INFLUENCER SIZE EFFECTING CLIMATE CHANGE DISCOURSE: A STUDY ON INDONESIAN TWITTER

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ABSTRACT

This study seeks to understand the climate change discourse on Indonesian Twitter. Searching Twitter with the key word "perubahaniklim" returned 4542 individual tweets in the six-month period from March to October 2019. This study took a quantitative approach to observe Twitter users contributing to the climate change discourse. By analyzing the frequency distribution of tweets, we analyze Indonesian Twitter accounts based on the number of followers, the number of tweets, and the distribution of tweets. We categorize contributors to the Indonesian climate change discourse onbyinfluencer size (mega, macro, micro, and nano-influencer). The study found that influencer size effectsin climate change discourse on Twitter. The effect is more strongly correlated to the distribution of tweets than the number of tweets.This study provides new insights for future climate change communicationthat combines interpersonal communication, mass communication, journalism development, and new communication media, especially social media.

Keywords: Climate Change, Social Media, Influencer, Twitter, Discourse

Introduction

A Paradigm shift in communication has occurred in the new millennium era. The digital revolution is creating information and communication renaissance, which is more vibrant than ever, offering faster and cheaper communication access, fewer barriers to entry and more information to consume (Chatterjee, 2016). Meanwhile, climate change has now also become an attention in Indonesia. Public discourses in climate change have also spread in the digital ecosystem in Indonesia. According to the search index using Google trend within the past year by finding information based on "*perubahaniklim*" (climate change in English) keyword, people who accessed and searched information about climate change in Indonesia increased from March 2019 to March 2020 (see Figure 1).

Figure 1. Search for keywords of climate change in the past year

According to (Cody et al., 2015), 'many to many' communication changes the way of journalists or environmental scientists in informing the climate change. Instead of a single journalist or scientist telling the public what happens, social media offers a

mechanism for many people from various backgrounds to communicate and form their own opinions about climate change so that public discourse can be productive. Exposure to social media can potentially turn climate change problems into public discourse (Boykoff, 2011; Cody et al., 2015; Dearing, James W, 1996). Social media utilization to obtain information about public discourse has increased, especially in modern research nowadays (Lineman et al., 2015).

According to Kemp (2019), Twitter is the sixth most accessed social media (52 percent) in Indonesia. As a microblogging platform, Twitter provides a platform for verbal expressions and emotional responses (Lineman et al., 2015; Signorini et al., 2011). In Sharma &Goyal (2018), Twitter is mentioned as a powerful communication tool because of its utilization as a social networking platform. Twitter is used to circulate fact, information, idea, or thought that is known as a tweet. In contrast, Fuchs (2014) has mentioned that Twitter is not categorized as a communication tool instead of mostly information media as it is very limited to public discourse. Nowadays, a tweet is restricted to 280 characters in most languages (Sharma &Goyal, 2018). Cody et al. (2015) argued that the limited length of tweets means that tweets represent the thinking-doing-feeling of the community in the digital ecosystem.

In social media, as well as Twitter, we also know about an influencer who is trustworthy spokespeople. Mediated communication model through a trustworthy spokesperson will also be a vital component in climate change communication shortly (Priest, 2016). Social media influencers represent the third party forming specific behavior of the audience through their blog, tweet, and other social media channels (Freberg et al., 2011). The concept of influencer on Twitter more or less refers to opinion leaders in the Two-Step Flow Theory within the scope of social media (Wu et al., 2011; Baran, 2013).
Many researchers have tried to measure influence on Twitter. Cha et al., (2010) described indegree influence which was the number of followers of a user, directly indicating the size of the audience for that user; retweet influence, which was the number of retweets containing one's name, indicating the ability of that user to generate content with pass-along value; and mention influence, which was the number of mentions containing one's name, indicating the ability of that user to engage others in a conversation. Kwak et al. (2010) compared the number of followers, PageRank, and the number of retweets. Meanwhile, Weng et al. (2010) compared the number of followers and PageRank with a modified PageRank measure, which accounted for a topic.

