

A Perspective of Community at Flood Prone Zone on ICT for Flood Risks Communication

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Abstract: *This article aims to take account community perspective on the use of ICT in flood risk communication, particularly for public awareness that may encourage community to take any action for flood prevention to minimize the potential occurrence of flood and the loss. There are three research question addressed in this paper. First, what are the existing knowledge on flood risk and how to deal with that risk owned by community?; Second, in what extent community have access to ICT; and the last, with the existing knowledge owned by community and degree of access to ICT?, will community access ICT to seek additional information for flood risk communication? This study points out some findings as follows. Community mainly rely on their tacit knowledge in recognizing the likely occurrence of flooding, the characteristics of flooding and the area covered and not covered with flooding, which is gained from yearly experience on flooding event. However, the communities do not have sufficient knowledge on how to minimize the likely occurrence of inundation and flood, both sourced from tacit knowledge and explicit one. The extent of community in accessing ICT are measured through Smartphone ownership, regularity in purchasing internet and internet based platform accessed by community. The ownership of Smartphone, which achieves 80% of community, is followed with regularity in purchasing internet, mainly for accessing social media platform. Among these three variables, only knowledge variable does not have significant correlation with willingness to access ICT based flood risk communication. Regarding to its benefits, ICT based flood risk communication should be taken account as one of strategy in developing flood preparedness of the city. However, the application of this approach in areas that are new to / are developing ICT systems for this purpose requires an understanding of the community perspectives and practices in using ICT as media in delivering information and communication, which may determine community willingness to access ICT based flood risk communication.*

Keywords: Flood, ICT, Knowledge, Smartphone and Internet

1. Introduction

This study was undertaken in Kelurahan Bende in Kendari City, Indonesia. Kendari is a coastal city surrounded by hills and directly facing Kendari Bay, which is an estuary for 13 streams and rivers that pass through the city. Most of its district centers are located at flood prone area and potentially experienced with losses in property, building and infrastructure even live. Thus, flood becomes a serious environmental problem in Kendari City and needs to be addressed.

In Master Plan of Urban Drainage of Kendari City, Kelurahan Bende was identified located at flood-prone areas, regarding to its topographical condition, which forms significantly gently slope to Kendari Bay. Another waterfront issue related to Bende, is its location as estuary of Wanggu River, one of the biggest river in South East Sulawesi Province. In the other hand, Bende is located at

district centre with high population and dense buildings. Therefore Kelurahan Bende is determined as extremely be potentially experienced with high loss. Based on historical flood map, there were identified several community clusters in Bende experienced with severe impact of flood, namely RT 3, RT 7, RT 24, and RT 31. These communities dominated with dense housing, mostly as permanent and semi permanent houses. Inundation and flood are common situation experienced by community in rainy season. It was identified that the flood frequency may reach six times in a year. The flood height was varying from 0.2 to 0.5 meter, which needed two to four hours to recede. The coverage area of flood reached 2 Ha in average. However the widest flood area was in RT 24 which achieved 8 Ha.

Moreover, flood mitigation in Kendari City is under coordination of Regional Disaster Management Authority (BPBD), which has direct bottom-up and vice versa coordination line with Major and parallel coordination with

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other government agencies such as National Search and Rescue Agency (BASARNAS) for Kendari City, Public Work Office, Public Health Office, Social Office, Information and Communication Office and others. Sharing information for disaster management from BPBD to community is still delivered orally through community survey, community meeting and mosque loudspeaker. Flood mitigation efforts were also conducted through school and community simulation rescue and evacuation at potentially flooded area. There have been some ICT applications in disaster management, such as early warning message particularly about extreme weather and earthquake using SMS gateway and Facebook. As addition BPBD also uses social media such Facebook to get the news about the disaster occurrences from public. However, from risk communication perspective, communication happened is mostly in the form of one way communication and in incidental manner. The message about flood risk and how to deal with the flood were delivered from BPBD and to community mostly in emergency situation, when disaster likely would happened, such as when extreme weather or earthquake. While, information related to how to deal with disaster is mostly delivered through community meeting and community survey.

