Local risk managers’ and disaster volunteers’ awareness of, attitudes toward, and intention to use a local government-developed disaster information system: A Case study of SIKK Magelang

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Abstract. SIKK (Sistem Informasi Kebencanaan Kabupaten or Regency Disaster Information System) Magelang is a disaster information system developed by local government in Magelang Regency to support disaster management. Despite having useful features, as with many e-government services, it shows a low adoption rate. This paper aims to explore the barriers impeding the adoption of SIKK Magelang from the perspective of local risk managers and disaster volunteers. Preliminary data were gathered by scrutinizing related disaster management documents and SIKK Magelang reports and interviewing the information system’s operators. Next, a half-day workshop was conducted with the help of BPBD (Badan Penanggulangan Bencana Daerah) of Magelang Regency to assess local risk managers’ and disaster volunteers’ awareness of, intention to use, and attitudes toward SIKK Magelang. Of the 150 people invited, 112 attended the workshop; however, 107 participants could be analyzed. We found that participants had a low awareness of SIKK Magelang and were unfamiliar with the disaster information system. After the trial session, however, they had positive attitudes toward the information system and were willing to use it in the future, especially in the context of supporting their disaster-related tasks. Our findings indicate that SIKK Magelang has the potential to be more widely used by local risk managers and disaster volunteers. More effort should be put into promoting SIKK Magelang, such as producing a clear tutorial.

1. Introduction
To improve disaster risk management and coordination in local government, the global framework of disaster risk reduction, the Sendai Framework for Disaster Risk Reduction 2015-2030, encourages member states to develop, periodically update, and disseminate location-based disaster risk information, including risk maps, to decision-makers, the general public, and communities at risk of exposure to disasters [1]. Moreover, in terms of reaching the United Nations’ Sustainable Development Goals (SDGs), the availability of information on disaster-prone areas is essential and in high demand for handling rehabilitation, particularly of infrastructure, after disasters, and for emergency response. Advances in mobile technology and widespread access to the Internet have the
potential to make it easier to disseminate information about disasters. Recently, governments have begun adopting e-government technologies for disaster risk management. Therefore, a disaster information system accessible to the public, and all related stakeholders may be practicable.

Magelang Regency is an area with frequent volcanic activities located in Central Java province in Indonesia. It is located near the most active volcano in Indonesia, Mount Merapi. Besides volcanoes, landslides are the most hazardous natural phenomena in Magelang (BPBD of Magelang Regency, 2019). Accordingly, in 2017, BPBD of Magelang Regency, the regency’s local disaster management agency, developed a local disaster information system to support disaster management activities in Magelang, named SIKK Magelang.

SIKK Magelang was initially developed as an internal disaster database that helped emergency managers, especially those working in the field, report disasters immediately. However, seeing its potential to disseminate disaster information and risks, SIKK Magelang was recently made publicly accessible. The public can now access it via a desktop version (https://sikk.bpbdmagelang.id, previously http://sikk-bpdbmagelang.info/) or a mobile phone application (available since 2019). Besides records of disaster events, users will also have access to geographical information about disasters (e.g., hazards and evacuation maps).

However, despite its useful features, as with many e-government services in Indonesia, SIKK Magelang shows a low adoption rate, which is indicated by the low and stagnant usage statistics for the desktop version and the small number of downloads of the mobile application. Based on the records obtained from Google Web Analytics, from July 2018 to December 2019, the average number of users per month was 538, with 1,851 sessions. Usage statistics prior to conducting this study were even lower (247 users/month).

Information systems like SIKK Magelang are ineffective if they are not adopted at significant rates. The aim of this paper, therefore, is to explore the barriers that may be impeding the adoption of SIKK Magelang from the perspective of local risk managers and disaster volunteers.

The organization of this paper is as follows: in Section 2, we present our data collection methods, the types of data and materials used in the study, and a brief description of the data analysis; in Section 3, we discuss our findings; and in Section 4, we present our conclusions.

2. Research methodology and materials

2.1. Study context

This exploratory study is based on the technology acceptance model (TAM) from the information systems (IS) theory. Since this study concerns an application developed by a local government agency, studies on e-government adoption were also considered.

