Measurement analysis of the level of household preparedness for facing landslide in Bogor regency

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Abstract. There are so many areas in Indonesia that are prone to landslides. Bogor is the regency with the most frequent landslides. Therefore, high community preparedness is needed to deal with the landslide, especially at the household level because it is the spearhead of preparedness and influence disaster risk. The objective of this research is to measure and analyze the level of household preparedness for facing landslide. The location of this research is in Cibadak Village, Bogor regency where a landslide disaster had happened. This is a quantitative research. The number of the samples were 100 household. Data collection was done by surveying samples and distributing questionnaires. The data would be analyzed with descriptive analysis, and the results of level of household preparedness would be categorized to five levels which were very prepared (80-100), prepared (65-79), almost prepared (55-64), less prepared (40-54), and not prepared (0-39). The results of the research are the average index value of Knowledge and Attitude (KA) parameter is 66.77, Emergency Planning (EP) parameter is 52.24, Warning System (WS) parameter is 64.80, Resources Mobilization Capacity (RMC) parameter is 51.25 and the level of household preparedness for facing landslide is 59.26 or and it is significant at the almost prepared level.

1. Introduction

Bogor is the one of regency with the most frequent landslides. Landslide is one of the disaster event cause of the soil movement and high frequent rainfall. According to the Indonesia National Disaster Management Agency (BNPB), Landslide disaster risk in Bogor is high with a score of 15.9 [1]. In 2017, BNPB recorded there were 39 landslide disaster events. Total loss cause of landslide in Bogor from 2002 – 2013 was IDR24,716,400,000,-, with high-level category [2]. In 2014, one of the biggest landslide disasters was happened in Cibadak Village and cause 593 peoples evacuated to public facility and other family houses, 55 houses were heavily damaged, 41 houses were lightly damaged and 43 houses were threatened [3]. The matrix level of disaster threats in Figure 1. shows the
correlation between threat index of disaster in Bogor regency and population exposed index. The threat index of landslide disaster in Bogor regency is high level and give high level of impact to population exposed index [2]. The matrix level of disaster loss in Figure 2, shows the correlation between threat index of disaster in Bogor regency and loss index. The threat index of landslide disaster in Bogor Regency is high level and cause high level of loss index [2]. We can say that the threats (see Figure 1), risks, and large impacts (see Figure 2) cause the landslide is becoming a priority disaster to be managed by the Bogor government [2].

The landslide event is not the main problem. Landslide is a normal phenomenon if there are no residents exposed, but if it is disrupting the function of the community, it will be a disaster. The impact of landslides is so large which can cause fatalities, injuries, displacement, loss of property, loss of housing, and damage to infrastructure. Those are consequences that must be accepted by the community and ultimately can reduce the level of community welfare itself. The size of the impact depends on the level of threat (Hazard), vulnerability, and capacity in dealing with disasters. Thus, in situations where there is a landslide potential hazard should implement certain activities such as preparedness, early warning, and disaster mitigation.

Preparedness is an important component to reduce disaster risk [4]. Three stakeholders have a very important role in community preparedness i.e. individuals and households, government and school community [5]. In this case, households are spreadsheet, subject, and object of preparedness, because they can influence directly to disaster risk reduction [5]. Household preparedness is the first step in community defense effort to disaster threats so that it will create a community resilience that leads to national security. Household preparedness consists of food and water preparation [4,6], mitigation action [4], emergency planning [4,6], increasing skills [4], accessing to family or friends [4], etc.

There are some components to measure household preparedness. In previous research show that the component of preparedness are knowledge, education and training, emergency plan, warning system, response mechanism, and resources availability [7]. Knowledge, disaster emergency plan, information, and communication are also proposed as key performance indicators to measure the household level [8]. Some similar components are also used in the measurement of preparedness in Indonesia, such as knowledge and attitude, emergency plans, warning systems, and resource mobilization capacity [5]. But the most important thing is to measure the level of household preparedness to be immediately evaluated the result.

In disaster risk reduction, early preparedness measurements are needed [9]. By knowing preparedness early, we can prepare better with increasing the capacity for facing future disaster events [10]. And we can also overcome disaster immediately so that they can recover to their original normal condition [10].

It is urgent to research measuring the level of household preparedness for facing landslide in prone areas like Bogor regency. The objective of this research is to measure and analyze the level of...
household preparedness for facing landslide in Bogor regency. This research expects to be able to provide a picture and information to the government and disaster activists to take strategic steps in efforts to reduce disaster risk and increase the level of household preparedness for facing landslide.