Table 1: Flood Characteristics in Bende

Community Cluster	Height (m)	Duration of Flood (Hour)	Flood Area (Ha)	Frequency of Flood (times/year)
RT 3	0.1	1	1	3
RT 7	0.2	2	1	6
RT 24	0.2	2	8	6
RT 31	0.5	4	2	6

Moreover, disaster risk management follows the stages of mitigation, preparedness, response and recovery. Mitigation includes all actions to avoid or minimize the adverse impact of hazards and related disasters, where the function of mitigation covers techniques and hazard-resistant construction as well as enhancing the environment policy and public awareness [1]. Regarding to Becker et all in Mondino [2,3] risk awareness can be understood as knowledge on the presence of a risk. Regularly, flood weakness is related with an absence of attention to the natural environmental factors, which means lack of awareness. Bucker et all in Mondino et all argued that risk communication strategies can increase flood risk awareness [4,3]. Thus, public awareness could be said as one of key factors for prevention effort that may minimize the potential occurrence of flood and the loss. Lamentably, despite the fact that preparatory measures are by and more expense effective and economical than emergency response measures, there is a propensity to ignore preventive and preparatory measures [5].

Furthermore, the documents on risk communication recommends that two-way communication is more productive than single direction communication, yet two-way communication restricts the degree to which the more extensive public can be reached in light of the fact that numerous individuals are not set up to go to information meetings or workshops [6, 7, in 8]. Therefore, Information and Communication Technology (ICT) may be a valuable tool to help municipality in disseminating information and

knowledge related to the risk, in the same time provide communication channel from community to government. As ICT allows to various form of communication without face to face and may reach large number community even in remote area, risk communication through ICT then should be taken account as one of strategy in developing flood preparedness of the city. However, as this strategy is relatively new approach in Kendari City, thus, it is important to understand community perspective in using ICT as media in delivering information and communication related to flood risk.

2. Literature Survey

The essential function of communication is to influence recipient knowledge or behaviour by informing, directing, and regulating [9 in 10]. Risk communication is extensively characterized as 'a social interaction of data trade between any substances in the public eye on any type of risk (individual, social, political, environmental) that is intentional or non-intentional' [11 in 12]. Communication of flood risk is a critical component of flood risk management, which plans to reinforce individuals' risk awareness and to inspire the populace at risk to initiate preventive efforts and to be prepared [13 in 14]. The point of communication of flood risk is to convey the message of information and knowledge identified with flood to the local area which may impact their way of thinking, perception and behavior in managing flood. According to APCICT/ESCAP the information management cycle follow the stage of disaster risk management, which involves data, information, knowledge and action [1]. In this cycle, the analyzed data becomes information which turns into knowledge through a learning process. Then, well-timed and suitably applied knowledge turns into practical activities in the real situation, which will generate new data base.

The adequacy of flood risk communication strategies is reliant on numerous variables like public perception [12]. Shan et al., in Hasan, M et al., brought up that it is critical to comprehend the individual perception and the relationship behind knowledge sharing practices of individuals in virtual networks which can assist with reproducing the knowledge sharing practices in virtual networks [15 in 16]. Not very many investigations have inspected this behavior from the disaster management board viewpoint [16]. Despite the fact that, social elements have a high impact level in managing disaster successfully [17].

Furthermore, in the case of flood risk communication, ICT could be regarded as useful tool not only for dissemination information and knowledge about flood risk and to raise awareness but also for early warning system. Information and Communication Technology (ICT) is an umbrella term that incorporates PC equipment and programming, digital broadcast and telecommunications technologies as well as digital information repositories online or offline, contemporary social networking aspects, read/write interfaces on the Web; besides file sharing systems online [18 in 19]. It addresses an expansive and consistently developing scope of components that further incorporates the (TV), radio, cell phones and the arrangements and laws that administer the far and wide utilization of these media

and gadgets [19]. ICTs that have demonstrated basic to Disaster Risk Management (DRM) DRM incorporate however are not restricted to: mobile technology, the Internet and online web-based media devices, space-based technologies like remote sensing and satellite communications, and various sorts of radios, including beginner radio and satellite radio [1]. The innovation of cell phones and the web permits interconnect a mass audience, simultaneously gives people the choice of different types of communication (one-to-one, one-to-many, many-to-many [20 in 5]. Through internet network, knowledge and information may arrive at extraordinary number of local people even in a distant region without going to the gathering or workshop. Networking software can likewise be successfully utilized for local area assembly, learning and activity [21 in 19].

