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Evaluating Conceptual Framework for Landslides Natural Disaster Management using Feature Analysis

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Abstract. Landslides is the top rank disaster in the number of incidents in Batu City. Currently, the handling of landslides in Batu City still lack preparation in preparedness phase. In preparedness phase, as an early step before a landslide take place, need a systematic disaster management. The disaster management refers to the use of a framework as a guideline to understand disasters that will occur. Batu City have developed a framework as a guideline for landslide management, but the quality and maturity are questionable. Therefore, this study proposes an evaluation of conceptual framework for landslides natural disaster management. The specific objective is to know the quality of proposed framework, find the weakness and strength. Evaluation is held by using featured based analysis which using seven criteria i.e. background, goal, model, content, legitimation, implementation and contribution. The result shows that the framework is feasible to use as a guideline to manage the landslide management in preparedness phase in Batu City.

1 Introduction

Landslides is a type of disaster that occurs due to the movement of material forming a slope [1]. In majority, landslides occur in areas that have a geographical location of mountain and hills. The example is in Batu City, East Java Province, which was ranked in the first position for landslides [2]. In 2018, the big three of disasters in Batu City are landslides with 27 incidents, storm with 25 incidents and fire with 14 incidents. The disasters resulted 6 deaths, 3 people injured, and 19 people we displaced. Building damage due to the disaster included 6 lightly damage housing units, 13 moderately damaged housing units, 12 heavily damaged housing units, 38 units damaged infrastructure, and 20 productive economic units. From the 3 sub districts in Batu City i.e. Batu, Bumiaji and Junrejo, Batu had the most incidents with 64 incidents, while Bumiaji 32 incidents and Junrejo 15 incidents [2].

The handling of landslides in Batu City, which covered by Badan Penanggulangan Bencana Daerah (BPBD) [2], focused on all disaster phases i.e. preparedness, response, recovery, and mitigation. In preparedness phase, as a preparation for early understanding and guideline to manage the landslides have not beet maximize. Measures for handling landslides require disaster management to improve management assistance, protect life, safety and property of the population [3]. Disaster management was developed to provide speed and accuracy of handling, suitability of disaster-related information delivery, supporting efficient decision making and disaster management actions [3]. The concept of disaster management refers to the use of framework that defines a policy and guidelines on how to take action before disaster occurs, prevents and respond to disaster [4]. As a guideline,

framework give the way to manage landslide in preparedness phase in every sub district.

Several previous studies that proposed a framework for disaster management in various cases and objectives, have been widely discussed. As research conducted by Nazir et al. in 2006 [5], which proposed the development of a conceptual framework for earthquake disaster management systems using geographic information systems (GIS) in Quetta city, Pakistan, to minimize the effects of earthquakes. Patel et al. in 2008 [6], discussed the framework used to facilitate general practice to assess influenza pandemic planning in five countries i.e. Australia, United Kingdom, United States, New Zealand, and Canada. Kim et al. in 2018 [7], discussed the framework for assessing the resilience of disaster debris management systems. Fan and Mostafavi in 2018 [8], discussed the framework system of system for disaster management systems and the process for analyzing, designing and operating the systems that are heterogeneous, interconnected and distributed. As well as Mohd et al. in 2018 [9], which discusses the framework for distributing humanitarian aid for the management of natural disasters in Malaysia.

All the previous study in developing framework for disaster management have the weakness in evaluation before the framework implemented. The evaluation is used to know the quality of the framework, find the weakness and the strength. This study aims to evaluate a conceptual framework for landslides natural disaster in BPBD Batu City. The evaluation method is using feature analysis comparison which developed by [10], [11], [12], [13] and [14]. The framework consists of guidance, priorities, and principles to manage landslide in preparedness phase. In what follows, we first review the existing research for evaluating conceptual framework for natural disaster management leading to the development of the framework. We then present the research methodology followed by a comprehensive analysis of data collected leading to the evaluation of the framework. Finally, we present a discussion of the research finding and their implications.

2 Study Area

The area of this study is in Badan Penanggulangan Bencana Daerah (BPBD) Batu City. BPBD cover disaster cases in 24 villages in three sub-districts of Batu City i.e. Batu, Bumiaji and Junrejo. BPBD divided the handling disasters case in Batu City into three division i.e. mitigation and preparedness, emergency and logistic, rehabilitation and reconstruction [2]. Mitigation and preparedness division is focused on preparation before and after disasters, while emergency and logistic focused on first response during disasters. The third division, rehabilitation and reconstruction are deal with building back the effected environment physically and mentally. In preparedness phase, BPBD lack of a document as a guideline to manage natural disaster, especially landslides.