2. Methodology

This is a quantitative research. The level of household preparedness (HP) is a variable which will be studied in this research. Incidental sampling is used in this research to select the samples [11]. The number of samples were 100 households in Cibadak village, Sukamakmur District, Bogor. Data collection was carried out by the survey technique, which was distributing modified questionnaires. Before the survey was started, validity and reliability test were conducted by distributing the questionnaire to 30 respondents. The value of product moment correlation and cronbach’s alpha showed that the instrument was valid and reliable then the survey was conducted. After getting the data, descriptive analysis was used to measure and describe the level of household preparedness by making cross tables, bar charts, and index analysis [5].

The index value in this research includes index per parameter. There were 4 parameters in this study which consist of Knowledge and Attitude (KA), Emergency Planning (EP), Warning System (WS), and Resource Mobilization Capacity (RMC) [5]. The level of household preparedness in this research was categorized into 5, as follows:

| No | Index Value | Category          |
|----|-------------|-------------------|
| 1  | 80 - 100    | Very Prepared     |
| 2  | 65 - 79     | Prepared          |
| 3  | 55 - 64     | Almost Prepared   |
| 4  | 40 - 54     | Less Prepared     |
| 5  | < 40 (0 - 39) | Not Prepared     |

Index per parameter in household individuals was using unbalance index numbers, which means that all questions in these parameters have the same weight [5]. Determination of the index value for each parameter was calculated based on the formula as follows:

\[
\text{Index} = \left( \frac{\text{Total Real Score Parameter}}{\text{Maximum Score Parameter}} \right) \times 100
\]

Household preparedness (HP) combined index of several parameters was calculated using a weighted composite index, meaning that each parameter has a different weight, with the following formula:

\[
\text{HP Index} = 0.45 \times \text{KA Index} + 0.35 \times \text{EP Index} + \text{RMC Index} + 0.05 \times \text{WS Index}
\]

3. Results and discussions

3.1. Knowledge and attitude parameters toward disaster risk

The measurement analysis of the Knowledge and Attitude parameter index shows that 17% not prepared, 9% less prepared, 5% almost prepared, 30% prepared and 39% very prepared. Most respondents have a fairly high index of knowledge and attitudes because more than half of the respondents are at the prepared and very prepared level. The average index value is 66.77 or at the preparation level. The results of these measurements are tabulated in Table 2.
Key role in disaster preparedness are knowledge and attitude [12]. Knowledge and attitude are significant predictors of the well preparedness [13] and sustained preparedness [14]. Households are required to have a high level of hazard knowledge because 80% of people live in prone areas. Knowledge and attitude parameters have a great weight in determining household preparedness, which is equal to 45%. Thus, by having a high level of knowledge and attitudes about disaster risk, it is expected that they can take action to prepare when a landslide occurs [15]. Training can improve knowledge [13]. Educating people by giving information is also one best way to achieve the preparedness goals [16]. Besides that, preparing supplies for disasters [4,6], developing family emergency plans [4,6,17,18], specific protection measures [4,18], measures to protect valuables [4,6,18], and relationships in the community [4,19] are also part of knowledge and attitude parameter.

### Table 2. Knowledge and Attitude (KA) parameters index.

| No | Parameter                        | Total Samples | Percentage (%) | Average |
|----|----------------------------------|---------------|----------------|---------|
| 1  | Knowledge and Attitude Index     |               |                |         |
| a  | Not Prepared (<40)              | 17            | 17             |         |
| b  | Less Prepared (40-54)           | 9             | 9              |         |
| c  | Almost Prepared (55-64)         | 5             | 5              | 66.77   |
| d  | Prepared (65-79)                | 30            | 30             |         |
| e  | Very Prepared (80-100)          | 39            | 39             |         |

#### 3.2. Emergency planning

The measurement analysis of the Emergency Planning parameter index shows that 32% not prepared, 23% less prepared, 11% almost prepared, 16% prepared, and 18% very prepared. The average index value is 52.24 or at the less prepared level. The results of these measurements are tabulated in the following table:

### Table 3. Emergency Planning (EP) parameter index.

| No | Parameter                | Total Samples | Percentage (%) | Average |
|----|--------------------------|---------------|----------------|---------|
| 2  | Emergency Planning Index |               |                |         |
| a  | Not Prepared (<40)      | 32            | 32             |         |
| b  | Less Prepared (40-54)   | 23            | 23             |         |
| c  | Almost Prepared (55-64) | 11            | 11             | 52.24   |
| d  | Prepared (65-79)        | 16            | 16             |         |
| e  | Very Prepared (80-100)  | 18            | 18             |         |

Emergency planning is very important [4,6,17,18]. Emergency planning should be supported by one of the household preparedness components, it is knowledge to quick response. One of the purposes preparedness is to reduce the suffering caused by a threat, the community needs to have preparation so that they can act quickly in the event of a disaster. The purposes of emergency planning are also protecting the vulnerable community like children and the elderly. Nevertheless, protecting safety and healthy the family member is the main priority along with disaster emergency.