3. Methods

3.1 Research Question

This article aims to take account community perspective on the use of ICT in flood risk communication, particularly for public awareness that may encourage community to take any action for flood prevention to minimize the potential occurrence of flood and the loss. Bende community, particularly community cluster in RT 3, RT 7, RT 24 and RT 31 are the object study of this discussion. One of the main communication purposes for utilizing ICT is to look for extra information in order to acquire understanding into an issue [22,23 in 24]. As expansion, giving information and data to be transferred as wanted knowledge and activity to come up with the issue, is a matter that is attempted to be accomplished in information management cycle with regards to disaster risk management [1]. Regarding to this premise, it is important to understand the existing information and/or knowledge owned by community and what additional information needed to complete information that is perceived sufficient to deal with inundation and flood as environmental problem in Bende community. For this purpose, the first research question (RQ1) that will be addressed in this article is what are the existing knowledge on flood risk and how to deal with that risk owned by community. Discussion on this section will describe the broad range of information, which is owned and whether that information looked as sufficient or not to deal with flood risk.

However, as the information exchange is mediated by ICT, then the second research question (RQ2) will address in what extent community have access to ICT. Fink and Kenny in Maysela argued the importance of access to ICT, which was described as one factor contributing to digital divide [25 in 26]. They described that a gap in access to use of ICTs is crudely measured by the number and spread of telephones, Smartphone or web-enabled computers. They also argued that in this recent, Smartphone is contributing to the fast development of ICT, as it allows mobile access to information: anytime and anywhere. Thus, to describe the extent of community in accessing ICT, the ownership of Smartphone and regularity in purchasing internet are used in this research. This research focuses on how to deliver information related to flood risk and the way to deal with

that risk using website integrated with Smartphone Application, regarding to the complexity of information delivered and the accommodation for multi-directional communication: among community members and between community and Village (Kelurahan) officers.

Moreover, searching for information is a significant communicative function of most ICTs [22 in 24]. Regarding to our literature review on research conducted by Griffin, people will in general look for information to adapt to the risk when the individual in question apparent that the person information is not exactly adequate to manage the risk [27]. However, there are some factors contributed to individual's assessment on information sufficiency, namely affective response to the risk (e.g., worry, anger); informational subjective norms, that is, perceived norms about knowledge and information gathering about the risk; a set of perceive hazard characteristics; and selected characteristics of the individual [27]. Thus, with the existing information and knowledge owned by community and community access to ICT, this article will discuss whether community will access ICT to seek additional information for flood risk communication as research question number three (RQ3).

3.2 Data Gathering

To cope with RQ 1 and RQ 2, a set of questionnaire was conducted to Bende communities particularly community cluster in RT 3, RT 7, RT 24 and RT 31. The minimum sample was taken from every community cluster. However the completely filled questionnaires were 114 questionnaires.

To address RQ3, Focus Group Discussion (FGD) involving community leaders, village leader (Lurah) and his staffs as well as government officer from Regional Disaster Management Authority (BPBD) of Kendari city was also conducted to gain information into detail. Past research has shown that investigating risk requires knowledge into the real setting to comprehend its implication for the organization [27]. Thus, due to the lack of ICT application for flood risk communication in Kendari City, a simulation on the application of ICT for risk communication, which has been made in laboratory, was conducted in this meeting to take account community respond to the application of ICT for risk communication.

The material discussion in this FGD covers overview of flood risk, how to deal with the risk, who has to be involved in managing the risk and how to use ICT for getting information and facilitating communication among community and village government using laboratory model of website integrated with Smartphone Application. The features in this website consist of:

- Village profile and gallery. This menu contains village information, such as vision and mission of the village, organizational structure of village officer, administration map of Bende, number of population, number of community cluster and its population and picture of important space.
- Information on flood risk. The information provided are both in video form and picture form, which cover map of potential flood areas, map of the areas with the highest

loss rate, map of existing condition of drainage channels in Bende Village and selected sustainable drainage method in household, village and city scale.

- Village Information, which provide latest news, policy, regulation, incentive and program related to community, particularly in managing the (occurrence) of flood.
- Discussion room. This facility serves as a media for the community to convey advice / information and other matters related to inundation and floods or other matters deemed important / urgent. This facility also attains information and knowledge among community and community – village officers.