There is a literature gap in observing influencers on Twitter in terms of the number of followers. Some researchers believe that a fundamental principle emphasizes on social media user with a large number of followers representing a higher level of influence on social media platforms (Li, 2018). Other researchers stated that the number of followers was not necessarily related to his/her influence (Cha et al., 2010; Kwak et al., 2010; and Weng., 2010). This premise mostly relates to the number of followers not directly generating retweet or mention. This paper will highlight the gap by focusing on the number of followers' influence on Indonesian Twitter in climate change discourse contributed by influencers in various sizes (mega, macro, micro, and nano), who mostly rely on the number of followers. This study will answer the question if the influencer size on Twitter has an influence on climate change discourse.

Importance of the study
Twitter plays an essential role in public discourse about politics. Twitter has gained its global popularity because it is used in the American election campaign in 2016 to provoke political campaign support (Sharma &Goyal, 2018). Twitter message examines information that stimulates audiences to follow, retweet, and recite narrative descriptions. Political personalities cause command considerable authority because of the repeated devolution of Twitter narratives (Cook et al., 2014).

According to Evans et al. (2018) in Leal Filho et al., (2018), Social media, like Twitter, is the right vehicle for sharing and exchanging information in communicating climate change in order to stimulate global, regional, national and local-scale change. Through social media, climate change communication can cope with geographic obstacles and actualize interaction convergence between communities, both

physically and virtually. Unfortunately, research in climate change discourse in social media, especially Twitter, is scarce in Indonesia.

Jang & Hart (2015) said that climate change communication research focusing on framing issues in some literature was very limited to analyze the natural framing of issues in people's daily interpersonal conversations, which can be conducted through social media research, like Twitter. In modern research, new media provides an alternative way to transcend limitations in existing research by analyzing social media content. By using an analysis machine, modern research can analyze online conversation that is generated and shared by the audience (Brossard &Scheufele, 2013; Jang & Hart, 2015). This research variation enables the flexibility of the approach and helps scholar notice what occurs in public on Twitter about climate change so that the result can be utilized to formulate responses of public discourse in climate change and be useful for practitioners in creating powerful climate change communication.

Theoretical Framework

Twitter and Climate Change Communication

According to Evans et al. (2018), effective communication about climate change must include the participation of the audience to promote inclusivity and fairness in discussion and decision making. Trends in climate change communication research have focused on the role of media, and journalists include scientists and science experts, business elites, politicians, and civil society representatives as sources when they create stories and news coverage about climate change. In this context, the general public becomes the passive recipients of the news. This leads to a climate change communication process is dominated by journalists, scientists, politicians, and other organizations whose views are already framed in the context of global climate change. As a result, framed perception and understanding occurred in public, especially those who had limited and low levels of knowledge. They caused less deliberate action towards the emerging issue of climate change in their area (Evans, 2015). Therefore, according to Evans et al. (2018), communicating climate change needs a hybrid model that can build a bottom-up and bottom-down communication process. A hybrid model might be developed through social media in the wider climate change communication process.

Information and Communication Technology (ICT) plays an essential role in supporting the development and social change. Although social media is not a large-scale impact on making social change, the small impact resulted in digital initiatives in social media can create greener lifestyle preferences (Evans et al., 2018). Twitter, for instance, affects online public discourse positively. Society has freedom in accessing information, discussing, and throwing opinions with each other. Social media and computer networks also provide secure and decentralized communication systems in which people can argue about many things. Therefore, individuals are challenged and triggered to express their thoughts and opinion about an issue (Cogburn & Espinoza-Vasquez, 2011; Ye et al., 2017).