The TAM [2] has been widely used by scholars to explain users’ attitudes toward and acceptance of new technologies. The original information systems success model developed by Delone and McLean [3,4] proposed user satisfaction and individual impact, and their updated model refers to net benefits to understand technology adoption. The model evaluates information systems according to information quality, system quality, and service quality, and uses these variables to predict users’ intention to use and satisfaction.

In the context of e-government services, several factors have been used to explain adoption rates. One of these factors is awareness. Some scholars argue that awareness is essential for the adoption of a service [5–8]. When people are aware of the benefits of a service and its system credibility, they will eventually adopt it. Borrowing a notion from an e-commerce consumer adoption model, adoption of a new product starts with consumer awareness; consumers then form attitudes toward the product, which potentially lead to an intention to use it (on a trial basis) and results in full adoption and regular use with satisfaction [9]. Thus, stakeholders and the intended users of an e-government service first need to be aware of its features. Several studies have suggested that users’ awareness of an e-government service has a positive relationship with the adoption of the service [8,10,11]. Another factor that can influence the intention to use e-government services is satisfaction [8,12,13]. As people become more
Internet savvy and experience excellent electronic services from the private sector with high satisfaction levels, they begin to expect the same quality and satisfaction from government agencies [13].

To understand the low adoption rate of SIKK Magelang, we considered adoption to be a continuous process starting from awareness of the system. Moreover, since the adoption rate was low, we first provided the intended users with a trial session and focused on their future intention to use. Based on the trial, we explored attitudes toward the information system. Therefore, only a limited number of variables were assessed in this study, including awareness, intention to use, and attitudes.

Although a diverse set of users can use this information system, this study was primarily concerned with local risk managers – local government, subdistrict, and village officials – and disaster volunteers, since they constitute the government’s front line when dealing with disasters at the community level. These individuals make reports when disasters occur and need easy access to data for rapid decision making. They are also well-positioned to interact with the local population, especially regarding direct disseminating information about disasters. Thus, they can make use of spatial information on SIKK Magelang for risk communication purposes.

Participants were asked the following four questions regarding their awareness of SIKK Magelang:

- Do you know, or have you ever heard of SIKK Magelang?
- How did you learn about SIKK Magelang?
- With what kinds of SIKK Magelang platforms you are familiar? Android or desktop version?
- When was the first time you accessed SIKK Magelang?

Intention to use was measured according to participants’ willingness to use SIKK Magelang in the future for job-related purposes and as a source of disaster information. This factor also includes users’ willingness to recommend SIKK Magelang to others (e.g., family, friends, colleagues, community members). According to Shareef et al. [8], the success of online services provided by governments depends on a willingness to adopt these services and a lack of adoption will hamper the realization benefits [14].

Attitudes have long been shown to influence behavioral intentions. In this study, ‘attitude’ refers to a user’s evaluation of SIKK Magelang and their satisfaction. Attitudes toward SIKK Magelang comprise three dimensions:

1. Perceived information quality
   Survey items about information quality often pertain to accuracy, timeliness, completeness, relevance, understandability, conciseness, currency, usability, and consistency [3,4,8]. In this study, we were only concerned with whether the information was useful, understandable, interesting, reliable, complete, and up to date. SIKK Magelang has six main features: maps (hazards and risk maps), visualizations of disasters’ spatial distributions, visualizations of evacuation routes, assembly points, evacuation sites, and evacuation signage. Accordingly, perceived information quality was measured by pairing the six aspects of information quality and the six features on a 7-point Likert scale. Hence, there were 36 questions administered to the respondents.

2. Perceived system quality
   This variable was mainly measured by asking participants about SIKK Magelang’s ease of use and ease of learning [4]. There were 15 items measured with a 7-point Likert scale. Participants were asked, for example, whether they knew and understood the symbols used for visualizing different kinds of hazards or the colors used for different levels of risk. They were also asked whether they could locate evacuation routes, assembly points, and evacuation sites – whether they could recognize and locate areas at risk of flooding, flash flooding, extreme weather, earthquakes, droughts, forest and wildland fires, volcanic eruptions, and landslides when operating SIKK Magelang. The last two questions focused on whether participants were able to locate villages designated as Desa Tangguh Bencana (Resilient Villages) and the “Points of Interest” (POIs).