After receiving and understanding flood risk and the benefit that may gain from risks communication based ICT, questionnaires then be offered to find out whether information and knowledge on flood risk owned by community and ICT practices as independent variable correlate with willingness to access ICT for flood risk communication as dependent variable using spearman correlation test. Spearman correlation test is performed to determine the correlation between two variables and the degree/significance of the correlation that occurs, which is formulated as follows:

$$\rho = 1 - \frac{6 \sum d_i^2}{n(n^2 - 1)}$$

Where:

ρ = Spearman Rank Correlation Value

d = Difference between rank pair

n = Number of rank pairs for Spearman

Whereas value for significance can be calculate using following formula:

$$Z_{\text{ calculation}} = \frac{\rho}{\frac{1}{\sqrt{n-1}}}$$

This assessment is run to find out whether communities will take an action in this case seeking information from ICT, which can sufficient their knowledge to take an action for dealing with flood risk. The spearman correlation test is conducted using SPSS software.

4. Result and Discussion

4.1 Existing Knowledge in Flood Risk

Mohanty et al. in Pathirange et al. defined knowledge as the reality or state of knowing something with an extensive level of familiarity through experience, affiliation or contact [28 in 17] . Knowledge is consisted of explicit knowledge, which is perceived as codifiable knowledge natural in non-human storage facilities including organizational manuals, reports and data sets; and tacit knowledge, which addresses knowledge dependent on the experience of people, expressed in human activities as evaluation, attitudes, points, of view, commitments and motivation [29 in 17]. Corresponding to flood risk, Mondino, et all pointed out that is knowledge characterized as individuals' perception of how well they know a risk, and of how well a risk is known to science [13]. She also argued that knowledge is unquestionably not just a result of direct flood experience, thus, in addition to recognizing knowledge that a person assesses for himself, it is also important to recognize an individual's logical knowledge, the sources of which can be

books, hazard and risk assessments, maps, city plans, and historical chronicles.

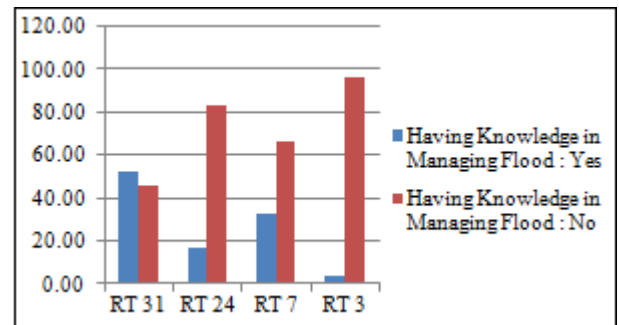


Figure 1: Percentage of Having Knowledge in Managing Flood

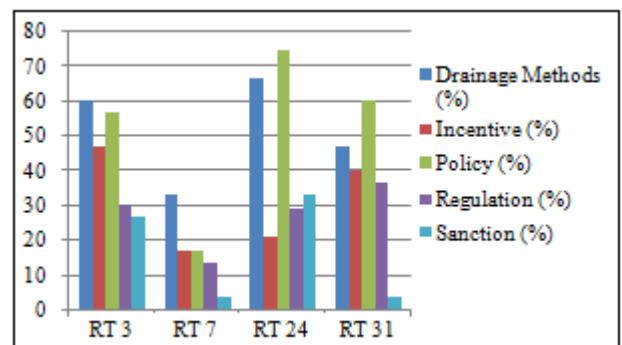


Figure 2: Additional Information Needed by Community to Complete Their Already Owned Information

In the case of Bende Community, location and condition of their settlement provide information to community that their place of living located in flood prone which is caused by the low elevation level and its location near the biggest river in Kendari City. The weather, particularly whether it is rainy days or not and the height of water level also provide information on whether flood will occur or not. By the time, with their experience, all these information processed by community as knowledge that these conditions make them realize that the conditions in which they live cause them to experience with flooding, especially during the rainy season. Their experiences in flooding almost every year have made them able to recognize the character of the floods that hit their settlements, namely its height, coverage area and time of inundation. By which, they know which areas are under inundation and are not during flooding, thus, which are not, are recognized as place for escaping when flooding to save themselves and their families or minimize material loss. Meanwhile, community knowledge on ways / methods to minimize the potential occurrence of inundation and flooding are varies. The lowest percentage of people who do not have knowledge of the method is 43% and the highest percentage is 98%. Community with sufficient percentage of having knowledge on how managing the potential occurrence of flooding, is only RT 31, which covers 53% of sample. The common knowledge owned by community is by cleaning the drainage channel especially before rainy season and managing solid waste well by putting it in its conveyor and avoiding throwing away the waste into the river. From FGD and interview, it is found that there was not much explicit knowledge such as organizational manuals, documents and databases on managing the flood risk,

delivered to or acquired by community. However, the communities perceive that there is some additional information needed to complete their already owned information. It is identified that more than 50% of community point out knowledge on drainage method and policy in managing the flood are information that preferred to complete the existing information owned by community to deal with flood, excluding in RT 7, while sanction is overlooked as important additional information that want to be gained by community.