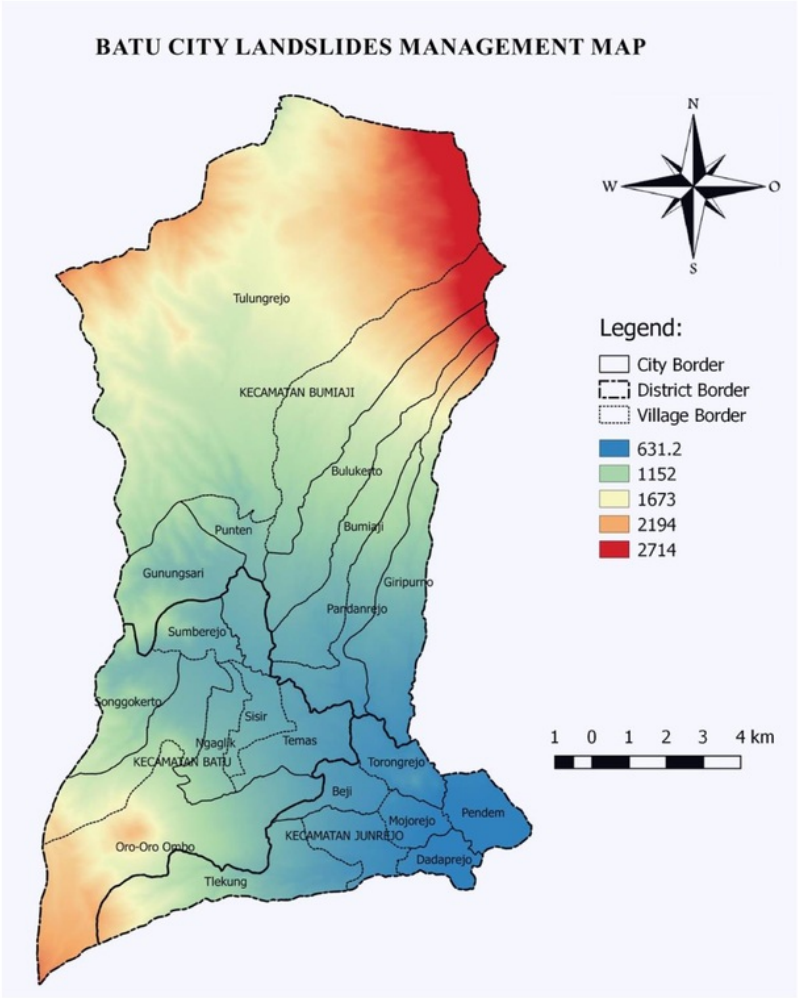

Fig. 1. Batu City administration and landslides management map

3 Conceptual Framework

Conceptual framework is one of effective tools to guide organization to solve the complex problem by defining the concept relevant to the topic of interest [10]. Conceptual framework also helps to identify indicators for the concepts and aid derivation of theories [10]. The conceptual framework for landslide natural disaster management consist of principle guidance and priorities to manage landslides in preparedness phase. The framework is crucial, considering the Batu City is one the cities in Indonesia with mostly landslides case found every year. The framework will help the BPBD to manage the landslides management in preparedness phase by using the elements of the framework.

4 Evaluation Method

This research proposes an evaluation of a conceptual framework for landslides natural disaster management. Evaluation can help the organization to get information on how mature the development of framework for landslides management. Without evaluation it is impossible to judge if the framework was going in the right direction, and how future framework efforts might be developed. Whether the conceptual framework performs its function can be objectively evaluated only when it is applied to issues and tested through a rigorous procedure. A rigorous procedure to evaluate a theory has two parts: (i) evaluate the set of sentences constituting the logical structure of the theory and its inferences by way of mathematical or logical proofs, and (ii) evaluate the content of the sentences of constituting the theory and its inferences by way of evidence, be it empirical, intuitive, or otherwise [11].

The evaluation technique in this study is adapted from [10], [11], [12], [13] and [14]. The technique is accomplished by a systematic examination with selected criteria such as background, goals, model, content, legitimation, implementation and contribution. Each criterion comprises of questions to analyze the framework and questionnaire statements to give quick answer for evaluation.