3. User satisfaction
   Four items measured users’ satisfaction with SIKK Magelang on a 7-point Likert scale: three items measured satisfaction with each feature, while one item measured overall satisfaction.
This study also includes a path analysis to understand the influence of attitudes on the intention to use. Awareness was excluded from the correlation analysis to avoid bias from the explanation sessions. Correlations between variables were developed from the existing literature [4,7,8], and the results are the following:

- **System quality → user satisfaction**
  Perceptions of system quality of a disaster information system were positively associated with user satisfaction. The strength of the relationship was moderate.

- **System quality → intention to use**
  Perceptions of system quality were positively or negatively associated with intention to use. The strength of the relationship was moderate.

- **Information quality → user satisfaction**
  Perceptions of the information quality of a disaster information system were positively associated with user satisfaction. The strength of the relationship was moderate.

- **Information quality → intention to use**
  Perceptions of information quality of a disaster information system were positively associated with intention to use. The strength of the relationship was moderate.

- **User satisfaction → intention to use**
  The satisfaction of a disaster information system was positively associated with intention to use. The strength of the relationship was moderate.

### 2.2. Data collection and analysis methods

A half-day workshop was conducted with some local risk managers and disaster volunteers at the meeting hall of BPBD Magelang Regency on 28 June 2019 with the help of some staff from the agency. A literature review and interviews were conducted before the workshop in May and June of 2019. The literature review focused on disaster management and the development of the SIKK Magelang system. Meanwhile, the interviews were conducted with BPBD Magelang officials and the system’s operators. Initially, we expected that around 150 people from various agencies, institutions, sub-districts (kecamatan), villages (desa), sub-villages (dusun), and disaster volunteer groups (relawan penanggulangan bencana) would come to the workshop. However, only 112 people were able to attend.

Participants were given pre- and post-workshop questionnaires. We described SIKK Magelang comprehensively to the participants in between questionnaires, anticipating participants who might be unfamiliar with it. Questions in the first phase were limited to participants’ awareness of SIKK Magelang. This first phase included gathering demographic data, such as age, gender, education level, work experience, and type of work (i.e., technical or administrative). During this phase, participants were also asked what online sources for disaster data and information they were likely to access by giving several options from local to national government online services. Participants could choose multiple sources. Afterward, a trial session was conducted in which participants were asked to access the web version and install and try the mobile version. Participants were arranged into ten groups, and two or three assistants from BPBD accompanied each group. The assistants helped them install and try SIKK Magelang. They also helped the participants providing an Internet connection by tethering their mobile phones to the participants’. Participants were also allowed to use their Internet connection if available. Finally, the post-workshop questionnaire prompted participants about their perceptions of and their intentions to use and recommend SIKK Magelang. Due to incomplete questionnaires, only 107 questionnaires for the first and 45 questionnaires for the second phase were valid for further analysis.

Data analyses in this study include descriptive analysis, factor analysis (exploratory factor analysis), and partial least squares (PLS) analysis. IBM SPSS 27 and Smart PLS version 3.3.2 [15] were utilized to analyze the data.
2.3. Materials
SIKK Magelang is a map-based disaster information system comprised of various disaster-related maps (risk, hazard, and capacity maps, as well as evacuation plan maps), non-spatial and spatial databases, and records of disaster occurrences in Magelang, including several graphics and photographs. It also allows specific users to upload reports about disaster occurrences from the field. The addition of new features recently has improved it.

(a). Displays of the desktop version of SIKK Magelang

(b). Interfaces of the mobile version of SIKK Magelang

Figure 1. Examples of interfaces of SIKK Magelang in both versions

Figure 1 shows the interfaces of both the desktop and mobile versions of SIKK Magelang. The left picture of Figure 1(a) displays the Sister Village menu, which visualizes an evacuation plan for Mount Merapi’s severe future eruptions. This plan includes visualization of evacuation routes, assembly points, evacuation sites, and evacuation signage that were developed after a program called Sister Village or paseduluran ndeso. This program matches 19 villages at high risks of volcanic eruptions with one or two safer villages (located out of the risky radius. The evacuation routes are drawn connecting these pairs of villages, started from the locations of assembly points or village offices or meeting halls, and ended at the evacuation sites’ location. Detailed information on the evacuation site, such as photographs, coordinates, and the sites’ capacity, will be shown through a pop-up window.