Social media grows content from non-elite media or users outside the media organization that can influence public views. The impact of the rise of the user's content is forming the role of an opinion leader. As an opinion leader grows, the media no longer monopolizes information related to climate change. Opinion leaders are the agents of community polarization in climate change issues (Anderson et al., 2014; Lee, 2012; Metzger et al., 2010; Walther & Jang, 2012). Nevertheless, the media still has a significant influence on the consumptive elements of social media. Newman's research (2016) proves that 35 percent of the '100 domain names that appear most often' in American user tweets after the IPCC 2013 report came from major media outlets such as CNN, The Atlantic, and The Washington Post. The media remains a dominant player in the consumptive element of social media and as an essential role in shaping public views in climate change issues (Gladston & Wing, 2019; Newman, 2017).

Research in climate change discourse is mostly related to global climate change issues or framing issues and their effect in media. The research purpose is to explore the awareness, perception, and opinion of an individual or the public about climate change. The limitations of the studies are the results that do not reflect everyday conversation in the public sphere, for instance, in social media.

Twitter offers a new research opportunity to capture conversations in the network that naturally occur in everyday life (Jang & Hart, 2015; Kwak et al., 2010).

In previous studies, Twitter became the research object. Jang & Hart (2015) utilized Twitter data to observe social media user trends in America, especially in states where Republican was the dominant party. They used 'global warming' terminology to mention climate change. Lineman et al. (2015) revealed the differences in the sentiment within the population between those who used 'climate change' and 'global warming' terminology. Meanwhile, Cody et al. (2015) explored much information from Twitter about climate change. There are many ways to express their concern about climate change, starting from book launching, idea contestation, to public figures who discuss climate change. The use of specific terms or information and 'who' delivers the information on Twitter can raise the sentiment in the climate change issue. By using the analysis machine, we can search for data on Twitter through a particular keyword. This machine will look for suitable data that are relevant to the keyword. The machine will also determine the frequency, but it does not reveal popularity. The relation between frequency and popularity lies in the search volume during a specific duration. By identifying a particular number of searches in a certain period, we can get direct comprehension regarding what are the popular terms within the population (Lineman et al., 2015).

Measuring Influencer Size Effect on Twitter

Interpersonal communication overgrows through the social network that not only one person can talk to another, but also much information is revealed and becomes more influential in the internet era like today. In general, influencers in social media are often associated as someone, mostly celebrities, who have power and influence. Unfortunately, this definition contains an ambiguous meaning. Everyone is an influencer. They could be some experts, some ordinary people, journalists, or even semi-public figure like media representative, and government officials who communicated the same way, through a tweet and to their followers (Bakshy et al., 2011). This study does not discuss whether an influencer is an individual or a group of people. Influencers in this study are social media influencers that could be anyone, any media outlet, organization, or celebrities (as known as celeb tweet), depend on the number of followers.

The industry offers more clarity about influencer classification, whilst academic literature lacks consistent about specific definitions of what constitutes a large number of followers of an influencer. In Kay et al. (2020), there are several influencers classifications, such as two-level influencers (micro and macro) and three-level influencers (micro, macro, and celebrity). Thomas (2017) in Kay et al. (2020) argues that determining social media influencers by their number of followers is easily adapted to focus on the number of likes influencers receive as well as through the percentage of followers that like posts.

Twitter influencers in this study are in the context of marketing practice, which can be categorized based on the number of followers. The first category is mega-influencers, which are the influencers whose followers are more than 1 million. The second category is macro-influencers, whose followers are between 100,000 to 1 million. The third category is micro-influencers, whose followers are between 1,000 to 100,000. The fourth category is nano-influencers, whose followers are less than 1,000 (Firmansyah, 2019).

To discuss the influencer size effect, we must refer to previous research conducted by Cha et al. (2010). One of the Twitter influences is in degree, the number of followers of users who directly shows influencer size. Indegree only represents user popularity. However, it is not related to other essential things, such as influence and audience views. This conclusion is based on Twitter users who have a high indegree (the number of followers) are not necessarily influential in terms of spawning retweet or mention.

