# Utilization of Info BMKG Application as a Medium for Disaster Risk Communication in Jakarta, Indonesia

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**Abstract.** The presence of Info BMKG (National Agency for Meteorology and Climatology) Application is intended to be accessible by the public. This study aims to investigate whether Info BMKG Application can act as a medium for disaster risk communication and to identify its utilization for disaster risk communication. This study advanced mixed methods with the sequential explanatory design and have involved more than 100 respondents for quantitative and qualitative data analysis. The data were first analysed quantitatively using descriptive statistics and were filtered and selected to be investigated qualitatively at the second stage in order to obtain further deepened results. The result of study showed that Info BMKG Application that contains risk information can trigger cognitive, affective, and behavioural changes; which is in line with the aim of successful risk communication; especially in the context of dealing with climate-related disasters risk information and disaster risk reduction.

**Keywords:** Info BMKG Application, Climate-related disasters, Disaster risk communication.

## 1 Introduction

Communication is basic in human life. Communication is present in every aspect of human life, whether in friendships, organizations, or even the wider public. Communication is one of the central points because its role is very crucial. Many important decisions are made through the communication process [1]. One of the major contexts of communication is risk and disaster communication. Disaster risk communication is defined as communication that risks dealing with a hazard such as an industrial accident, underground shock, or the emergence ofa disease outbreak [2]. In a simpler sense it can be explained that communication is present, even in dangerous conditions.

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Talking about danger, there are several dangers that we can encounter. Starting from the dangers when driving, the dangers in terms of health, to the dangers of disasters that can befallvictims in large numbers. Based on data from the National Disaster Management Agency (BNPB) in 2018, 1,113 tornadoes, 871 floods, 615 landslides, 527 forest and land fires, 130 droughts, 58 volcanic explosions, 53 tidal waves, 28 earth waves and 1 tsunami [3]. From the data above, there is one thing that can be drawn from the fact that the most frequent disasters are those related to climate change (cyclones, floods, and landslides) rather than disasters related to geo-physical disasters such as volcanic eruptions. fire, earthquake and tsunami. Seeing the enormous potential for disasters that can occur in Indonesia, every communitymust equip itself as best as possible to be aware of disasters. In the era of sophisticated communication technology, there are already various kinds of applications specifically madeto monitor current and future disasters. Several applications can be used by the public to monitor disasters, such as the Flood Monitor application, the DKI Jakarta Province FloodEarly Warning System, and Info BMKG.

The presence of these applications is a tool that will make it easier for people to be moreaware of disasters; especially now that many people are already using smartphones. This confirms the findings of Winarni and Purwadani [4] which revealed that the use of smartphones to study disaster prevention would be faster to catch than conventional learning. In this study, researchers will focus on one application, namely Info BMKG. Info BMKG is anapplication formed by BMKG, an Indonesian non-departmental government agency in charge of meteorology, climatology, and geophysics. Currently, the Info BMKG application can be used by iOS and Android users. There are several things that make researchers choose Info BMKG as the object of research. First, when viewed from the user's point of view, this application is much more downloaded than the Flood Monitor application or the Flood Early Warning System. Info BMKG has been downloaded by 5 million users, while other applications are far below the figure that has been achieved by Info BMKG. Then from the information, Info BMKG continues to provide the latest information from observations, while the previous two applications are still limited in terms of information. The second reason is because this research wants to focus on disasters related to weather and climate change, namely floods.

Based on data for the last five years in DKI Jakarta, every city in DKI Jakarta has experienced floods [3]. Flood disasters are the most prone to occur in the city of East Jakarta, at least from 2014 to 2018 there were 43 flood disasters. Furthermore, the second most vulnerable city is South Jakarta, with 25 floods in the same period. This flood disaster brought great losses; where the floods that occurred in the past five years affected 694,363 refugees, 34 victimsdied, and 38,258 buildings were submerged [3] As the current capital of Indonesia, floods that regularly occur will be very detrimental. Given that Jakarta is the centre of all activities, from government, business, to education. For this reason, this research is important to do, to see how Jakarta has the potential for flood disasters, which can cause material losses and loss of life.