4.1 Background

Background is defining the origin, the historical influence and motivation of framework. The evaluation questions in background are:

- What is the origin of framework?
- What is the main motivation?
- Are there factors that influence the framework?
- Is the framework explained explicitly?
- Are there relevant references regarding the framework?

4.2 Goal

Goal refers to the declaration of an important thing that is expected to be achieved in the future for a period of time. The evaluation questions in goal are:

- What is the objective of framework?
- What is the target of the framework?
- Is the target appropriate with content?
- Is the objective appropriate with the whole contents?
- Does the goal appropriate with the actual condition?

4.3 Model

Model refers to the visualization to express the framework in every step of the content. The evaluation questions in models are described below:

- Does the framework have a conceptual model?
- Does the framework have a model in each point of content?
- Does the framework model appropriate with whole content?
- Does the framework provide a model in every step to deal with landslides management?
- Is the model clearly visualized?

4.4 Content

Content refers to the description of all elements in framework which is explained in detail. The evaluation question in contents are:

- What is the main point of framework?
- What results are expected from the development of the framework?
- What are the guiding principles of the framework?
- What is the main content of the framework?
- What is the main priority action of the framework?

4.5 Legitimation

Legitimation refers to the validity of the framework and the evaluation questions are defined below:

- Does the framework provide the appropriate guidelines?
- Is the framework feasible being used as a guideline?
- Is the framework could be a good guideline?
- How to know the validity of the framework?
- Is there any organization recognition which can state the validity of the framework?

4.6 Implementation

Implementation refers to the criteria that discuss the application of the framework. The evaluation questions in implementation are:

- Has the framework been implemented?
- Will the framework be implemented by BPBD?
- Can the framework be applied to every village in Batu City?
- How to implement the framework for landslide in preparedness phase?
- How to implement the framework in every village?

4.7 Contribution

Contribution refers to the role of the framework for management of landslides. The evaluation questions in contribution are:

- What is the main contribution of the framework?
- Is the contribution significant for future landslides management in Batu City?
- Does the framework have a direct contribution to BPBD?
- Does the framework have direct contribution to every village?
- Is there any development of the next version of the framework?

5 Results & Discussion

The framework is found to specify results for the steps, the evaluation result from each criterion presented in Table 1 below:

Table 1. Evaluation Result

Criteria	Sub Criteria	Result	Checklist
Background	• What is the origin of the framework?	The framework was developed in 2019 inspired by the Sendai Framework. The framework was developed specifically at the preparedness phase of landslides natural disaster due to the absence of guidelines for BPBD.	√
	• What is the main motivation?	The main motivation of the framework is giving the guidelines for BPPD in management of natural disasters landslide on the preparedness phase.	√
	• Are there any factors that affects the	The only factor that affects the framework development is the absence of the guideline in	√

	framework?	the preparedness phase.	
	• Is the framework explicitly explained?	**Yes**, the framework is explicitly explained in every single essential point that is suitable for the condition of the sub district in Batu City.	√
	• Are there any relevant references regarding the framework?	**Yes**, there is Sendai framework as the main reference which is focused in landslide disaster on the preparedness phase.	√
Goal	• What is the general purpose of the framework?	The general purpose of the framework is to provide the guidelines related to landslides natural disaster on the preparedness phase for BPPD and the civilization of Batu City.	√
	• What is the main target of the framework?	The main target of the framework is to decrease the rate of mortality, the affected civilization, economy loss, the infrastructure damage caused by the landslide natural disaster, and also to increase the availability of the landslide natural disaster information.	√
	• Is the target appropriate with the content?	**Yes**, the general and the specific purpose of the framework are appropriate with the detailed content in every single point	√
	• Is the objective appropriate with the whole content?	**Yes**, the objective is appropriate with the whole content	√
	• Does the goal appropriate with the actual condition?	**Yes**, the goal is appropriate with the actual condition since the general and the specific purpose are arranged by the situation and the condition in Batu City in handling the landslides natural disaster on the preparedness phase	√
Model	• Does the framework have a conceptual model?	**Yes**, the framework has a conceptual model	√
	• Does the framework have a model in each point?	**No**, the framework does not have a model in each point	X
	• Does the model appropriate with the content?	**Yes**, the model is appropriate with the content	√
	• Does the framework provide a model in every step to deal with landslide management?	**No**, the framework does not provide a model in every step to deal with landslide management	X
	• Is the model clearly visualized?	**Yes**, the model is clearly visualized	√
Content	• What is the main point of the framework?	The main point of the framework consists of five essential point, those are the expected result, the objectives, the guidance principal, the target, and the main priority	√
	• What is the expected result from the development of the framework?	The expected result from the development of the framework are the good, systematic, and comprehensive understanding, and the risk reduction of the landslide natural disaster such as the loss of life, living, health, asset, physic, social, culture, environment, business, and society	√
	• What are the guidance principles of the framework?	The guidance principles of the framework are: a. The responsibility from each sub district b. The classification of the responsibility from each sub district c. The objective of landslide natural disaster management Society empowerment d. The mechanism of the disaster management	√