In contrast, Baskhy et al. (2011) said that although the content was not found to improve predictive performance, it remains the case that individual-level attributes in particular past local influence and number of followers can be used to predict the average future influence. A new class of semi-public individuals like bloggers, authors, journalists,

and subject matter experts has come to occupy an important niche on Twitter, in some cases becoming more prominent (at least in terms of the number of followers) than traditional public figures such as entertainers and elected officials (Wu et al., 2011). Another research highlights that micro and macro-influencers impact differently on purchasing intention while disclosing or not disclosing sponsorship (Kay et al., 2020). It means that the number of followers does affect audience engagement. From the previous studies, the hypothesis of this study is given below:

H0. There is no influencer size effect in climate change discourse on Twitter.
H1. There is an influencer size effect in climate change discourse on Twitter.

Methods

This study combines collecting tweets and quantitative research methods. Tweets from influencers consist of the number of tweets and the distribution of tweets. In this study, we call them tweet frequency distribution. Neuman (2010) defines frequency distribution as a table that shows the distribution of variables in a category of some instances/information. The variables can be nominal, ordinal, interval, or ratio level data.
There were 4542 tweets from Indonesian users by searching keyword "*perubahaniklim*" through an analysis machine called Socialert from March to October 2019. Socialert provides the details, including reach, mentions, and replies of each tweet. By collecting tweets frequency distribution, we have data variables about influencers based on the number of followers, the number of tweets, and the distribution of tweets.

Meanwhile, the most important thing in quantitative research is dealing with data. Quantitative research can use generated data from surveys, content analysis, or experiments (Neuman, 2011). In this study, we use collected tweets from Socialert as a data source to do quantitative analysis. However, the challenge is to combine, to analyze, and to conclude them. One of the essential steps is tweet coding.

Referring to Neuman (2011), the coding procedure is a set of rules created by the researcher for assigning numbers in specific variable attributes, usually in preparation for statistical analysis. The coding procedure explains how we convert non-numerical information into numbers to be a codebook. In this case, the codebook is the document that explains the coding variable derived from collected tweets. After that, we continue the coding process by entering data in which one of their methods is a code sheet. We collect the information, then transferred it from the source onto a grid format (code sheet).

TweetsCoding

There were only 1540 tweets, and 818 Twitter accounts from 4542 tweets can be a data source. We excluded tweets from Malaysian and Singaporean accounts even though they are in the Malay language. For the next step, we coded the data manually. In doing so, the content contained in the tweets was categorized by the climate change mitigation sectors in Indonesia. Mitigation is an attempt to reduce greenhouse gasses (GHG) and carbon emissions that contribute to climate change (Zhao et al., 2018). According to the Knowledge Center of Climate Change Indonesia (2019), the Indonesian government divides the mitigation actions into five sectors, such as forestry, agriculture, waste management, industry, and energy. In addition, this study adds a general category for tweets that cannot fit into the category.

Furthermore, we categorized influencers size by grouping them based on the number of followers as mega-influencers (more than 1 million followers), macro-influencers (followers are between 100,000 to 1 million), micro-influencers (followers are between 1,000 to 100,000), and nano-influencers (followers are less than 1,000). After that, we classified the frequency distribution of 1540 tweets coming from influencers into six climate change topics (general, forestry, agriculture, waste management, industry, and energy).

Statistical Test

The next stage of this study is to test statistics using SPSS software. The statistical test looks at the relationship between influencer size and tweets about climate change in six predefined topics. As the assumption of data normality is not fulfilled, this study uses a non-parametric Kruskall Wallis test. Through the statistical test, this study looks at whether there is a difference in climate change discourse in terms