4.2 The Extent of Community in Accessing ICT

As per Stork a significant ICT indicators is the one between access, usage and impact [30]. In his research, it is defined that access indicators measure what individuals or organizations have regarding ICTs or the number of exist in a country, while usage indicators measure how and for what ICTs are being utilized by families, people, organizations or governments and so forth. However, despite the fact that it is important, not many ICT summaries include information on the number of people, families or organizations that have access to, and use ICTs, or the uses made by those who use them, for example, the Internet [31]. As addition, Fink and Kenny in Maysela contended the significance of access to ICT, which was depicted as one factor adding to digital gap [25 in 26]. They depicted that a gap in utilization of ICTs is roughly estimated by the number and spread of phones, Smartphone or web-empowered PCs. They likewise contended that in this new, Smartphone is adding to the quick advancement of ICT, as it allows mobile access to information: anytime and anywhere. Therefore, assessing the degree of access to internet using a Smartphone can be considered as an ICT indicator that can explain not only the number of ICT users, but also the level of advancement of ICT to facilitate information exchange and communication in community.

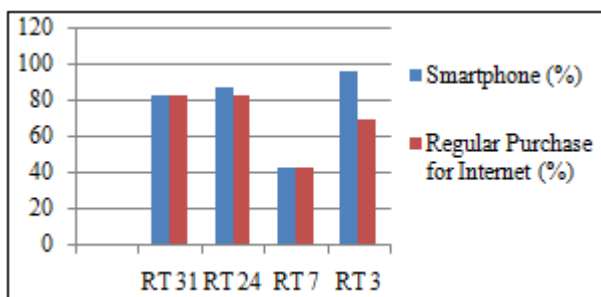


Figure 3: Comparison between Smartphone Ownership and Regularity in Purchasing Internet

In the case of Bende community, to measure the extent of community in accessing ICT, Smartphone Ownership, Regularity in Purchasing Internet and Internet based Feature Accessed by Community are utilized. Figure 1 shows that Smartphone is a common ICT tool for community, as most community has already had Smartphone, even though most of communities are categorized as middle-low income. The percentage of having Smartphone achieves more than 80%, excluding in RT 7, which the percentage is lower than 50%. It is quite surprising that the percentage of Smartphone ownership is roughly the same as the percentage of Smartphone ownership globally, which indicated in

Gadzama et al research that the current expansion in the degree of Smartphone reception by mobile users has lead to the fact that Smartphone has become a truly attractive gadget in the realm of information and communication technology [32 and 33] and accomplish almost 70% of the total populace associated and conveying through a cell phone in 2015 [33].

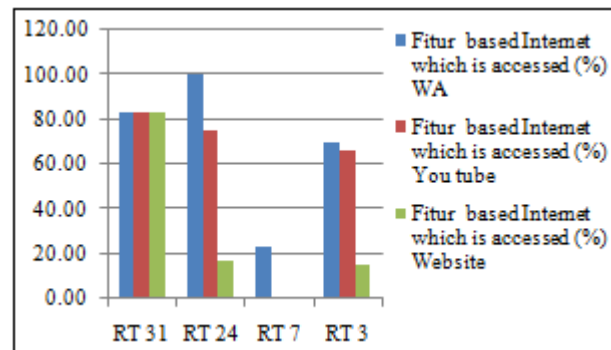


Figure 4: Comparison of Internet based Feature Accessed by Community

Moreover, the ownership of Smartphone is followed with regularity in purchasing internet, excluding in RT 3, which there is 30% difference between Smartphone ownership and regularity in purchasing internet. This can indicate that there is a great need in society for ICT-based communication. Having a Smartphone is a way / bridge to access ICT-based information. This is reflected in the ownership of Smartphone and the purchase of internet data packages on a regular basis which is quite high in the community, even though in general they are categorized as middle to lower income people. Furthermore, internet purchasing is mostly addressed to access Whats App as social media. Whats App is accessed by more than 70% in all communities cluster, excluding in RT 7, which is only 23.33%. Youtube is the other internet based platform, which is mostly accessed by community cluster, which achieves more than 60% excluding in RT 7. However, website is the most unpopular internet based feature accessed by community cluster, excluding in RT 31. From communication point of view, communities prefer to access two directional communications, which in this case is provided by Whats App. The broad range features, from written based communication to video/animation based communication and from individual to individual communication to individual to group communication, provided by this application, causes communities to use this application in ICT-based communication. In addition, the community also looks for information in the form of audio-video, in this case Youtube, which is felt to provide more information both in terms of verbal messages and emotions and the atmosphere that is conveyed. Regarding to the access and the usage of ICT, there is a good possibility to share information and conduct communication in managing the flood using ICT in Bende community. However, does community will access the ICT for flood risk communication?