Even though floods have often occurred, the community's ability to minimize the impact of losses from floods is still low [5]. BMKG as a government agency has the task of disseminating information to the public. This information dissemination is carried out not onlywhen facing a disaster situation, but also preparations before a disaster strikes. For this reason,the community must at least equip themselves with information before the flood hits, especially before the flood hits buildings. This information can be obtained, one of which is from the Info BMKG application. The explanation above shows that there is a gap; where it should be that if every

year floods hit Jakarta, the people should have been prepared to facethe flood. Especially now that there are applications that make it easier for the public to monitor changes in water levels and climate. In fact, from the loss data above, the community is still not able to prepare themselves as well as possible before facing a disaster. Departing from the existing problems, the researcher wants to conduct a study that aims to see how the Info BMKG application is used as a disaster risk communication medium in the Jakarta area.

## 2 Concept and Theory

Following are the concept, including theoretical background and research framework that are utilized in this research.

### 2.1 Disaster Risk Communication

Terminology of disaster risk communication is a concept where each component has its own meaning. However, in this research, the researcher wants to see disaster risk communication as a unit. That is, communication is a core part and disaster risk is a context in which the communication takes place. According to the book of Communicating Emergency Preparedness, then risk means the chance of something bad happening, or causing an unfavourable outcome [6]. Meanwhile, the book Ongoing Crisis Communication states that the crisis has a broad definition [7]. For this reason, crises are divided into two sub-crises, namely organizational crises and disasters. According to Quarantelli in Coombs [7] a disaster is an event that occurs suddenly, then disrupts the routine of the system, thus requiring an action to overcome the disturbance and danger to social values and goals. The definition gives many characteristics of a disaster, although it does not directly explain what the definition of disaster is like. Referring to the definition of disaster, events such as terrorism or floods can be categorized as disasters because both have an impact on disrupting social life. Then the crisis is the perception of an unexpected event related to health, safety, environmental, and economic issues and has a serious impact on the organization [7]. From the two literatures, theresearchers found differences regarding risk and disaster. Risk talks about the chance of something bad happening, including disaster, and disaster is the event that things happen that disturb and endanger individuals in a system. After knowing the definition of each component in disaster risk communication terminology, the researcher defines disaster risk communication as communication related to the potential for hazards and disasters to occur.

### 2.2 Disaster Risk Communication Media

When facing a potential hazard and disaster, one of the efforts currently being intensified is the use of technology, information and communication (ICT). The World Bank Group [8] says that ICT consists of hardware, software, networks, data collection media, data storage, processing, sending and presenting information, either in the form of voice, data, text, or images. The use of ICT in disasters and dealing with climate change is central; because the useof ICT in disasters will increase people's capacity to collect risk [8]. In the use of ICT, there are three components in risk communication that can manage risk and reduce risk [9]. These are the following factors:

(1) Risk Reception: the creation, sending, and receiving of messages from ICT have an influence on a person's perception. In this study, the reception of messages from ICT will have an influence on disaster awareness; (2) Risk Understanding: when the message is received and understood, then the recipient of the message will understand what the actual message is to be conveyed; and (3) Risk Action: once understood, then the recipient of the message will take an action based on understanding the message.

The availability of messages or information in ICT will be used to reduce uncertainty in dealing with disasters, meaning that the information obtained by ICT users is useful in providing clarity about what will happen and how to respond to things that will happen. For this reason, after explaining the benefits that may arise and how the ICT process is accepted by its users; It will be explained how Info BMKG has an impact on its users as the results of the research.