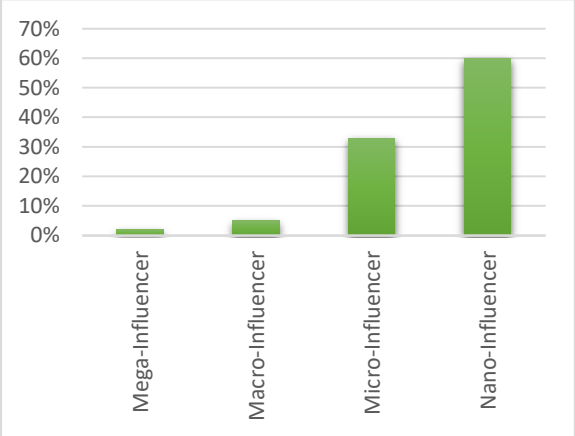
of influencer size with the following statistical hypotheses:
H0: there is no difference in climate change discourse in terms of influencer size
H1: there is a difference in climate change discourse in terms of influencer size

We decide to accept H0 if p-value> 0.05, which means there is no influencer size effect because climate change discourse is not different in terms of mega, macro, micro, and nano-influencer and reject H0 if p-value <0.05, which means there is influencer size effect because climate change discourse is different in terms of mega, macro, micro, and nano.

Results

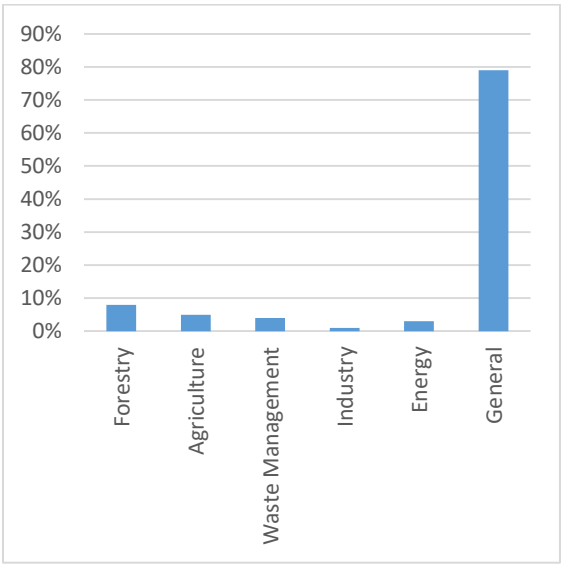
According to Lineman et al. (2015), data search on Twitter can be done using specific keywords. The result of these keywords produces relevant data from the keywords. From the tweet coding based on the search results of Socialert, we can figure out the influencer size in climate change discourse on Twitter, as shown in Figure 2 below:

Figure 2. Influencer size in climate change discourse on Twitter



Climate change discourse on Twitter was dominated by nano-influencer from March – October 2019 (see Figure 2). The highest number of influencers in sequence werenano-influencers 490 accounts, micro-influencers 270 accounts, macro-influencers 43 accounts, and mega-influencers 15 accounts. Based on the data, we can define that discourses occurred centered on a general level that only discussed definition or phenomenon, less about mitigation action in Indonesia (see Figure 3).

Figure 3. Climate change discourse in mitigation topics on Twitter



The Kruskal Wallis test revealsa difference between mega-influencer, macro-influencer, and nano-influencer in climate change discourse. The difference in overallis statistically significant (*p value*< 0.05) (see Table 1). As a result, the hypothetic decision rejects H0, which means a significant difference in climate change discourse in terms of influencer size.

From the result, we confirm that there is an influencer size effect in climate change discourse. This result criticizes the previous studies, which stated the number of followers is not necessarily influential (Cha et al., 2010). The result may not be able to directly state that influencer size effects audience engagement to generate retweet and mention; however, the influencer size does affect climate change

Table 1: The mean difference between influencers based on the number of followers

		N	Mean Rank	**Test Statistics[a,b]**	
Climate Change Discourse	Nano-Influencer	490	352,04	Chi-Square	133.955
	Micro-Influencer	270	470,85	df	3
	Macro-Influencer	43	618,48	Asymp. Sig.	.000
	Mega-Influencer	15	583,23	a. Kruskal Wallis Test	
	Total	818		b. Grouping Variable: Influencer Size	

discourse on Twitter. We can see the argument of this hypothesis in the next section.

