Application Design: Community Response to Disaster Information System Features

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Abstract: A tool is needed to support a series of processes in disaster management, including an information system, primarily spatial based, especially about spatial planning. Thus, it is necessary to review the profile of the community as a community regarding their knowledge of disasters, their readiness in disaster mitigation efforts, willingness to contribute to participatory mapping for disaster events, and the need for and requests for disaster information application or system. Besides, the benefits of developing user-based applications are expected to be utilized by various parties/levels of society/stakeholders and be helpful as a disaster mitigation education infrastructure, media for increasing community participation in mapping, tools in disaster mitigation-based spatial planning. The purpose of this research is to explore users' perceptions of disasters and the need for features in an information system for disaster mitigation. The interactive design emerged as a demand for app users. Also, people need an application that functioned as a powerful viewer and contained up-to-date data. What is unique from the survey is that the public has various views regarding the usefulness of the disaster information system.

1 INTRODUCTION

As the disaster has an extensive impact, it requires society to concede disaster management. Nurjannah in (Mahful, et.al., 2020) stated disaster management as a dynamic process about the operational functions (planning, organizing, actuating, controlling). It includes prevention and mitigation for emergency response and recovery. In developing countries, disaster management is more prone to disaster risks due to rapid urbanization, poorly planned urban expansion, concentrated poverty, poor governance, and environmental degradation (Brown, et.al., 2018). A tool is needed to support a series of processes in disaster management, including an information system, primarily spatial based, especially about spatial planning.

Currently, many web-based applications have been created to disseminate information, especially spatial-based. One area that is important in terms of urgency to create a spatial-based information system is a disaster. It is also in line with Indonesia's title as a disaster self-service, so the disaster information system is crucial. The use of GIS and the internet has changed the process of utilizing geographic information, accessing, sharing, and analyzing data, where many advantages are gained by utilizing GIS and the internet online (Tanaamah, Wardoyo, 2010).

As a forum for disseminating disaster information and mitigation efforts, the Government through Ministries / Agencies and NGOs, and even academics have developed a web-based application to increase the dissemination and understanding of the community about disaster events and inspire community participation in updating disaster or hazard events. Community participation in mapping is related to the Geo-participatory concept, accommodating a series of practices that adopt various tools, involve different participatory processes, and produce different participation outcomes. The crowdsourcing concept originated from a collection of GIS practitioners, users, and researchers who are more interested in the results of gathering information (Verplanke, et.al., 2016). Related to this, it is appropriate for an application or disaster information system to be built with a user-centred focus. Besides, the benefits of developing user-based applications are expected to be utilized by various parties/levels of society/stakeholders and be helpful as a disaster mitigation education infrastructure, media for increasing community participation in mapping, tools in disaster

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mitigation-based spatial planning. It is crucial to afford a user-friendly interface to facilitate geospatial information. In a web mapping application, all principal elements (GIS databases, web map servers, and web map browsers) should delight the user needs and accomplish the objectives of mapping services (Tsou, Curran, 2008).

The purpose of this research is to explore users' perceptions of disasters and the need for features in an information system for disaster mitigation purposes. Using a questionnaire, we tried to examine the features needed by a spatial information system for disaster. Previous research has focused on the technical side of informatics design and webGIS development or applications (Cao, et.al., 2015). For this reason, it is necessary to review the profile of the community as a community regarding their knowledge of disasters, their readiness in disaster mitigation efforts, willingness to contribute to participatory mapping for disaster events, and the need for and requests for disaster information application or system. It refers to the concept of successful disaster risk reduction requiring a collaborative approach from interdisciplinary. Thus dissemination of information is communicated effectively (Aye, et.al., 2016).

2 RESEARCH METHOD

2.1 Case Study Location and Period

In 2019, Semarang chose as the research location due to its characteristics. As a developing coastal city with a heterogeneous population (social and ethnic variety), Semarang can provide an overview of urban areas in Indonesia.

2.2 Data Collection and Analysis

A descriptive quantitative study is a way this research goes. The data was collected using a questionnaire. According to Arikunto (Mahful, et.al, 2020), "Questionnaire is a written statement that is used to obtain information from the respondent in the sense of a report about the person or things that he knows." The primary data used in this research include variable data used to measure people's knowledge about disasters, willingness to be involved, awareness of content, and feature choices for disaster information systems/applications. El-Masri and Tipple stated that citizens are increasingly and particularly identified as key to progress in disaster management, given their contributions to risk information management and adaptation measures (AlQahtany, Abubakar, 2020).