### 2.3 Risk Communication Theory

Risk communication is always faced by everyone from parents, children, representatives of the people, policy makers, scientists, farmers, factory workers, to writers [2]. Risk communication begins with a hazard, potential, or real threat to the environment, safety, or human health. To deal with these risks, risk management is needed. Risk management begins with calculating a risk. The information available will be used to determine the actions to be taken to deal with the risks. The decisions taken will be communicated to the parties who may be exposed to the risk. When it comes to risk communication, the actions taken require the right approach. There are various approaches that can be used for risk communication. One of the fourteen risk communication approaches used in this study is the National Research Council (NRC) approach. The risk communication referred to by the NRC in Lundgren and MacMakin [2] states that "Risk communication can be defined as the interactive process of exchange of information and opinions among individuals, groups, and institutions concerning a risk or potential risk to human health or the environmental"; that in risk communication there is a process of exchanging information and opinions between individuals, groups, and institutions that focus on risk. The NRC also states that risk communication should be directed at informing how decisions and problem-solving actions are taken considering the social context of risk, and then continuing through management and communication [2]. In this approach there is a point that explains that in dealing with risks, apart from informing the community about the potential dangers that will be faced by the community, it is also necessary to be informed about actions or decisions that must be taken immediately/when danger occurs. This means that risk communication has the aim of triggering a behaviour or action to prepare for the danger ahead.

To trigger a behaviour or action, it takes a process. According to Coppola and Maloney [6] someone who has been exposed to a message will evaluate the information. After evaluating, there will be adjustments to the knowledge structure, which results in a change in the belief system. There are three components in attitude [6]: (1) Cognitive: something related to opinions, knowledge, or beliefs about an issue; (2) Affective: something related to judgments or feelings about an issue; and (3) Behaviour: a behaviour related to an issue.

Because each of these components has a relationship with one another, therefore influencing the cognitive and affective components is the initial effort to lead to a behaviour change. Before discussing risk communication further, it should be noted that risk communication in the context of a disaster is analogous to a crisis. Where the crisis conditions can be divided into three

stages, namely: before the crisis, during the crisis, and after the crisis. Each of the stages has its own sub-stages, which can be described as follows:

(1) Before the crisis

In the pre-crisis stage, there are three sub-stages: signal detection, prevention, crisis preparation. Signal detection provides early warning signs. According to Gonzalez-Herrero & Pratt in Coombs [7], when an early warning appears, early action will be taken so that a crisis can be avoided. Any information regarding warning signs will be identified and analysed, so that corrective action will be taken later. This action is useful for preventing a potential crisis. Prevention is the action taken to prevent a crisis that aims to reduce the level of risk. Finally, crisis preparation is preparation that includes identification of crisis vulnerabilities, team formation, selection of spokespersons, and preparation of a crisis communication system.

(2) In times of crisis

When a crisis occurs, there is a need for appropriate action in handling it. There are twophases in this stage, namely crisis recognition and crisis containment. All must be aware ofand respond to the crisis. Crisis recognition includes understanding how an event is defined as a crisis. Then when it is clear, then the next focus is crisis containment and recovery, namely response to the crisis through communication links, contingency plans, and follow-up on problems.

(3) After the crisis

When the crisis has occurred and is considered over. There are three actions that need to be taken. First, make thorough preparations to face the next crisis. Second, ensure that all parties remain positive with crisis management efforts. Third, ensure that the crisis is completely over.

From the explanation above, the stages of the crisis are divided into three. If the analogy isthat a disaster is a crisis, then disaster management must also pay attention to the three phases above. One example of an institution related to disaster issues is the National Disaster Management Agency (BNPB). BNPB has a disaster management cycle that has a similar approach to the three stages previously discussed: namely before the crisis, during the crisis, and after the crisis. In this study, the researcher will limit the scope of the research so that the research to be carried out focuses on only one segment. This study will focus on pre-disaster, the choice of this focus has a reason, namely that floods that occur every year cause enormous losses. The presence of the Info BMKG application as a disaster risk communication medium, ideally, is able to provide information to the public, where people are triggered to take action, so that losses from flood disasters can be minimized.