Discussion

How influencer size effects on climate change discourse is when influencers (from nano to mega-influencer) contribute different tweets

For further detail, we describe the mean rank based on the topics of climate change mitigation, as shown in Table 2, as follows:

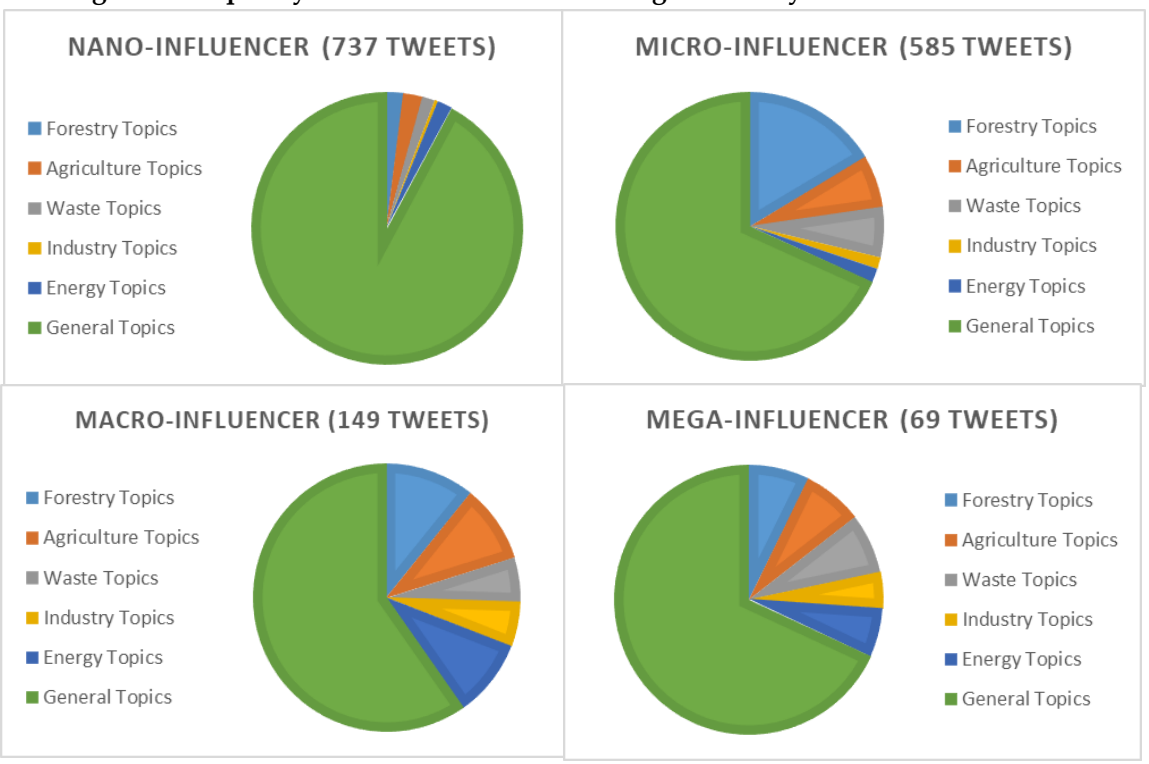
As shown in Table 2 above, some interesting facts can be mentioned. Mega-influencer is the influencer who has the highest mean

Table 2. The mean rankof influencers size in climate change mitigation topics

Influencer	Mean Rank					
	Climate Change Discourse					
	Forestry Topics	Agriculture Topics	Waste Topics	Industry Topics	Energy Topics	General Topics
Mega	499,67	492,47	413,77	455,00	451,40	537,70
Macro	473,35	470,24	442,27	457,16	463,59	511,40
Micro	451,31	421,98	430,34	412,09	407,08	421,50
Nano	378,10	394,75	394,14	402,50	404,80	390,02

(N: 818, chi-square=133,955,df 3, p-value < 0.05)