Meanwhile, on the right side is the interface of the Pantauan Bencana (disaster monitoring) menu. This menu provides users with various maps illustrating areas exposed to particular or multiple natural hazards. It also provides a geographical distribution and other detailed information on disasters in the last 30 days (previously, 90 days). Two additional features have recently been added: GeoServer
allows users to download disaster maps/layers and other attributes (mostly in .KML files); “Info Corona” shows the geographical distribution of suspected COVID-19 cases in Magelang Regency.

Figure 1(b) shows some interfaces from the mobile version of SIKK Magelang. The mobile version, currently only available on Android, has more than 1,000 downloads. It has a rating of 4.7/5, with positive reviews from its active users.

3. Results and discussion

3.1. Demographics

Respondents were mostly male (92.5%) and in the following age groups: 31–40 (33.6%) and 41–50 (36.4%) years old. More than two-thirds of the respondents only completed primary and high school (79.4%). Respondents who worked for the agencies were more likely to be university graduates or have a diploma. Most of the respondents who worked for local government agencies and as disaster volunteers had been working at their jobs for one to five years (45.5% and 40.5%, respectively). Those who worked as sub-district/village/sub-village officials had mostly worked at their jobs for six to ten years (45.8%). Respondents who worked for agencies and sub-districts/villages/sub-villages mostly stated that they had a mixed-type job, i.e., doing both administrative and fieldwork or technical tasks (72.7% and 47.5%, respectively). Meanwhile, disaster volunteers mostly worked in the field (67.6%).

Regarding online sources of data and information about disasters, we found that, in general, local risk managers and disaster volunteers in Magelang Regency preferred local government sources to national government services. More than half of the respondents (54 persons) preferred WhatsApp groups, such as volunteers’ or village officials’ WhatsApp groups, for getting information about disasters. The BPBD of Magelang Regency’s social media – including its Instagram page, Facebook page, and YouTube channel – were chosen by 41.1% of the respondents, making it the second most popular online source, followed by the agency’s official website (28.0%). Only one respondent chose DIBI (Data dan Informasi Bencana Indonesia (Indonesia Disaster Data and Information)). The official websites and social networking services (SNSs) of BMKG (Badan Meteorologi, Klimatologi, dan Geofisika) and BPPTKG (Badan Penyelidikan dan Pengembangan Teknologi Kebencanaan Geologi) were among the most popular non-local government sources for disaster data and information (22.4% and 24.3%, respectively). SIKK Magelang was only selected by 22 participants (20.6%).

3.2. Awareness

Our findings demonstrate that 72.9% of the respondents were aware of SIKK Magelang, while 27.1% were not aware of the information system’s presence prior to the meeting. Also, it is found that the desktop version of SIKK Magelang was the more common platform among the respondents (48.6%). Respondents who worked for local government agencies and disaster volunteers were more familiar with SIKK Magelang than those who worked for sub-districts/villages/sub-villages, which suggests that more effort must be put into promoting SIKK Magelang at the sub-district or village level to maximize its effectiveness.

Next, we found that the majority of respondents heard about SIKK Magelang from friends, family members, or colleagues (43.9%), followed by SNSs such as Facebook, WhatsApp, Instagram, Twitter, or YouTube (27.1%), the BPBD of Magelang Regency’s official website (7.5%), and other (14.0%). This finding is contrary to what BPBD of Magelang Regency claimed in the interview, namely, that the system had been promoted and disseminated, for example, during a meeting with the other members of the emergency response team and when visiting villages to conduct disaster drills. Additionally, BPBD of Magelang Regency mentioned that the URL and link to download the mobile version of SIKK Magelang was always included at the closure of any messages sent to its WhatsApp Group. However, the results indicate that word-of-mouth sharing performed better.

We compared the times at which respondents first heard about SIKK Magelang to the times at which they first used it (Table 1). Evidently, most respondents had first heard about and first accessed SIKK Magelang in the last month. This table also indicates that half of the respondents had not yet
accessed SIKK Magelang because they had not heard of it (29). The rest of the respondents said that they had never accessed it although they had been aware of SIKK Magelang. Participants who never accessed SIKK Magelang were predominantly those who had never heard of it and those who were although aware of the presence of the system but did not know yet how to access it. Our first attempt to explain this situation is that there has been a lack of comprehensive explanations on how to use SIKK Magelang. The second explanation will be on the unfamiliarity of the respondents with an online map-based information system. Further studies are needed to identify why respondents refused to use the information system despite being aware of its existence.