4.3 Taking Account Community Responses through Simulation on Flood Risk Communication based ICT

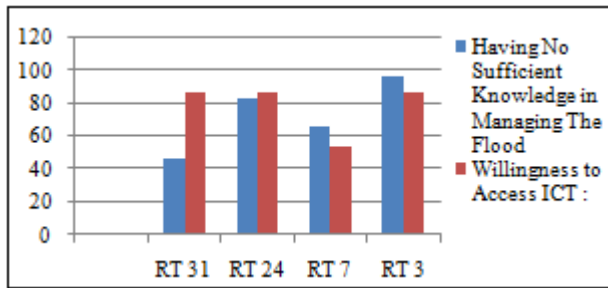


Figure 5: Comparison between Knowledge in Managing Flood Risk and Willingness to Access ICT

Table 1: Correlation Between Knowledge and Willingness to Access Information related to Flood Risk

Community Cluster	Correlation Coefficient	(Sig. (2-tailed))	Conclusion
RT 3	0,073	0,702	No significant relation
RT 7	-0,114	0,447	No significant relation
RT 24	0,093	0,665	No significant relation
RT 31	0,033	0,861	No significant relation

Public knowledge on methods to minimize the potential occurrence of inundation and flooding are varies. The lowest percentage of people who do not have knowledge of the method is 45% and the highest percentage is 97%. What is quite encouraging is that the willingness of the community to access ICT to obtain information related to flood risk is quite significant, which its percentage is more than 80%, but not including in RT 7 where the percentage is less than 60%. Based on the results of Spearman's analysis, there is no significant relationship between the presence or absence of knowledge about how to minimize the occurrence of flooding owned by the community and the desire to access information related to flood risk and mitigation efforts using ICT. In this case knowledge cannot be used to predict particular behavior, in this case the willingness to access ICT for flood risk communication. In the community cluster, both low percentage and high percentage of people who do not have knowledge on flood inundation prevention methods have high percentage of desire to access ICT. Examples taken here are RT 31, which the percentage of people who do not have knowledge of flood prevention methods is only 47% and RT 3, which has that percentage of 97%, both of which have high desire to access ICT, amounting to more than 80%. In this case, although having different levels of knowledge on how to minimize the occurrence of inundation and flood, the same experience, namely that every year people experience with flooding, is able to motivate people to access ICT. It is possible that the experience of experiencing flooding every year creates feelings of anxiety in the community every time when the rainy season arrives. This feeling of worry in research conducted by Griffin can foster self-assessment that there is insufficient knowledge in the individual so that He/She believes that He/She needs additional information, in this case ICT based flood risk, to make him capable to handle the risk. The affective respond, which was expressed as a feeling of worry, was expressed in the FGD, that the community hoped that efforts could be made so as to minimize the potential for flooding and they would not have to bother again every time a flood occurred.

The community also hopes that the flood risk communication system can be directly connected to the BNPD, so that emergency actions can be taken immediately when a disaster occurs. This in the line with argued by Mondino that people who report that direct experience with danger contributes to their knowledge, also more likely to report higher perceptions of threats to their home, self, city as a whole, and higher foreseeable future damage.