The convenience sampling method is used to collect data. Convenience sampling (also known as Haphazard Sampling or Accidental Sampling) a kind of non-random sampling of the target population are selected for the study on specific criteria (geographical proximity, accessibility and availability, or the willingness to volunteer) (Farrokhi, Mahmoudi-Hamidabad, 2012). The total number of respondents who were the target of the questionnaire and interview was 120 respondents, provided that the selected respondents had a smartphone with internet access.

The distributed questionnaire was built based on several research questions to fulfil the 1st stage 1 in the Software Development Life Cycle, defining user needs for a disaster application. Thus it will generate input for application design that accommodates user needs. The research questions used are:

- The level of internet/communication technology utilization
- Knowledge of disaster
- Disaster Information System as a medium for disseminating Disaster Geospatial Information/ Early Warning System
- Habits of community in accessing disaster information
- Suggestions regarding the user interface of the Information System that the community needs?
- Features needed by the community in a spatial-based GIS application
- Examples of disaster webGIS known to the public?
- Public willingness to participate in dissemination and validation of disaster information (support for crowdsourcing)

To analyze the data obtained through the questionnaire used descriptive analysis methods and non-parametric statistical analysis that was chosen to see whether there is a relationship between variables and measured parameters. Also, non-parametric statistical analysis was used to see how strong the relationship and direction of the relationship between variables and parameters were observed using the crosstab analysis method or cross-tabulation (Gelgel, 2020).

3 RESULTS AND DISCUSSION

3.1 Respondent Profile

Based on the age composition, most respondents were from the 21-40 years age range (74.17% of respondents). While respondents from 41-60 years old were 10% and those aged less than 20 years was 15.83%. Based on this trend, most respondents are considerably active in using technology because nowadays, in that young and productive age range (21-40 years old), the average respondent has been exposed to a smartphone that has internet access. Based on the education/academic background, respondents with a higher education level are53.33% from all samples. They were in college/university. Meanwhile, 45.83%respondent having a primary school/equivalent education level. Based on occupation, the majority of respondents were students (34.17%). Furthermore, 15% work as civil servants, 28.33% are private employees, and the rest are TNI/Polri, entrepreneurs, contract workers, consultants, homemakers, lecturers/teachers, and academic assistants.

The level of knowledge possessed by 120 respondents is generally in the moderate range (48% of respondents) to high (46% of respondents). Factors taken into account in assessing the level of knowledge about disasters include (1) definition of disasters and their types, (2) mechanisms for disseminating disaster information through internet networks, (3) applications for disseminating disaster-related information, (4) existence of disaster information systems as an effort to mitigate disasters. Related to point (3), around 61.98% of respondents know webGIS. It has become necessary since knowledge in the community on the disaster management index can be one source of information in conducting a risk management disaster. In Aceh, the results of a study of 210 students who received education on geographic and earthquake risk perception positively affect preparedness (Aksa, et.al, 2020). Rosadi, with a research set in West Karawang District, also concluded that student's disaster preparedness behaviour could improve through either disaster knowledge and environmental culture (Rosadi, et.al, 2020). Even though someone has been given education and training, it is not sure that they will have a good preparedness attitude if a disaster preparedness factor does not function. The research results on the relationship between the level of knowledge and the attitude of landslide disaster preparedness in the volunteers "Kelurahan Tangguh" in Kelurahan Kotalama, Bandungrejosari and Polehan Kota Malang states that there is a relationship between the level of knowledge and attitudes of preparedness. There is a positive relationship between knowledge and the attitude toward landslide disaster preparedness (Rini, et.al, 2010).

3.2 Digital Behaviour

The majority of respondents in this study tend to include the digital literate crowd. It happens because most respondents have a high level of education and own a smartphone, so they have been exposed to a lot of information obtained from the internet. Therefore, in developing a good application, it is necessary to observe the digital behaviour of potential users. The exchange of various information is often provided from various platforms on the smartphone, including information related to disasters. Currently, most respondents access information about disaster events via mobile devices such as smartphones or tablets (85.6%), while only 34.6% have access to disaster information via computers/laptops (Figure 1). Based on this matter, in the future, the application needs to be developed in a mobile version that can be accessed using a smartphone or tablet computer. It is crucial so that users can be more efficiently and instantly access disaster data.

