonesia's State Owned Enterprises in 2019 is offered to demonstrate the significance of using big data to analyze online public sentiment during a crisis. Likewise, this article shows how important it is for public relations practitioners to have big data abilities if they want to survive in the future world.

Unlike research in the field of information systems and computer science which focuses more on developing methodologies and software, this study will concentrate on the simple use of big data while also connecting the results to the foundations of social theory and public relations. This research concludes with how Public Relations experts may run big data autonomously without the involvement of third parties or consultants, which will have an impact on the company's cost efficiency.

Adoption of Big Data for Crisis Communication and Management

Within the field of crisis communication and management, the debate and discussion surrounding big data is comparatively unknown. The ability of corporations and organizations to respond to crises has reached a tipping point due to big data technologies. There is a lot of hope that big data technologies will be able to handle massive volumes of crisis-related data and give insight into the rapidly changing situation, allowing for a more effective crisis response (Qadir, et al. 2016). To improve the efficiency of crisis management systems, technological advancements are required (Emmanouil, et al. 2015). Although the discourse on big data in crisis and catastrophe is interdisciplinary in nature, it brings together faculty from computer science, statistics, signal processing, data mining, and machine learning (in particular, techniques for computational linguistics), but few studies has been focused on big data related to crisis in public relations and social sciences perspective.

Big data, in general, refers to our increasing ability to collect, process, and analyze large volumes of largely unstructured data, such as word documents, emails, blog posts, social media, and multimedia data that cannot be stored in an orderly manner in relational databases (Leavitt 2010) as in the mid-1990s, digital storage became more cost-effective than paper for data storage (Morris & Truskowski 2003). With big data's revolutionary implications in a variety of disciplines, there is a surge of attention in harnessing its power for development and social good, as well as a lot of promise for communication research in general (Parks 2014), including strategic communication and public relations (Holtzhausen & Zerfass 2015). All too often that because of the fast evolution of big data, many leaders frequently fail to comprehend its full complexities

(Gandomi & Haider 2015). In recent years, it has remained unclear if this is also applicable for communication professionals, particularly among Indonesian practitioners and researchers.

However, it is important to conceptualize beforehand on what is big data in the public relations and corporate communications perspective. The following is how we include the preceding explanation into our definition of big data: Big data are information assets with a big volume, high velocity, a wide diversity, and a high veracity created by computer and storage systems in a way that makes them manageable and usable for businesses and individuals (Wiencierz & Röttger 2017). Based on these concept, it is crucial for practitioners to make sure that the data reliable in order to make profound communication decisions on the basis of such data.

The most promising areas for big data applications in public relations are issue management and crisis communication. Issues or possibly image-damaging information may be detected and forecasted more precisely and rapidly using data generated by social media. There is a lot of anticipation that big data techniques will be able to analyze massive amounts of crisis-related data in order to provide insight into the quickly changing situation and drive an effective crisis response. Corporations' future priority will be to measure what matters and to translate massive data into decision making (Loebbecke & Picot 2015), especially in times of crisis where practitioners often require to make accurate decisions as soon as possible. As such, big crisis data analytics has the ability to revolutionize all phases of a crisis's life cycle (i.e., before, during, and after the crisis) and may be valuable for emergency prevention, preparedness, response, and recovery (Qadir et al. 2016).
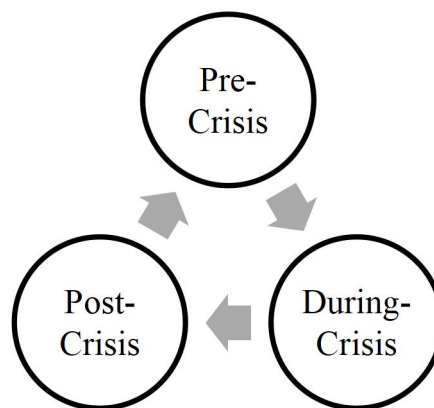
The whole crisis life cycle may be classified and examined into three stages: before, during, and after the crisis. The first stage Pre-Crisis Preparedness is concerned with the proactive preparedness for a future crisis as well as attempts to reduce disaster risk (Twigg 2004). Big data analytics can be beneficial in this stage for emergency prediction, either before the triggering event (such as an airplane crash or pandemic) or as part of the ongoing crisis' unfolding (such as prediction of the public sentiment toward corporate image). This stage will also include any actions aimed at averting potential crises. Many companies, for

example, have a crisis communication and management strategy, such as an emergency response plan, in place to be implemented when a crisis happens.