		e. Society empowerment f. The approach and the decision making g. The direction of the landslide natural disaster management h. The risk understanding of the landslide natural disaster i. To overcome the landslide natural disaster factors j. The understanding of landslide natural disaster on the preparedness phase	
	• What is the main content of the framework?	The main content of the framework 1. To reduce the rate of mortality caused by landslide natural disaster 2. To reduce the affected society 3. To decrease the economic loss caused by landslide natural disaster 4. To decrease the infrastructure damage 5. To increase the availability of the landslide natural disaster	√
	• What is the main priority of the framework?	The main priority of the framework 1. Understanding the risk of landslide natural disaster 2. Strengthen the risk governance of the landslide natural disaster 3. Investment in reducing the risk of landslide natural disaster 4. Increasing the preparedness for landslide natural disaster 5. Increasing the availability of the landslide natural disaster	√
Legitimation	• Does the framework provide the appropriate guideline?	**Yes**, the framework provides the appropriate guideline in each point	√
	• Is the framework feasible being used as a guideline?	**Yes**, the framework is feasible to be used as a guideline	√
	• Is the framework could be a good guideline?	**Yes**, the framework is a good guideline since it gives a suitable statement according to the condition of Batu City and the direction also given clearly and detailed	√
	• How to know the validity of the framework?	The validity of the framework can be known by getting the BPPD involved in verification and validation the framework	√
	• Is there any organization which can state the validity of the framework?	**Yes**, there is an organization which can state the validity of the framework, that is BPPD	√
Implementation	• Has the framework been implemented?	**Not yet**, the framework is being in the development process and not yet evaluated nor implemented by anyone	X
	• Will the framework be implemented by BPBD?	**Yes**, BPPD will implemented the framework in landslide natural disaster management after the framework has been validated and ready to be used	√
	• Can the framework be applied to every village in Batu City?	**Yes**, the framework is especially designed so that it can be applied in every village in Batu City	√
	• How to implement the framework for landslide in preparedness phase?	The framework is implemented by following its principles to reduce the risk of landslide natural disaster	√
	• How to implement the	The framework is implemented in every	√

	framework in every village?	village by building a landslide natural disaster Tough Village and Tough Volunteer	
Contribution	• What is the main contribution of the framework?	The main contribution is the essential points that are developed according to the situation and condition in Batu City	√
	• Is the contribution significant for future landslides management in Batu City?	**Yes**, the contribution is significant for future landslide management in Batu City	√
	• Does the framework have a direct contribution to BPBD?	**Yes**, the framework has a direct contribution to BPPD by providing the guidance in landslide natural disaster management	√
	• Does the framework have a direct contribution to every village?	**Yes**, the framework has a direct contribution to the society by helping them tough in dealing with the landslide natural disaster	√
	• Is there any development of the next version of the framework?	**Yes**, in the future the framework will be improved and developed continuously	√

The evaluation result on Table 1 above shows that the framework can answer almost in every criterion, only in model and implementation the framework cannot answer few questions. In the model criteria, the framework has weakness in modeling each main point. While in implementation, the framework cannot answer the question regarding the implementation in the real world, but this answer can change after the implementation in BPBD.

6 Conclusion

This paper proposes an evaluation of conceptual framework to manage landslides in preparedness phase in Batu City. We use the featured based evaluation technique by using seven criteria, i.e. background, goal, model, content, legitimation, implementation and contribution. The evaluation gives BPBD the guidelines to manage the landslides in preparedness phase. The evaluation result shows that the framework is feasible to be implemented by BPBD in every villages in Batu City.

Further research is needed to learn, analyze and compare the framework with new criteria to know the strength and weaknesses in another aspect. The framework also needs to be tested and validated by using another method, because it will help the development of next version of the framework.

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