### 2.4 Research Framework

Risk communication has been described as communication related to the potential for hazards and disasters to occur. When talking about disaster risk communication, it has been explained that there are three-time phases of disaster management, namely pre-disaster, during disaster, and post-disaster. In BNPB's disaster management cycle, activities carried out prior to a disaster focus on disaster prevention and mitigation, the aim of which is to minimize the impact of

disasters. Concrete actions that can be taken for disaster mitigation are to collect accurate information from credible sources and take action (change attitudes or behaviour) based on the information obtained. In this study, researchers will raise a flood disaster issue that has had a detrimental impact on the community. One of the efforts that can be made by the community to prepare for flooding in the context of disaster risk communication is to collect accurate and credible information to trigger behaviour change, which is estimated to beobtained from Info BMKG. When users have equipped themselves with accurate information and are triggered to make behaviour changes, the impact of losses can be minimized. Therefore, the research question is how to use the Info BMKG application as a risk communication medium? Below is a research framework that explains the relationship between theory and concepts, so that the theories and concepts are in accordance with the problems raised in the research to be carried out.

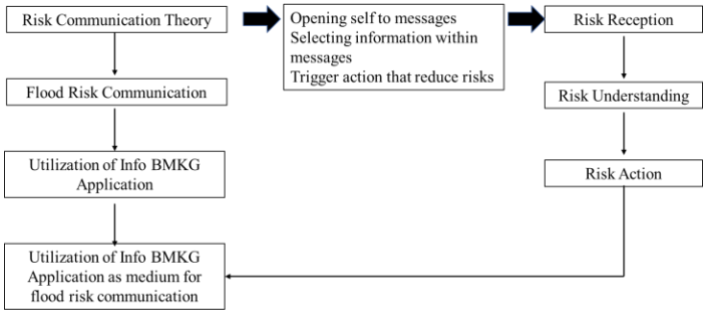


**Fig. 1.** Theoretical framework for research on the use of info BMK applications as a communication media for disaster risk in the Jakarta area.

## 3 Methodology

This study will use a mixed method (Mixed Method), which is a combination of quantitative and qualitative approaches. This research will be carried out in two stages sequentially with sequential explanatory design [10]. The first stage will use a quantitative approach and the second stage will use a qualitative approach. In the first stage, researchers will collect quantitative data using survey techniques. To carry out this survey, the researcher will arrange questions which are then read by the respondents themselves and the respondents fill in the answers to these questions [11]. The questions that will be submitted to the respondents have already gone through the operationalization of each variable. In this first stage, the sampling technique that will be used is convenience sampling (accidental sampling), namely the sample that will be used as a preliminary exploratory study (overview) and qualitative [11]. Sampling of convenience will be carried out by distributing surveys online, therefore it can be said that the first stage of research uses an accidental online approach. Then after the quantitative data is collected, the researcher will filter the respondents who will be taken for the second stage of research. In this second stage, the technique that will be used is purposive sampling, namely taking samples aimed at special situations [11], namely qualitatively. The special situation in this study is that researchers will contact respondents who meet predetermined criteria (using

the Info BMKG application and looking for information about weather and climate forecasts). The findings from this qualitative research will answer the research questions at the beginning.

Primary data will be collected from questionnaires distributed online. Online means that researchers distribute questionnaires on social media (twitter). Researchers targeted the respondents who live in the Jakarta area. At the second stage, researchers will select respondents using purposive sampling, where researchers will contact respondents who have filled out the questionnaire, use the Info BMKG application, and use the Info BMKG application to find weather and climate information. After going through the screening, then the researcher conducted interviews to meet the needs of qualitative data. The dimension to be operationalised in the survey are user of Info BMKG, the use of Info BMKG, reason of not using Info BMKG; and for the interview: knowledge (risk perception), attitude (risk understanding), and user response (risk action), needs, usefulness, accessibility, and disaster information media.

Secondary data are data collected from various literature reviews as research supporting data. In this case, the researcher collects data from BNPB related to disaster reports, as an initial overview of the problem.