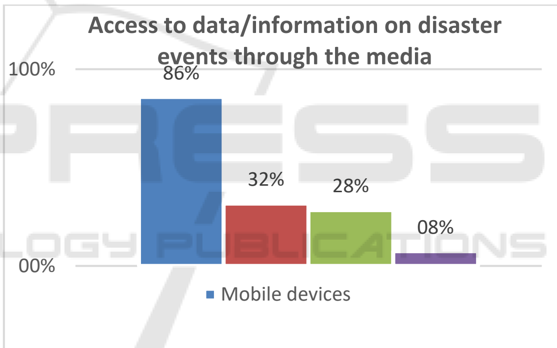


Figure 1. Media to access data and information on the disaster

Based on the survey results, most respondents used smartphones to access social media and messaging applications. For this reason, the data sharing feature on social media is quite important to be available on a disaster website/application. The sharing feature to social media applications that are used by the majority of the respondent, such as Instagram, YouTube, Twitter & Facebook or messaging applications (Line/Whatsapp) will make the dissemination of disaster information more effective and widespread quickly (Figure 2).

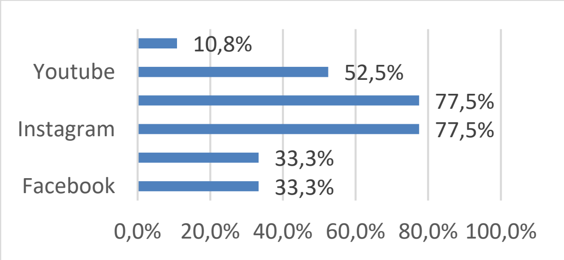
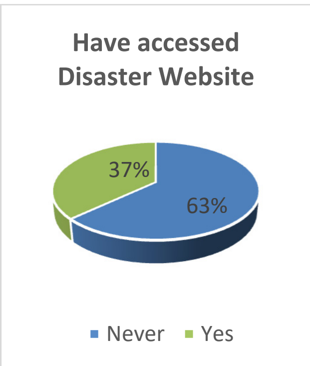


Figure 2. Social media applications used by the respondent

This matter is also consistent with research conducted by Gelgel (2020) [13]which shows that: (1) social media became the most resourceful media to gain disaster information; (2) though some people didn't verify the information (3) 30% respondent share without verification. It explained that most respondents have a high dependence on using social media but still need improvement in gaining disaster information.

Concerning disasters, 37% of respondents have accessed Disaster Information Systems (Figure 3). It shows that the respondents are gradually starting to apprehend the importance of disaster information. Some of the disaster information systems that several respondents have accessed in Semarang are websites from the BNPB Disaster Information System (Inarisk, Unaware, Inasafe, DIBI, Disaster Map), and BMKG Information System (Info BMKG). Based on the survey results, respondents accessed disaster information from the BMKG website (22,7%) and BNPB website (25%).Information related to the Disaster Information System according to respondents came from the internet/social media (63,3%), information from family/friends/colleagues (13,3%), and television/radio programs (10,0%). Based on this, it can be observed that the internet/social media is the most effective media for disseminating disaster information in society.



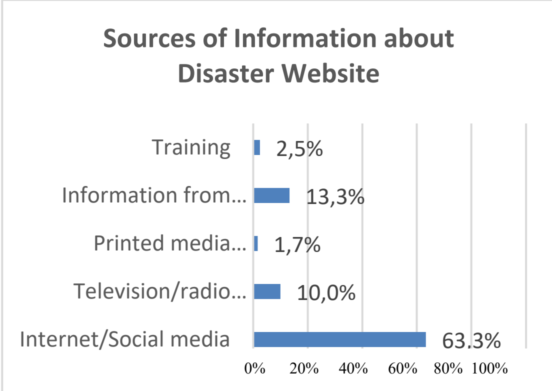


Figure 3. Experience of the user in accessing Disaster Website

3.3 Willingness to Participate

Natural disasters affect people expectations about the prevalence and severity of future disasters subjectively. It might affect individual investment behaviours on their incomes. The consequences that exposure to natural disasters has on risk attitudes, perceptions, and behaviour. Assessment of the public's willingness to be involved in disseminating disaster information in this research is based on several indicators, namely the willingness to receive disaster-related information (mitigation, emergency response, and post-disaster recovery activities), willingness to disseminate disaster-related information, willingness to verify information related to disasters, willingness to do update information related to disasters, as well as a willingness to become a volunteer as a node for disaster information networks.

The words "participatory action research" highlight that the research subjects are full participatory partners in the work of trying to solve a problem. Action required to solve the problem needs to arise from the collaboration. Lastly, research is being (co)produced (Kelman, et.al, 2011). Interesting findings by doing research in a coastal metropolis of Saudi Arabia, where the cities have been recently experiencing incidences of disasters, such as floods, disease epidemics (AlQahtany, Abubakar, 2020). The results indicate that although almost two-thirds (64.7%) of the participants are aware of disasters, and 81% are concerned about disaster risks, less than half (47.3%) believe that their settlements could be at risk. While 37% opine that natural factors and human activities cause disasters, about half (54%) indicate that they can personally reduce disaster risks. However, the analysis indicated a significant positive relationship between place of residence, perception of disaster risks, and concern about disaster risks. Socioeconomic and demographic factors such as age, education, income, and location (Al-Nammari, Alzaghal, 2015), types of disasters, and prior exposure to previous disasters like floods, earthquakes, and landslides (Ho, et.al, 2008).