The second stage, During-Crisis Response, focuses with coordination in the aftermath of a crisis to resolve any gaps or overlaps that may be influencing the efficacy of the response (Qadir, et al. 2016). When a crisis strikes, time is of the essence, and safety is at stake, therefore people must respond promptly and with as much understanding of the situation as possible. In this point, it is vital to use big data to acquire information on the problem during crisis.

Finally, the final step is Post-Crisis Response, which is concerned with the overall crisis response's reporting, auditing, and accounting. This stage examines the crisis response in a more complete, analytical, and insightful manner, in order to learn lessons and create insights for future crises (Qadir, et al. 2016).

Figure 1.

Crisis Cycle

(Source: Qadir, et al. 2016)

Social Media Sentiment Analysis for Crisis Communication and Management

One of the important parts in extracting information during a crisis is knowing what other people think and feel, and nowadays there are more and more people who convey their thoughts and opinions freely via the internet to other people they don't know (Pang & Lee 2008). However, to find out public sentiment sometimes requires cost and effort that is not easy in which the corporation will be required to go directly to the field and find out first-hand the public opinion about the crisis that hit. Long before the World Wide Web was widely known, many of

us inquired our friends for recommendations on auto mechanics or who they planned to vote for in local elections, received reference letters for job applications from co-workers, or checked Consumer Reports to select which dishwasher to buy (Pang & Lee 2008).

Nonetheless, as we approach the digital era, the Internet and the Web have made it easy to learn about public sentiment, since more and more individuals make their thoughts visible to strangers via the Internet. As the availability and popularity of opinion-rich resources such since online review sites and personal blogs has increased, new opportunities and challenges have arisen, as people can and do actively use information technology to seek out and grasp the thoughts of others (Pang & Lee 2008).

The emergence of social media and the Internet which now become the main platforms for the digital community to seek and even share information with other people, while at the same time it has also produced a very large amount of data. The data can be in the form of opinions and information that are spread massively, it can come from the community, stakeholders, policy makers and the corporation itself. So what needs to be done is an effort to collect all of these opinions and data and process them into something useful for the company in times of crisis.

The sudden information explosion followed by the development of analytical methodologies such as sentiment analysis (also known as opinion mining). Sentiment analysis is a communication methodology that can be used in understanding public assessments and feelings about a particular event. Sentiment analysis is basically important for determining opinions about brands and services, and or for understanding consumer attitudes (Neri, et al. 2012). Sentiment analysis, also known as mood analysis, is a subset of data mining that seeks to evaluate, comprehend, process, and extract textual data in the form of views about things such as products, services, organizations, persons, and specific themes (Liu 2012). The primary goal of sentiment analysis is to categorize opinionated materials as conveying a positive, negative, or neutral view (also known as document-level classification), or to do the same for a sentence (sentence-level sentiment classification) (Johansson, et al. 2012). Thus, conducting a sentiment analysis during a crisis is a necessity for companies, be it before the crisis, during the crisis and post crisis stages.

METHOD

This research will take advantage of big data to analyze public sentiment in times of crisis by taking a recent crisis case experienced by Garuda Indonesia, a national flag carrier airline of Indonesia. In 2019, Garuda Indonesia experienced a crisis which was preceded by a review from a vlogger regarding their unsatisfactory service. In this research, big data will be used to collect the sentiment data from Twitter toward crisis experienced by Garuda Indonesia. Using conventional methods such as quantitative surveys on gathering consumer opinions and sentiment may be a costly and time-consuming effort (Younis 2015). The data in this research collected in real-time right after the crisis appear in public and became viral in social media, which was around July 2019.

In this study, data from Twitter Microblogs was collected, pre-processed, analyzed, and visualized using open source tools such as the TwitteR package to perform text mining and sentiment analysis on user-submitted online tweets concerning Garuda Indonesia during the 2019 crisis. In unstructured textual data resources, text mining is the automated process of finding and disclosing new, discovered knowledge, inter-relationships, and patterns (Younis 2019). So, basically, there are at least six sources of big data, where in the context of this research, only online activity and crowdsourcing will be used.

Sources

First, online activity is a sort of big data that comprises user-generated data (e.g., emails, SMS, blogs, comments), social media (e.g., Facebook comments, Google+ posts, and Twitter tweets), and search activity utilizing a search engine (e.g., Google). Thus, Twitter was chosen to gather the information about the crisis it provides a real-time perspective of what people are thinking and doing. One advantages of online data is that it is frequently made public, therefore scholars in big crisis data study make extensive use of it (Qadir, et al. 2016).