The findings of this study indicate that SIKK Magelang has been insufficiently promoted. More importantly, its developers must anticipate users who may be entirely new to the platform to more easily learn to use it by, for example, providing the intended users with a clear tutorial. In addition to regular publications of SIKK Magelang as a part of broadcasted messages on BPBD of Magelang Regency’s WhatsApp group, endorsements in brochures, posts and feeds on social media, brief workshops and training, and tutorial videos on YouTube are some alternative ways to resolve these issues.

Table 1. Numbers of respondents who had heard of and accessed SIKK Magelang by periods

| First time accessing SIKK Magelang | I have never accessed/used it | In the last month | In the last 3 months | In the last 6 months | In the last 12 months | > 12 months | Total |
|----------------------------------|-----------------------------|------------------|---------------------|---------------------|----------------------|------------|-------|
| First time hearing about SIKK Magelang | I have never heard of/do not know it | 29 | 0 | 0 | 0 | 0 | 0 | 29 |
| In the last month | 18 | 33 | 0 | 0 | 0 | 0 | 51 |
| In the last 3 months | 3 | 6 | 1 | 0 | 0 | 0 | 13 |
| In the last 6 months | 1 | 1 | 0 | 0 | 0 | 0 | 2 |
| In the last 12 months | 2 | 4 | 1 | 1 | 2 | 0 | 10 |
| > 12 months | 1 | 0 | 0 | 0 | 4 | 0 | 1 |
| Total | 54 | 44 | 2 | 1 | 6 | 0 | 107 |

3.3. Attitudes

For assessing awareness, 107 questionnaires were valid; however, for attitudes and intention to use, only 45 post-workshop questionnaires were valid. Most of the second phase respondents were volunteers (24 people or 64.9%); the rest were agency officials (5 people) and subdistrict/village/sub-village officials (16 respondents).

Perceived information quality was the first attitude toward SIKK Magelang that we measured. After performing an exploratory factor analysis, 36 sub-items were reduced to 6 items detailing perceived information quality for each SIKK Magelang feature. The Cronbach’s alpha values for all items were above 0.80, showing an acceptable internal consistency since they passed the 0.70 thresholds [16]. Among the six items, the mean of perceived information quality of the visualization of evacuation routes (IQER) marked as the highest mean with 6.43, whereas the lowest was the mean of the perceptions of the visualization of the evacuation signage (IQSEG) (6.36). The mean of perceived information quality of maps showing areas prone to disasters (IQM) and visualizations of the geographical distribution of disaster occurrences (IQDO) was similar 6.42. Last, the mean of evacuation sites (IQES) was 6.40, while the mean of assembly point visualizations (IQAP) was 6.37. The means of all items were above 6.00 with a standard deviation of less than 0.75 ranged from 0.57 to 0.73, suggesting that the data were well distributed. These findings indicate a generally positive attitude among participants toward the information quality of SIKK Magelang.
Regarding perceived system quality, most respondents (more than 50%) had a positive attitude (somewhat agree (5) to strongly agree (7)) toward SIKK Magelang. Most of the participants agreed and strongly agreed that, during their SIKK Magelang trial, they recognized and understood the symbols used for visualizing different kinds of hazards and the different colors used for different levels of risk. However, it should be noted that this result may be biased since there was an explanation session that feeds participants brief explanations of the symbols or colors on SIKK Magelang before the trial. In real practice, users might face difficulties understanding the symbols and colors due to the lack of explanations. Although SIKK Magelang employs an ordinary traffic light coloring for its hazard and risk maps, red represents the highest risk and dark green as the least dangerous, those who are not familiar with hazard maps or risk maps might find it difficult to read the maps on this information system.

They also understood the evacuation routes and the locations of the assembly points and evacuation sites for future eruption emergency from SIKK Magelang. Since the visualization of evacuation plans is still limited for the case of Merapi Volcano, the evacuation plans for other natural hazards may be taken into considerations for the future improvement of SIKK Magelang.