Table 2: Correlation Between Smartphone Ownership and Willingness to Access Information related to Flood Risk

Community Cluster	Correlation Coefficient	(Sig. (2-tailed))	Conclusion
RT 3	-0,073	0,702	No significant relation
RT 7	0,714	0,000	Significant relation
RT 24	-0,079	0,714	No significant relation
RT 31	0,617	0,000	Significant relation

Table 3: Correlation Between Regularity in Purchasing Internet and Willingness to Access Information related to Flood Risk

Community Cluster	Correlation Coefficient	(Sig. (2-tailed))	Conclusion
RT 3	0,385	0,036	Significant relation
RT 7	0,714	0,000	Significant relation
RT 24	0,692	0,000	Significant relation
RT 31	0,671	0,000	Significant relation

In the case of Smartphone ownership and willingness to access information to flood risk, Spearman's analysis points out that there is a strong relationship between Smartphone ownership and the desire to access information, especially in RT 7 and RT31. Various internet-based applications, platforms, features can be operated via a Smartphone which allows messages to be communicated not only in the form of text messages but also in visual and audiovisual form (video) even in a real time. The ability to present a broad range of forms of information and communication seems to encourage Smartphone users to access information related to flood risk, which is expected to be conveyed more clearly and easily understood. Smartphone also allows community to gain an instant and continuous transmission of information between two or more individuals simultaneously.

Moreover, the desire to access information related to flood risk seems to be based on the desire to know how to deal with and live with the uncomfortable situation caused by flooding. Even though community have experienced with flood every year, being in a flood condition certainly remains a situation that is not to be enjoyed. Examination directed by Lai et all. clarifies that most Indonesians feel that during disaster like typhoon and flood, they can generally depend on somebody to listen when they want to talk, trust in, share individual concerns, converse with assistance comprehend individual issue, look for exhortation and look for information[34]. Thus, being a person who has information and understands the situation during a flood, of course, will be very beneficial not only for his/herself but also for others. This can be understood if it is related to the use of Smartphones in the Bende community, namely mainly to access social network platforms, in this case Whats App. The desire to connect as well as to inform and to be informed with friends and family is certainly not

unreasonable, especially when someone is in an uncomfortable condition, namely a flood. Using Smartphone, community exchange information and communication in more real time, which is needed in disaster event.

Furthermore, based on Spearman's analysis, there is a strong relationship between regularity in purchasing internet and willingness to access ICT based flood risk communication. In this case, purchasing data packages in monthly regular basis provides repetition in the use of ICT, thus creating familiarity and confident to that individual in the use of ICT, particularly in this case for seeking for flood risk information and communication. This is in accordance with what was expressed by Agarwal and Prasad; Rogers; Tan and Teo in Waleed A., Sanzogni, L, Sandu, K. that the matter of trialability is that people who have had a lot of opportunity to try the innovation tend to adopt it as opposed to the individuals who didn't try it [35, 36, 37 in 38]. On the grounds that the trial gives a path to the likely adopters to be sure that the aftereffects of utilizing this innovation meet their expectation.

In addition, purchasing data packages regularly every month as precondition for repeated internet use can indicate that connecting to the internet has become a habit, given that people have to allocate certain funds while their income is classified as middle to lower income, which needs to be careful in managing their monthly expenses. This supposition that depends on the reason that habit formation depends on operant learning and repeated practice of a behavior, which differentiate habits from different types of automaticity, for instance reflexes [39]. Habits are related with automatic behavior, little awareness, attention, and control [40 in 39]. Thusly, individuals who purchase internet bundles consistently will in general access the ICT based flood hazard communication as accessing ICT has become habitual activities.

5. Conclusion and Recommendation

According to APCICT/ ESCAP the information management cycle follows the stage of disaster risk management, which involves data, information, knowledge and action. There are various sources of information that can contribute to flood knowledge, which in this case the experience of flooding and informal channel, namely communication about floods through friends or family facilitated by social media. On the other hand, formal information such as from books, maps, city plans, public authorities and so on has not been widely conveyed to or sought after by Bende Community. In fact, every source of information and knowledge of flood risk will have different effect on increasing different risk perception [13]. Flooding experience and informal communication and information exchange through social media can significantly increase perceptions of flood risk. With only based on the tacit knowledge gained from their flooding experience, the community understands when a flood will occur and what to do in the event of a flood. However, explicit knowledge that comes from formal information, for example in this case information from the village office and municipality, can provide information that is not obtained through tacit

knowledge information, such as sustainable drainage methods or techniques that can be applied at the household and community scale for minimize the potential for inundation and flooding. This is quite interesting, because the percentage of people who want to gain this information is quite significant. This indicates that the public realize that the tacit knowledge they have only plays a role when the flood likely happened and happening, so that the community is only able to take responsive actions. As for the preventive efforts, they have not been able to do it because of a lack of information and knowledge about it.