## 4 Results and Discussion

There are 80 people who responded to the survey, 45% are in their 20s, and 4 out of 80 were able to be interviewed. In terms of the use of the Info BMKG, the respondents use the Info BMKG application to fulfil their daily personal and family needs. The daily needs are for mobilization, while for the family needs, they use it when they felt that flood will be occurred. As for the perceived benefits, the respondents have something in common, namely through the Info BMKG application they can prepare for the weather to come. However, still, based on the responses, there are less user who uses the Info BMKG although Jakarta is one of the areas that are prone to disasters, especially floods. Every year floods hit Jakarta; and incur a lot of losses. From these two findings, even though Jakarta is an area that experiences floods every year, this has not encouraged people to use the Info BMKG application.

If it is associated with the three components in risk communication that have been described earlier; Lee, Watson-Manhem, and Ramaprasad [9] stated that when someone uses ICT, the person's perception will be influenced when receiving a message. After receiving the message, the next step is understanding the message that has been received. From the respondent's answers above, receiving messages begins when the respondent installs the Info BMKG application. Once installed, respondents will receive information related to the disaster. Here then, understanding of disaster risk is evidenced by respondents choosing disaster information that is close to their lives; with the most accessible information is for earthquakes and weather.

Then, if it is associated with risk communication theory, that there are three stages in a risk situation, namely: before the crisis, during the crisis, and after the crisis [7]. One of these three stages is implemented in the disaster management cycle by BNPB. The cycle is divided into four stages: prevention and mitigation, preparedness, emergency response, and recovery. From the respondents' answers, it was found that while using the Info BMKG application, they felt a benefit, namely being prepared or alert to rainy weather conditions and using the Info BMKG application for their personal or family daily needs. From the findings of the study, what

respondents did was included in the pre-crisis stage; where Coombs [7] explained that the pre-crisis stage was marked by crisis prevention and preparation, then BNPB explained that prevention and mitigation were in the no-disaster stage.

In terms of disaster media information, there are several things that can be seen that to access the Info BMKG application, all answers showed that the application was easily accessible, even though the signal condition is not good. The display of the Info BMKG application is understandable and interesting. There are things that need to be improved so that the display is easier to read. Respondents found difficulties in grasping the symbols and pictures because some were not accompanied by descriptions. As for information packaging, the language used is easy to understand and not too long, despite the small size font. However, respondents found the information from the Info BMKG application was easy to understand. ICT consists of hardware, software, networks, data collection media, data storage, processing, sending, and presenting information in the form of sound, data, text, or images [8]. Based on that definition,then Info BMKG fulfils the criteria. BMKG as an institution focuses on meteorology, climatology, and geophysics collects data, processes the data obtained into information. Afterwards, BMKG will send the information to users via the Info BMKG application. Information received by users is in the form of press releases, early warnings, and information about earthquakes, weather, climate, air quality, and hotspots. Based on above, the InfoBMKG application met the ICT criteria that is used to deal with disaster situations. Regarding the use of the Info BMKG application, users of the Info BMKG application open themselves up to information related to disasters. It starts with installing the Info BMKG application, using the application, and selecting the available information. Info BMKG as ICT in disaster has prepared the application to be easily accessible, so that even in difficult conditions the signal can still be accessed.

Users who use the Info BMKG application can be said as people who have disaster awareness. They are aware that disasters related to climate change are susceptible in the Jakarta area, so they choose information related to flood disasters, namely weather and climate information. Followingly, the research findings found out that respondents receive information in the form of symbols or images and text (press releases or early warnings). Respondents admitted that they understood the information conveyed because the use of language was easy to understand, and the information was not too long; although there were still some symbols that were not understood. This finding is in line with what has been explained by Lee, Watson- Manhem, and Ramaprasad [9] that the selection of information on ICT will help recipients of information to understand the risks involved. From this it can be understood that Info BMKG as an example of ICT has helped users to understand risks.