Figure 4. Frequency distribution in climate change tweets by influencers



frequency distribution about climate change topics, such as the number of tweets and the distribution of tweets. Mega and macro-influencer results in the highest mean rank in climate change tweets amongst other influencers. Micro-influencer result in lower mean rank than macro and mega. Meanwhile, nano-influencer results in the lowest mean rank (see Table 1).

rankabout forestry topics, agriculture topics, and general topics. Meanwhile, macro-influencer is the influencer who has the highest mean rank about waste topics, industry topics, and energy topics. On the other hand, nano-influencer is the one who has the lowestmean rankcompared with the other influencer size in any topic.

Furthermore, we can find that mega-influencer has 69 tweets of 15 accounts, macro-influencer has 149 tweets of 43 accounts, micro-influencer

has 585 tweets of 270 accounts, and micro-influencer has 737 tweets of 490 accounts. These numbers are interesting research findings. Nano and micro-influencer have a large number of tweets and accounts, but lower mean rank than mega and macro-influencer whilst the distribution of tweets of mega and macro-influencer more spread out in various topics of climate change than nano and micro-influencer (See Figure 4).

To concludewhich one is more correlated with the effect of influencer sizein climate change discourse, we conducteda correlation test. The Kendall Tau b test shows that influencer size has a significant, positive correlation, and fair agreement with the number of tweets (τb = 0.364, *p-value*< 0.01) andthe distribution of tweets (τb = 0.400, *p-value*< 0.01). However, influencer size is more strongly correlated to the distribution of tweets than the number of tweets. It means the distribution of tweets gives more effect of influencer size in climate change discourse.

In social media, such as Twitter, content from users about climate change can grow. The impact of this proliferation of user content is the emergence of opinion leaders formingnano, micro, macro, and mega-influencers (Anderson et al., 2014; Lee, 2012; Metzger et al., 2010; Walther and Jang, 2012). However, who are the influencers in mega and macro size? Mega and macro-influencers in this study consist of three dominant parties, namely the media, non-profit / community, and celebrity (see Figure 5).

As shown in Figure 5, media remains a dominant player in the consumptive element of social media and as an important factor in shaping public views about climate change (Gladston& Wing, 2019). With the presence of media in social media, the role of media is multiplied.Not only does media act as an informant about climate change, but it alsoplays a role as social media influencersthat has a significant impact on climate change discourse. In the future, gatekeepingroles regarding climate change issues possiblyweakened, while media role as influencers strengthens up becauseof shifted audience tendency from passive to active information-seekers through new media (Priest, 2016, h 95-117).

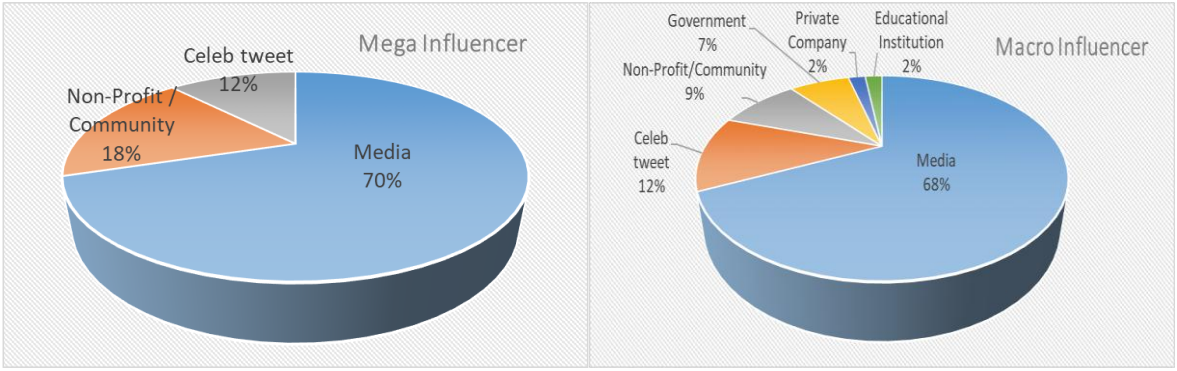
Besides the media, non-profit organization/ community and celeb tweet are also part of macro or mega-influencer in climate change discourse(see Table 3). The top ten most-followed users onTwitter are not corporations or media organizations, butindividual people, mostly celebrities. Ordinary users onTwitter are receiving their information from many thousands of distinct sources, most of which are not traditionalmedia organizations. Only about 15% of tweetsreceived by ordinary users are received directly from the media (Wu et al., 2011).