#### 3.3. Warning system

The measurement analysis of the Warning System parameter index shows that 18% not prepared, 7% less prepared, 12% almost prepared, 35% prepared, and 28% very prepared. Most respondents have a fairly high index of warning system because more than half of the respondents are at the prepared and
very prepared level. The average index value is 64.80 or at the ready level. The results of these measurements are tabulated in Table 4.

**Table 4. Warning System (WS) parameter index.**

| No | Parameter                    | Total Samples | Percentage (%) | Average |
|----|------------------------------|---------------|----------------|---------|
| 3  | Disaster Warning System Index |               |                |         |
| a  | Not Prepared (<40)          | 18            | 18             |         |
| b  | Less Prepared (40-54)        | 7             | 7              |         |
| c  | Almost Prepared (55-64)      | 12            | 12             | 64.80   |
| d  | Prepared (65-79)             | 35            | 35             |         |
| e  | Very Prepared (80-100)       | 28            | 28             |         |

The warning system is a preparedness component [7] and a key performance indicator of preparedness [8]. Even though the Warning System parameter index is ready level, landslide warning systems should be built with good infrastructure and technology to improve individual and household preparedness. Because, by accessing to early warning can help individuals prepare and respond quickly [20].

**3.4. Resources mobilization capacity**

The measurement analysis of the Resources Mobilization Capacity parameter index shows that 46% not prepared, 4% less prepared, 4% almost prepared, 26% prepared, and 20% very prepared. The average index value is 51.25 or at the less prepared level. The results of these measurements are tabulated in the following table:

**Table 5. Resources Mobilization Capacity (RMC) parameter index.**

| No | Parameter                   | Total Samples | Percentage (%) | Average |
|----|------------------------------|---------------|----------------|---------|
| 4  | Resource Mobilization Capacity Index |               |                |         |
| A  | Not Prepared (<40)          | 46            | 46             |         |
| B  | Less Prepared (40-54)        | 4             | 4              |         |
| C  | Almost Prepared (55-64)      | 4             | 4              | 51.25   |
| D  | Prepared (65-79)             | 26            | 26             |         |
| E  | Very Prepared (80-100)       | 20            | 20             |         |

Base on the results of the analysis, the Resources Mobilization Capacity parameter index is still not fulfilling the expectation. While the Resources Mobilization Capacity parameter has a considerable weight in determining household preparedness, which is 15%. Developing and increasing skills is important [4] to get ready taking action to protect safety and property [15]. Also, the support of relatives or friends who help also greatly increases assistance for resource mobilization [4][19][21].

**3.5. The level of household preparedness for facing landslide**

The measurement analysis of the level of household preparedness for facing landslide index shows that 20% not prepared, 9% less prepared, 22% almost prepared, 32% prepared, and 17% very prepared. Almost half of the respondents are at the prepared and very prepared level or 49%. The average index value is 59.26 or at the almost prepared level. The results of these measurements are
tabulated in Table 6. According to the disaster experts and government validation, they agree that the level of household preparedness is almost prepared level.

Households are the level of society who are directly affected by the disaster. So that the level of household preparedness should be high or minimum prepared level, considering that it is a landslide-prone area. The low level of household preparedness for facing landslides will increase the risk of landslides and cause harm to households if the landslide happened at any time. For this reason, the role and commitment of the local government is very important to increase preparedness, reduce risks and increase resilience, by providing education to the community [7,16], providing training and skills [4] [7,13], installing an early warning system, evacuation routes, etc.

Table 6. The level of household preparedness for facing landslide index.

| No | Household Preparedness Category Index | Total Samples | Percentage (%) | Average |
|----|--------------------------------------|---------------|----------------|---------|
| 5  | Household Preparedness Index          |               |                |         |
| a  | Not Prepared (<40)                    | 20            | 20             |         |
| b  | Less Prepared (40-54)                  | 9             | 9              |         |
| c  | Almost Prepared (55-64)                | 22            | 22             | 59.26   |
| d  | Prepared (65-79)                       | 32            | 32             |         |
| e  | Very Prepared (80-100)                 | 17            | 17             |         |

![Figure 3. The level of household preparedness index diagram](image)

4. Conclusion
Base on the results of data analysis we can conclude the research as follows:
- The average index value of Knowledge and Attitude (KA) parameter is 66.77 or at the preparation level.
- The average index value of the Emergency Planning (EP) parameter is 52.24 or at the less prepared level.
- The average index value of the Warning System (WS) parameter is 64.80 or at the ready level.
- The average index value of the Resources Mobilization Capacity (RMC) parameter is 51.25 or at the less prepared level.
- The level of household preparedness for facing landslide is 59.26 or and it is significant at the almost prepared level.
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