In terms of disaster risk communication, as explained earlier, the National Research Council in Lundgren and MacMakin [2] states that risk communication is a process of exchanging information between individuals, groups, or institutions whose focus is risk. Risk communication should provide information about the behaviour to be taken when facing a risk. To trigger behaviour change, there are three components that must be interrelated,namely cognitive, affective, and behavioural aspects. For this reason, the research findings hadidentified the cognitive, affective, and behavioural conditions after using the Info BMKG application. Based on the respondents, the researcher found that there were several things that had similarities. It was found that for the cognitive aspect, when using the Info BMKG application, new knowledge was gained, especially in terms of geography. As for the affective aspect, after using the Info BMKG application the changes that occur are becoming more aware and more

alert to weather conditions. This awareness and awareness trigger an action tobe taken when receiving information from Info BMKG, both preparing oneself with umbrellasor raincoats and also sharing the information with friends or family.

According to Lee, Watson-Manhem, and Ramaprasad [9] in the use of ICT there are three components that can reduce risk. First, risk perception which is marked by receiving messages from ICT; where users of the Info BMKG application receive messages and messages affect knowledge and awareness of disasters. Second, risk understanding which is marked by understanding the message; after realizing the disaster then the user begins to select the information needed. Third, risk action which is marked by taking an action after understanding the message, after accessing information about weather and climate, the action taken is to prepare for rainy weather and disasters; by preparing an umbrella or raincoat and logistical needs. This also confirms the statement from The World Bank Group [8], which says that ICT in disasters can increase people's capacity to deal with disasters.

After knowing how Info BMKG triggers behaviour change and the impact of the role of ICT in disasters. From the point of view of the stages of risk, the crisis is divided into three stages: namely before the crisis, during the crisis, and after the crisis. One application of the three stages of the crisis is used in the management cycle of BNPB; namely the disaster management cycle; prevention and mitigation (a situation where a disaster does not occur), preparedness (a situation with a potential disaster), emergency response (when a disaster occurs), and recovery (after a disaster occurs) [12].

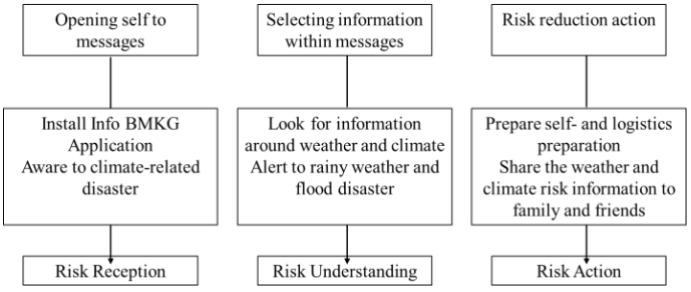


**Fig. 2.** Framework for using the info BMKG application as a disaster risk communication media.

The results of the study found that Info BMKG triggers a behaviour that is preparing for disasters. If it is associated with the stages of the crisis, then the existing behaviour is included in the pre-crisis level. Where according to Coombs [7] in the crisis stage is characterized by crisis prevention and preparation. Prevention here has the meaning of actions that aim to reduce the level of risk.

When linked to the BNPB disaster management cycle, the behaviours that emerge are included in the prevention/mitigation and preparedness stages. Therefore, the Info BMKG application can be the medium for disaster risk communication, especially for flood disaster preparedness.

## 5 Conclusion

At the beginning of writing, it was explained that one of the contexts in communication is risk communication. BMKG as an institution that focuses on meteorology, climatology, and geophysics has created the Info BMKG application, to share information with its users. The presence of the Info BMKG application should make it easier for the community to prepare for disasters related to climate change. For this reason, this study raises the title of using the Info BMKG application as a communication medium for disaster risk in the Jakarta area. The results of this study indicate that the Info BMKG application can be used as a communication medium for disaster risk, because through the Info BMKG application, they are aware of disasters, understand disasters related to climate change, and take an action. Thus, Info BMKGcan be used as a communication medium for disaster risk. After conducting interviews with users of the Info BMKG application, it was found that users of the Info BMKG application who access information about climate and weather experience changes in cognitive, affective, and behavioural, which makes them aware of disasters related to climate change, have a sense of alert, and prepare their personal needs when facing rainy weather to floods.

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