Second, the method of crowdsourcing is an active data collection method. Crowdsourcing, when it is used online, allows data from many sources to be

combined, allowing the extracted data to be used for new purposes such as academic research and marketing. Crowdsourcing often combines (a) digital technology, (b) human abilities, and (c) human giving in this manner (Qadir, et al., 2016). Crowdsourcing platforms are often open to the public and are commonly utilized by data and communication professionals. Many businesses and organizations have realized the potential of crowdsourcing all publicly available information on individual opinions and interests (Johansson, et al. 2012).

Data Collection

Firstly, in the process of data collection, one of the basic things needed to do first is the evaluation and accuracy of the language for estimating sentiment. In this research, we used a dictionary of Affective Norms for English Words (ANEW) to build a language related to sentiment for this study hence the results of text mining were as expected. However, one consequence of using this dictionary is that not all languages and words can be detected. After collecting sentiment dictionaries with the help of ANEW, we finally able to perform sentiment text mining using the TwitteR package for keyword search and tm package to assign a score for each tweet in order to find the association or emotions between the words.
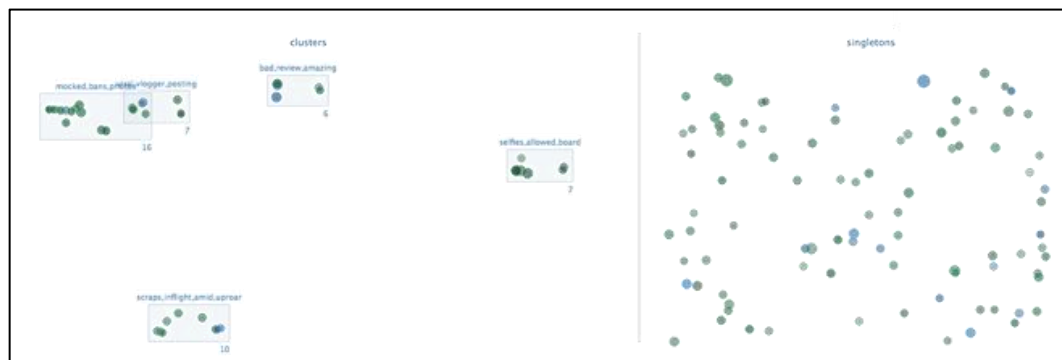
After the data collected and analyzed, then we can perform the next step that is no less important, namely visualization. This can be done using word cloud and Gephi. The gathered findings are then grouped and presented in various ways, allowing the user to interact with the system and zoom in on important areas of the data (Johansson, et al. 2012). This step is very important because the raw data that was previously collected must be reprocessed to make it easy and legible through the data visualization process. Tweet data can be visualized in various ways, such as it can be distinguished from sentiment, from the topic or from the popularity of the keyword or language, and many other categories. While sentiment analysis of textual data may be performed at three levels, this research focuses on the third level, where its entity and aspect level does finer grained analysis, with the purpose of discovering sentiments on entities and/or their many features (Mejova 2009).

RESULTS AND DISCUSSION

Before discussing the results of data visualization, the mechanism for reading visualization results based on color, brightness, size and transparency of visual data will first be explained. This is particularly important as each individual tweet will visualize different details for each sentiment based on these categories.
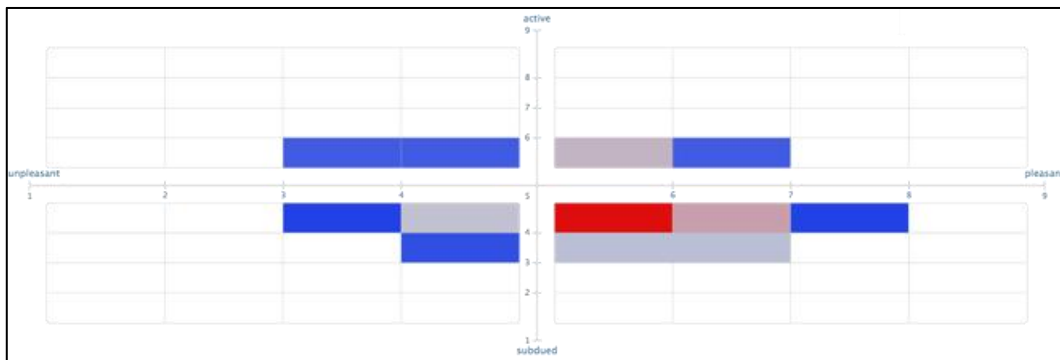
Firstly, based from the colors visualization, pleasant tweets are intentionally visualized in green, while tweets with unpleasant sentiments are in blue. The second category is from brightness which illustrates that active tweets are brighter, meanwhile passive or inactive tweets tend to be darker. The third is based on a measure that can measure confidence or validity according to the human coders on the estimated results or sentiment estimates for each tweet produced. Tweets with a larger size represent a higher estimate. The fourth and the last one is transparency, which measures the validity of the estimated emotion of each tweet. For example, opaquer or non-transparent tweet represents an estimate with a higher level of validity.