More than 80% of the participants agreed and strongly agreed that they could distinguish and locate areas at risk of flooding, flash flooding, extreme weather, earthquakes, droughts, forest and wildland fires, volcanic eruptions, and landslides. Around the same proportion of participants also agreed and strongly agreed that they could locate villages designated as Desa Tangguh Bencana with the information system. Only 73.3% of participants agreed and strongly agreed that they could locate the POIs (Points of Interest).

Regarding satisfaction, findings also show a positive response. For all satisfaction items, more than 95% of the participants agreed and strongly agreed that SIKK Magelang is satisfying. 97.8% of the respondents agreed and strongly agreed that they were satisfied with various information displayed by SIKK Magelang and the maps visualizing distributions of disasters on the Pantauan Bencana menu. Furthermore, 95.6% of the respondents agreed and strongly agreed that they were satisfied with the interactive maps displaying evacuation routes, assembly points, final evacuation sites, and signage for evacuation on the Sister Villages menu.

### 3.4. Intention to use

More than 50% of respondents strongly agreed that they would use SIKK Magelang for disaster management-related tasks and for finding geographical information about disasters. The vast majority of the participants also strongly agreed that they would recommend SIKK Magelang to others seeking geographical information about disasters (92.0%) or undertaking disaster management-related tasks (91.1%).

### 3.5. Relationship between attitudes toward SIKK Magelang and intention to use

This subsection explains whether perceived system quality, information quality, and satisfaction were likely to correlate to participants’ intention to use. Table 2 summarizes the convergent validity and internal consistency reliability of the indicators used in developing the model to explain the correlations. Convergent validity values, represented by the average variance extracted (AVE), were well above the required minimum of 0.50 and loadings were all above 0.70 [17]. Composite reliability values for each variable exceeded the threshold (i.e., 0.80) [18], which means that all four reflective constructs had high internal consistency reliability levels. The Cronbach’s alpha values for all constructs were also above the 0.70 threshold, which shows that the model had a high level of reliability. The model also had a high discriminant validity level since, for all variables, the hetero trait – mono trait ratio (HTMT) confidence interval did not include 1.

A bootstrap methodology was used with 500 sub-samples to generate t-statistics. Figure 2 illustrates the final path analysis model for the intention to use SIKK Magelang. At a 5% significance level, this study found that all path model relationships are significant, except for the correlation SYQ → SAT (p = 0.67). This study significantly demonstrated a moderate positive relationship between
satisfaction and intention to use, between system quality and information quality, and between information quality and satisfaction. Initially, we predicted that there would also be a moderate positive correlation between information quality and intention to use and between system quality and intention to use; however, the correlation was positive but weak. Information quality was significantly positively correlated with user satisfaction and influenced the intention to use it. These results suggest that to encourage local risk managers and disaster volunteers to use SIKK Magelang, BPBD of Magelang Regency must improve its system quality. For example, the system could be simplified so that intended users might find it easier to use, which would increase perceived system quality.