In the case of Bende, data, information and knowledge are mostly gathered by the community from their neighborhoods where they live and from their experiences on flooding every year. Community mainly relies on their tacit knowledge in dealing with inundation and flooding. This research shows that the experience of experiencing flooding every year provides an advantage in flood risk communication, because it can increase their awareness of the risk of flooding, which includes the possibility of future flooding in their location, the possibility of flooding hitting their house / themselves, the awareness that they live in the zone of flood risk, or the possibility of material loss that will be experienced. This creates a self-assessment that they have a lack of information in dealing with floods so that they are confident and motivated to seek additional information to complement their lack of information. These things can contribute to the use of ICT based flood risk communication to facilitate information exchange and communication. For this reason, an ICT system is needed that is able to synergize people's tacit knowledge with explicit one, which generally comes from formal information. The ICT system should be able to raise local content, for example by providing spaces for discussion from community members regarding their observations, experiences and views on flood risk parameters. However, because the information regarding tacit knowledge can come from various sources with different versions, a mediator from public or municipal authorities is needed who is able to regulate, direct and guarantee that the information exchange and communication that occurs is still respectful to the principle of trust, credibility, honesty, transparency and accountability. This is in line with what was pointed out by Glik [41 in 42] that the process of crisis risk communication scenario must contain elements of trust, credibility, honesty, transparency, and accountability for the sources of information. He also argued that lack of trust and credibility can doom risk communication efforts. " In addition, the presence of public or municipal authorities is also needed in order to follow up information from grassroots to a higher level, where actions are needed that require the involvement of multi-stakeholders, multi-communication channels and complex tasks and coordination and even funding. This is in line with what was conveyed by the community in FGD that they preferred the ICT system that connected with technical / field agencies, especially when a disaster occurs so that the necessary emergency actions could be taken immediately.

Furthermore, ICT based flood risk communication needs to consider the delivery of persuasive information, which is able to provide understanding, influence attitudes, and ultimately lead to preparedness and action before, during

and after the flood. In the Bende case, people tend to choose communication media that provide the broad range of features of communication from written based communication to video / animation based communication and from individual to individual communication to individual to group communication. In this case, the provision of audiovisual information needs to be considered in compiling an ICT base flood risk communication, given that this form of communication can provide more information both in terms of messages, emotions and the atmosphere that is conveyed. Audio-visual media has two elements, namely audio and visual, each of which has a synergistic power in providing information. The stimulus conveyed by audiovisual information makes the recipient of the information use more senses in absorbing information, in this case the sense of hearing (ears) and the sense of sight (eyes). The more senses used by humans to receive information, the more information is absorbed by the recipient of the information. In addition, the delivery of information through audio-visual media makes flood risk information more interesting and informative. Once the information is easy and attractive to be obtained and understood, it can encourage the desire to access the flood risk information.

Moreover, Smartphone ownership and regularity in purchasing internet indicate the good ability of the public to adopt internet-based technology and information. Technology especially internet usage can be affected by technology and social access [43 in 38]. Technology access refers to the infrastructure and capabilities of a person in the field of computer software and hardware [44 in 38]. In other hand, social access refers to the mix of educational, knowledge and economic resources required for internal use. In terms of ensuring public access to the ICT flood risk communication system, the system provided to the community needs to pay attention to the aspects of ease of installation and operation, flexible for information exchange and communication, and affordable for initial and operational costs. However, although it seems quite simple for community to download and operate application and system during simulation and FGD, there are many obstacles that come from the village office, such as the limited number of PCs, the limited number of personnel who have computer literacy and the absence of a good internet network cable or wireless. In this case, of course, the role of the city government is needed to allocate a budget for improving ICT infrastructure.

As conclusion, ICT based flood risk communication should be taken account as one of strategy in developing flood preparedness of the city. However, the application of this approach in areas that are new to / are developing ICT systems for this purpose requires an understanding of the community perspective in using ICT as media in delivering information and communication related to flood risk.

6. Future Scope

The essential function of communication is to influence recipient knowledge or behavior by informing, directing, and regulating. There are various sources of information that can contribute to flood knowledge. It is necessary to conduct

studies on which types of information are most interested and needed by the public and to what extent this information is able to direct the public to behave as desired in flood risk communication. In addition, the media and the process of delivering ICT-based information in an appropriate manner so that the image and content of the message can be accepted by the public effectively are important things that require further understanding.

At the end, research on ICT for marginalized communities, such as in this case the lower middle income community, as a group of people who often experience difficulties in accessing ICT, should be further explored to ensure a more fair distribution of ICT to reduce the damaging effects of nature disaster.

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