Table 3: Macro and Mega Influencers on Indonesian Twitter

Rank	Top Influencer in Climate Change Discourse
1	Media
2	Non-Profit/Community
3	Celeb tweet
4	Government
5	Private company
6	Educational institution

In this case, non-elite media or users outside the media organization grow their content that

Figure 5: Influencers in mega and macro size



can influence public views. As an opinion leader on Twitter grows, the media no longer monopolizes information related to climate change(Anderson et al., 2014; Lee, 2012; Metzger et al., 2010; Walther & Jang, 2012).

According to Evans et al. (2018), in the future, communication for climate change needs to have an integrated approach that combines communication and interpersonal, mass communication, journalism development, and new communication media, especially social media. The purpose of integration between these different models of communication is to create participative communication for continuous social changes. The direction of scientific communications, as climate change communications are shifting from previously sees individuals as information distribution of climate change into communication that emphasizes on public discussion and pushes social changes (Priest, 2016).

The implication of the Study

This study result will be useful for academic and practice purposes. The existence of non-elite media or users outside the media organization who grow their content in social media will impact to climate change communication. Media is not the only source to get climate change information. The future climate change communication combines interpersonal communication and mass communication in social media. As the climate change issue will be widespread through social media, environmentalists have to consider two-step flow information in communicating climate change, which involves influencers in social media. In Indonesia, climate change communication could be influential through macro and mega influencers such as media, non-profit organizations/communities, government, a private company, and educational institutions.

Conclusions

In this study, we observed influencers in climate change discourse on Indonesian Twitter. From the study, we know that nano-influencers dominate Twitter with a general topic in climate change discourse. In particular, from the research finding, we can also conclude that there is an influencer size effect in climate change discourse. How influencer size effects climate change discourse is when influencers contribute their tweet frequency distribution about climate change. From the statistical test result, mega and macro-influencer are the highest mean rank because of their tweets about climate change. The mega and macro-influencers in climate change discourse on Indonesian Twitter are media, non-profit organizations/communities, government, a private company, and educational institutions.

Media no longer monopolizes the distribution of information since non-elite media or users outside the media organization grow their content that can influence public views through social media. However, media remains a dominant player, an important factor in shaping public views about climate change. With the presence of media in social media, the role of media is now multiplied. Media acts as information gatekeeper about climate change; on the other hand, it also plays a role as social media influencers that has a significant impact on climate change discourse.

Limitation of the Study

Though we have resulted in finding in the research, this study still has some limitations. We know that the influencer size effects on climate change discourse on Indonesian Twitter. However, this study is lack of observing what effect coming from influencer size. The research finding may not be able to state that influencer size effects on audience engagement to generate retweet and mention. Moreover, all generated data from Socialert were only a tweet frequency distribution that correlates to only one keyword based on search volume for six months. As a result, not every tweet population is reliable to be analyzed, so that we need to reduce the data. The statistical test was also conducted as a non-parametric test because the distribution of data was not normal. Another limitation is the data coding based on climate change mitigation, yet including climate change adaptation.

These limitations can be a recommendation for future research about climate change communication utilizing big data as their sources. The research can set longer time range data as well as using a parametric statistical test. Beyond all the research limitations, this study can be an input to a communication professional to create their

strategy when communicating climate change in the future, especially in utilizing influencers based on their size effectively. New media can be the backbone of climate change communication research ahead.

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