**Table 2. Factors constructing the structural model (n=45)**

| Latent Variable                  | Indicators                                                                 | Convergent Reliability | Internal Consistency |
|---------------------------------|----------------------------------------------------------------------------|-------------------------|----------------------|
| Perceived Information Quality (IQ) | IQAP - Visualization of the assembly points                                | 0.94                    | 0.82                 | Composite Reliability: 0.93  |
|                                  | IQER - Visualization of the evacuation routes                             | 0.89                    |                      | Cronbach’s Alpha: 0.89       |
|                                  | IQM – Maps showing areas prone to disasters                               | 0.89                    |                      |                                |
| Perceived System Quality (SYQ)   | SQ12 - When using SIKK Magelang, I can recognize and point to areas at risk of volcanic eruptions | 0.82                    | 0.75                 | Composite Reliability: 0.95  |
|                                  | SQ13 - When using SIKK Magelang, I can recognize and point to areas at risk of landslides | 0.90                    |                      | Cronbach’s Alpha: 0.93       |
|                                  | SQ15 - When accessing SIKK Magelang, I am able to locate the POIs (Points of Interests) | 0.86                    |                      |                                |
|                                  | SQ2 - When accessing SIKK Magelang, I understand how the different colors are used for different levels of risk | 0.83                    |                      |                                |
|                                  | SQ5 - When using SIKK Magelang, I am able to locate the evacuation sites that I should go to when disasters happen | 0.91                    |                      |                                |
|                                  | SQ1 - When accessing SIKK Magelang, I understand how the different symbols are used for different kinds of hazards | 0.87                    |                      |                                |
| User Satisfaction (US)           | US1 - I am satisfied with the various information displayed on SIKK Magelang | 0.93                    | 0.82                 | Composite Reliability: 0.93  |
|                                  | US2 - I am satisfied with the maps visualizing distributions of disaster occurrences on the Pantauan Bencana menu | 0.89                    |                      | Cronbach’s Alpha: 0.89       |
|                                  | US3 - I am satisfied with the interactive maps displaying evacuation routes, assembly points, final evacuation sites, and signage for evacuation on the Sister Villages menu | 0.89                    |                      |                                |
| Intention to Use (ITU)           | ITU1 - I will use SIKK Magelang when doing disaster management-related tasks | 0.82                    | 0.70                 | Composite Reliability: 0.90  |
|                                  | ITU2 - I will use SIKK Magelang when I need geographical information about disasters | 0.85                    |                      | Cronbach’s Alpha: 0.85       |
|                                  | ITU3 - I will recommend SIKK Magelang to others when they require of geographical information about disasters | 0.79                    |                      |                                |
|                                  | ITU4 - I will recommend SIKK Magelang to others when they are undertaking disaster management-related tasks | 0.85                    |                      |                                |
Figure 2. Path analysis model explaining the correlations of attitudes (perceived information quality, perceived system quality, and satisfaction) and intention to use SIKK Magelang
(ns: not significant, ***Significant at p< 0.01 , **Significant at p< 0.05)

If SIKK Magelang is to support local risk managers in their disaster management-related tasks, they must first attain a deep understanding of its functions. The following points are critical to this end:

- Familiarity with resources used to access SIKK Magelang, such as computers, smartphones, and the Internet;
- Development of the skills required to use SIKK Magelang (e.g., online map reading);
- Understanding and full awareness of how and when to use SIKK Magelang for undertaking tasks related to disaster management;
- Understanding the SIKK Magelang operator’s manual provided by BPBD of Magelang Regency.

4. Conclusion
The intended users are the most critical factor in the success of information systems and technologies; this also applies to disaster management. The notion of a disaster information system should primarily focus on how it is useful as a decision-making support tool and should not only focus on generating vast amounts of data or tools that are never used [19]. Moreover, as users’ interactions with an information system play a significant role in determining whether or not it is useful, this suggests that understanding users’ attitudes toward information systems is critical to their development. Many studies have shown that awareness is a precursor to the use of any e-government or information system service, including disaster information systems. Our study confirmed this, as we found that local risk managers and disaster volunteers had low awareness of the availability of SIKK Magelang, which may be one of many reasons for its low usage statistics. This study found that although many of the respondents were already aware of SIKK Magelang, some were reluctant to use it. This situation may have been due to the absence of a clear explanation of operating the information system. When considering participants’ demographics, especially the education levels of local risk managers and disaster volunteers in Magelang, low literacy may have led to unfamiliarity with the system.

Regarding attitudes toward and intention to use SIKK Magelang, we found that, after the trial session with a comprehensive explanation of how to use the system’s features, the local risk managers and disaster volunteers who completed the post-workshop questionnaire, in general, showed a positive attitude toward it. They agreed and strongly agreed that SIKK Magelang has good information and system quality, which also shows their satisfaction with and willingness to use it. These findings indicate that SIKK Magelang has the potential to be used by local risk managers and volunteers more extensively.

Overall, this study suggests that, first, more effort must be put into making intended users more aware of SIKK Magelang. In addition to regular publications of SIKK Magelang as a part of
broadcasted messages on BPBD of Magelang Regency’s WhatsApp group, endorsements in brochures, posts and feeds on social media may be some alternative ways to resolve these issues. These efforts include the dissemination of a clear tutorial so that users can understand how to use it.

Moreover, to increase the intention to use, using SIKK Magelang should be made more comfortable and convenient. Improvement of the system is one way since it was found that system quality is correlated directly to intention to use and indirectly through information quality and user satisfaction.

Internet access should not constitute a barrier to the use of SIKK Magelang since the number of Internet users in Indonesia has been growing significantly over the last decade, and Internet connection speeds are continually improving. The greatest challenge will be promoting the information system so that optimal usage and benefits can be achieved.