Figure 2.
Results Based on Topics

Our results in Figure 2 shows the topics and themes related to the keywords of this research. We have input a keyword that mention the object of this research into the system and bring up approximately six topic groups or themes that are commonly discussed by Twitter users. The topics that appeared, as predicted, discussed more about the crisis cases which currently being experienced by the Garuda Indonesia. For example: bans, bad reviews, selfies, allowed, board, uproar, bad, reviews, and others. The majority of the topics identified were more negative in tone.
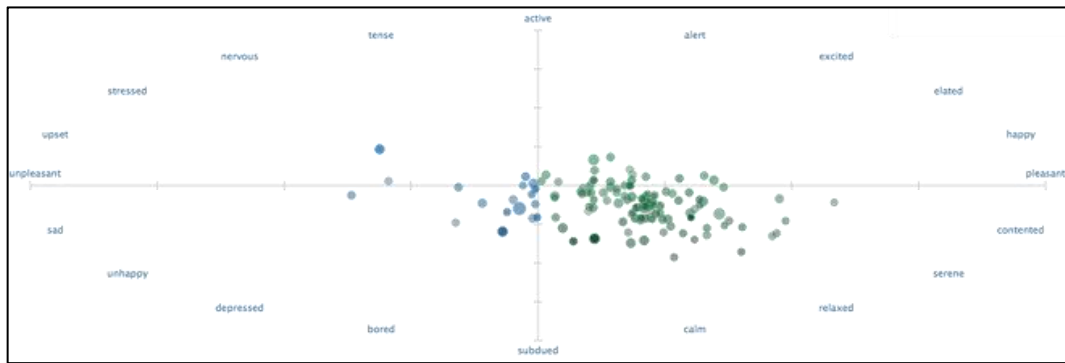
Figure 3.

Heatmap Visualization

The Figure 3 above shows a visualization of tweet sentiment based on colours or heatmap. The areas in red are identified as areas that have a lot of tweets related to the crisis, while the areas in blue consist of the few tweets. The so-called emotional scatterplot to categorize emotions from each tweet is divided into 8 x 8 boxes showing happy to unhappy emotions, like pleasant, unpleasant, active and subdued.

Additionally, the results in Figure 3 indicate that the red area is composed of lots of tweets that show pleasant or happy emotion compared to the tweets in the blue area that show unpleasant or unhappy emotion. Therefore, it can be said that the majority of public emotions in responding to the crisis case tended to be pleasant even though the unpleasant emotion still appeared quite significant.

Figure 4.

Sentiment and Emotional Visualization

The Figure 4 above is a sentiment tab that visualizes the position of the tweet on the distribution of each emotion or sentiment that has been processed before. The distribution of blue emotions on the left shows negative sentiments such as unpleasant, sad, upset, and bored. Meanwhile, the distribution of emotions on the right is green, on the other hand, shows positive sentiments such as pleasant, happy, relaxed and calm. It can be seen that the majority of public sentiment towards companies hit by a crisis are on the right in green, which means that people have more positive rather than negative sentiments in responding to the crisis case.

From the perspective of crisis management and communication, when it is clear that public opinion toward a crisis is bad, organizations must quickly strive to handle the issue properly in order to reestablish a positive image. There are at least four articles that mention the possibilities of using big data to carry out issues management (Kent and Saffer 2014; Colleoni 2013; Chen et al. 2012). At the same time, Uldam (2016) underlines the opportunities for companies to gather intelligence about such particular people through social media surveillance. This intelligence helps companies to undertake risk assessments or sentiment analysis, which provide a more complete view of the discussed issues as well as public opinion and feelings toward their reputation, while also making the process of crisis management easier. In this sense, depending on the public sentiment data collected, the use of real-time big data analysis may suggest which areas require the most immediate attention from crisis managers. Based on the literature on the crisis cycle, this study demonstrated that using big data to analyze public sentiment in the pre-crisis stage is quite valuable.