Based on the survey results, 59% of respondents stated willingness to participate even though only 37% of the surveyed population had participated in disseminating data and information on disaster events. Most (83%) have the objective of sharing data and information on disasters for an early warning system. And 43% of respondents also chose the importance of awards given to contributors to disseminating data and information on disaster events.

Based on the data from the questionnaire results, a study was carried out on community knowledge about disasters, the willingness of the community to be involved, and awareness of content for application development. The results of questionnaire data processing obtained a study of whether there is a relationship between several independent variables (parameters) and the three main (dependent) variables observed. The study results and analysis of the relationship between the variables of public knowledge about disasters and the observed independent variables are presented in Table 1. The study results and analysis of the relationship between the variable people's willingness to be involved and the observed independent variables are presented in Table 2. The study results and analysis of the relationship between the awareness variables of the content with the observed independent variables are presented in Table 3.

Table 1. Relationship between Community Knowledge Bound Variables and Independent Variables

Variables	df	PCS	Tab	Sig	A-Sig 2s	Relation
Education	8	18,884	15,51	0,05	0,015	
Job	8	13,962	15,51	0,05	0,083	
Use smartphone	4	15,974	9,49	0,05	0,003	
Frequently accessed link	10	15,422	18,31	0,05	0,117	
Use spatial-based apps	4	8,333	9,49	0,05	0,08	

Based on the data and processing results presented in Table 1, it is known that the independent variables of education, use of power banks, and use of Android-based cellphones have a relationship with the dependent variable, namely public knowledge about disasters. These results raise enough questions, especially regarding the relationship between knowledge and two independent variables, namely, power banks and Android-based cellphones. This fact needs to be explored further by analysing the direction and strength of the relationship that will be presented after this section.

Table 2. Relationship between Bound Variables Community Willingness to Be Involved with Independent Variables

Variable	df	PCS	Tab	Sig	A-Sig 2s	Relation
Education	8	16,464	15,51	0,05	0,036	
Job	8	18,568	15,51	0,05	0,017	
Use smartphone	4	11,184	9,49	0,05	0,025	
Frequently accessed link	10	18,854	18,31	0,05	0,042	
Use spatial-based apps	4	17,5	9,49	0,05	0,002	

Table 3. Relationship between Bound Variables Content Consciousness and Independent Variables

Variable	df	PCS	Tab	Sig	A-Sig 2s	Relation
Education	8	9,177	15,51	0,05	0.328	
Job	8	53,63	15,51	0,05	0	
Use smartphone	4	4,188	9,49	0,05	0,381	
Frequently accessed link	10	6,543	18,31	0,05	0,768	
Use spatial-based apps	4	6,63	9,49	0,05	0,157	

Based on the data and processing results presented in Table 2, it is known that the variable of the willingness of the people to be involved has a relationship or relationship with the independent variables including regional position, education, occupation, RT / RW management, use of Android-based cellphones, the content most frequently accessed and frequently used. Map content applications. Based on these results, an understanding is obtained that factors within or outside the individual can influence the willingness to be involved. Further information on the pattern and strength of the relationship between variables will be presented in subsequent processing results.

Based on the data and processing results presented in Table 3, it is known that the content awareness variable is related to job variables and the capacity of the power bank used. These results raise new questions regarding the form of the relationship that occurs. To better understand this phenomenon, it is better to analyse this fact further by paying attention to the results of the analysis of the strength test and the direction of the relationship between variables.

Table 4. Level of Strength and Direction Relationship between Independent Variables and Bound Variables

Parameter	Function	Knowledge of disaster	Willingness to involve	Content Awareness
Education Job	Correlation Coefficient	,351**	,199*	-0,099
	Sig. (2-tailed)	0,000	0,030	0,281

Parameter	Function	Knowledge of disaster	Willingness to involve	Content Awareness
Use smartphone	Correlation Coefficient	-0,077	-,204*	-0,177
Frequently accessed link	Sig. (2-tailed)	0,404	0,025	0,053
Use spatial-based apps	Correlation Coefficient	-,293**	-,298**	-0,074
Education	Sig. (2-tailed)	0,001	0,001	0,421
Job Use	Correlation Coefficient	-,225*	-0,170	-0,114
smartphone	Sig. (2-tailed)	0,013	0,063	0,216
Frequently accessed	Correlation Coefficient	0,128	,192*	0,144
link	Sig. (2-tailed)	0,165	0,035	0,116

A table of analysis results is obtained based on the non-parametric statistical analysis carried out to see the strength of the relationship and the direction of the relationship between all independent variables and the dependent variable. Information that presents data about the strength of the relationship and the direction of the relationship is presented in Table 21.