This paper reports only part of the analysis. Some issues we left out include facilitating conditions and participants’ self-efficacy and map literacy. Future studies could consider other factors, such as perceived mobility and locational accuracy since the accuracy of these variables significantly influenced user acceptance and intention to use the mobile map service [20]. Future studies could also adapt the usability metrics – user satisfaction, effectiveness (accuracy), and efficiency (completion time) [21] – from the cartographic literature to measure this map-based disaster information system’s usability.

References

[1] UNISDR 2015 The Sendai framework for disaster risk reduction 2015-2030
[2] Davis F D, Bagozzi R P and Warshaw P R 1989 User acceptance of computer technology: A comparison of two theoretical models Manage. Sci. 35 982–1003
[3] DeLone W H and McLean E R 2003 The DeLone and McLean model of information systems success: A ten-year update J. Manag. Inf. Syst. 19 9–30
[4] Petter S, DeLone W and McLean E 2008 Measuring information systems success: Models, dimensions, measures, and interrelationships Eur. J. Inf. Syst. 17 236–63
[5] Al-hashmi A and Suresha S 2013 Evaluating the awareness of e-government in the Republic of Yemen Int. J. Comput. Appl. 67 41–5
[6] Sipior J C, Ward B T and Connolly R 2013 E-government awareness and visitation among the digitally disadvantaged J. Internet Commer. 12 26–47
[7] Rehman M, Kamal M M and Esichaikul V 2016 Adoption of e-government services in Pakistan: A comparative study between online and offline users Inf. Syst. Manag. 33 248–67
[8] Shareef M A, Kumar V, Kumar U and Dwivedi Y K 2011 E-government adoption model (GAM): Differing service maturity levels Gov. Inf. Q. 28 17–35
[9] Pavlou P A and Fygenson M 2006 Understanding and predicting electronic commerce adoption: An extension of the theory of planned behavior MIS Q. 30 115–43
[10] Sigwejo A and Pather S 2016 A citizen-centric framework for assessing e-government effectiveness Electron. J. Inf. Syst. Dev. Ctries. 74 1–27
[11] Verdegem P and Verleye G 2009 User-centered e-Government in practice: A comprehensive model for measuring user satisfaction Gov. Inf. Q. 26 487–97
[12] Alawneh A, Al-Refaei H and Batika K 2013 Measuring user satisfaction from e-government services: Lessons from Jordan Gov. Inf. Q. 30 277–88
[13] Irani Z, Weerakkody V, Kamal M, Hindi N M, Osman I H, Anouze A L, El-Haddad H, Lee H, Osmani M and Al-Ayyoubi B 2012 An analysis of methodologies utilised in e-government research: A user satisfaction perspective J. Enterp. Inf. Manag. 25 298–313
[14] Huang Z and Benyousef M 2014 Usability and credibility of e-government websites Gov. Inf. Q. 31 584–95
[15] Ringle C M, Wende S and Becker J-M 2015 "SmartPLS 3." Boenningstedt: SmartPLS GmbH
[16] Hair Jr. J F, Hult G T M, Ringle C M and Sarstedt M 2016 A primer on Partial Least Squares Structural Equation Modeling (PLS-SEM) (Los Angeles: SAGE Publications)
[17] Fornell C and Larcker D F 1981 Evaluating structural equation models with unobservable Variables and Measurement Error J. Mark. Res. 18 39

[18] Nunnally J C and Bernstein I H 1994 Psychometric Theory (New York: McGraw-Hil)

[19] Thomas D S K 2018 The role of geographic information science & technology in disaster management Handbook of Disaster Research, Handbook of Sociology and Social Research ed H Rodríguez et al (Cham: Springer International Publishing) pp 311–330

[20] Park E, Kim K J, Jin D and del Pobil A P 2012 Towards a successful mobile map service: An empirical examination of technology acceptance model Commun. Comput. Inf. Sci. 293 Part 1 420–8

[21] Çöltekın A, Heil B, Garlandini S and Fabrikant S I 2009 Evaluating the effectiveness of interactive map interface designs: A case study integrating usability metrics with eye-movement analysis Cartogr. Geogr. Inf. Sci. 36 5–17

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