For example, the results in Figure 3 reveal that emotions based on subjects were mostly negative. As a result, the data demonstrates one of the most significant pieces of information for public relations to be acquired from big data applications in the first phase of crisis management. Following that, once public relations knows whether the attitude looks to be negative or positive, they may plan to execute the appropriate approach depending on the data gathered. Especially if the sentiment appears unfavorable, they must implement a rescue strategy to restore the positive sentiment while also maintaining the corporate reputation. Because the data reveals what kinds of subjects or concerns the public perceives as troublesome, public relations practitioners will be able to focus solely on these issues or topics based on the data gathered. That data is definitely useful for public relations to determine what steps to take immediately once a crisis happens.

Indeed, according to our findings, sentiment analysis employing computational approaches might be the first step in initiating crisis management and communication strategies in the digital era. Big data assists the company in optimizing analytical tools for crisis strategy formulation. In other words, it is true that vast volumes of data may play a significant role in giving information on the best method to respond to a crisis scenario (Qadir, et al. 2016). Knowing what information public relations practitioners are likely to receive from social media may save time and assist them determine where to spend their sometimes limited resources during a crisis. As González-Herrero (2008) explains regarding the role of new technologies in crisis:

> "New technologies have also dramatically changed the way companies collect time critical data when a crisis occurs. Reliable, front-line information about what is happening, why, and to whom is essential to execute any crisis management plan, both from the operations and the communications point of view."

Likewise, our analysis indicates that it is also possible for big data to provide communicators with added value for reputation management, especially in times of crisis. Big data analysis gives a better view of how one's product or corporation is perceived in different nations compared to competitors, as well as who the important players are in each market (Christian & Ulrike 2019). In such cases, communicators employ techniques like big data to examine the share of

voice about their own reputation, i.e. their organization's internet presence and share of the debate.

From the above explanation, it can be said that technological developments, especially big data and data mining, which are increasingly accessible have dramatically changed the way a company collects data when a crisis occurs. At the same time, growing digitization is significantly lowering the transaction costs for obtaining information (Christian & Ulrike 2019). It is also worth noting that, according to our findings, big data will enable communication professionals to work faster and smarter. Consequently, practitioners will require highly trained employees who can investigate, absorb, synthesize, and interpret big data information. Strategic and creative abilities will continue to be crucial, but big data and automation will play a larger role in public relations and strategic communication in the future.

Furthermore, our research found that the crisis management and communication efforts of Garuda Indonesia, the subject of this study, were already effective in terms of how they were able to reverse the negative sentiment that usually arose at the beginning of the crisis, where the negative sentiment was diminished at the end of the crisis. However, it can be seen from Figure 3 that there are still numerous tweets on the right with blue color, indicating that the public's unfavorable feeling toward the situation at the time does not completely disappear. Hence, if the negative sentiment still remains even if the 'during crisis' step has passed, crisis management must continue and must not be halted until the negative sentiment is fully disappeared.

CONCLUSION

This article has reviewed the use of big data and automation for analyzing online public sentiment during crisis, and it can be seen that it is feasible to use text mining and sentiment analysis together at all stages of the crisis cycle, including before, during, and after the crisis. Our study is one of the first attempts to perform sentiment analysis in the perspective of social science and public relations, but comes with some limitations. To begin, we are aware that important research on big data in general has been published in considerably more publications. We also recognize that the domain of big data has existed for a

longer amount of time than the time frame under study. Second, the crisis management cycle is often split into four stages: mitigation, preparedness, response, and recovery, as well as pre-crisis, during-crisis, and post-crisis. The work we present here is concerned mostly with the response and/or during crisis phase. Although we have mentioned little bit about mitigation, preparedness and recovery phase in the discussion section, we note that we did not successfully cover all possible crisis situations in this article. Last and the most crucial is the data that can be extracted and analyzed in this research is limited to tweets in English language because there is still no sufficient knowledge and application for processing data in Indonesian. Besides, there is no software yet designed for sentiment analysis using Indonesian as the main factor. Finally, it is obvious from our research findings that huge volumes of data have become critical for organizations and communication professionals, particularly in crisis management. "As Boyd and Crawford (2012) wrote: "The era of big data has already begun". Corporations and the scientific community, respectively, have just recently began to employ big data to improve public relations and investigate such communication initiatives. Therefore, future research should focus on gaining a greater understanding of the influence of big data and automation in the field of strategic communication, particularly in crisis communication, to examine various crisis dimensions, types of crises, and stages, which will undoubtedly enhance our current results. More ambitious projects might delve further into ethical issues and privacy concerns raised by stakeholders targeted by big data analytics.

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