Based on the previous relationship test results, the data observation can be focused on the part that is coloured green in Table 4. The focus of these observations is following the previous test results that the data is known. There is a relationship between the dependent variable and the observed independent variables. User responses to disaster information systems are obtained based on the respondent's level of knowledge regarding disaster websites/applications, values and perspectives regarding the dissemination of disaster data/information, willingness to participate in disseminating disaster information to measure the level of knowledge, perspectives, and agreement used a Likert scale with 5 choices of answer scales.

3.4 Visualization of User Needs towards Disaster Application Development

User needs for Disaster Application Development are obtained from assessing the quality of content/information that is important to be developed in the Disaster Application and the requirement for developing the application. Based on respondents' assessment of the quality of content/information that is important to be developed in a disaster website, it is recognized that providing reliable and up-to-date data and information (69%) and the accuracy of data and information (74%). Furthermore, 92% of respondents agreed that concerning developing disaster application prototypes, an application that is easy to use & learn (user friendly) and accessible from various platforms (web or mobile) is urgently needed. According to respondents, the most crucial disaster type information to be accessible in a disaster information system application is information related to earthquakes (79%), tsunamis (66%), volcanic eruptions (45%), and floods (39%). Regarding the option of the essential features to be performed in a disaster application, three features get the highest score according to respondents: the spatial data display feature/map viewer (89%); data sharing feature (65%), and data searching features (66%).

3.5 Integrated Disaster Information System Design

To fulfill the picture obtained from the survey results, an illustration has been compiled for an integrated system for the Disaster Information System as contained in Figure 4. Conceptually, the application is designed to connect or take advantage of services from portals or other applications, especially those under the management of an institution. It aims to achieve the effectiveness of developing the application design, namely minimizing the redundancy of the functions of previously available applications. The integrated design involves various portals of disaster types that are managed by both the government and the private sector. Thus, in one application, the citizen can receive / process and even update spatial data and attributes for various disasters.

Meanwhile, based on the results of respondents, according to the type of disaster that is most often selected as a priority, the portals connected to the information system contain at least information related to Earthquakes, Tsunamis, Floods, and Volcanic eruptions. In the crowdsourcing feature, this application involves all community elements to share information about reporting of natural disasters. Users apply the crowdsourcing concept by reporting natural disasters that are currently happening. The report contains details such as the incident's name, description, disaster category, location, and evidence. The application is equipped with the 'Disaster Reporting' feature to support the participatory mapping of disaster themes. However, this year, the reporting mechanism is still limited to certain users who have the authority and responsibility for verification, including for officers to avoid hoax. However, users from the general public who has verified can participate in reporting. The application's disaster data reporting includes location data (coordinates), events (time), event documentation, and event definitions. Collaborative efforts involving various stakeholders including the government, the private sector, citizens, and civil societies, can enhance disaster preparedness and response from information provision to protect vulnerable groups. Benson note that Donors, international non-governmental organizations and non-governmental organizations have become an essential component in the evolving disaster risk reduction context (Ruszcyk, et.al, 2020).

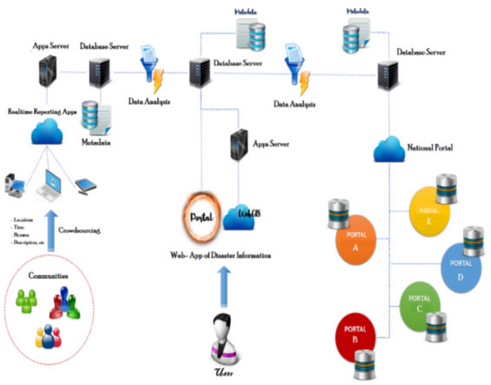


Figure 4. Integrated Design of Applicationfor Disaster Information System

4 CONCLUSION

Increasing disaster literacy by developing a Disaster Information System following user responses is expected to grow the sense of responsibility, preparedness, and independence of the community when a disaster occurs and reduce disaster risk and minimize casualties. In developing a disaster website/application design, it is essential to consider the digital behaviour of the potential user, their willingness to participate in crowdsourcing, user perceptions about the quality of content/information to be developed, the needs for system development, and types of disasters to be shown based on respondent perspectives.

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