

Evaluating Conceptual Framework for Landslides Natural Disaster Management using Feature Analysis

Puad Siswahyudi¹, Fatwa Ramdani², Fitra A. Bachtiar³

Geoinformatics Research Group, Brawijaya University, Malang, Indonesia
{¹puadsiswahyudi@gmail.com, ²fitra.bachtiar@ub.ac.id, ³fatwaramdani@ub.ac.id}

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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 ready 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.

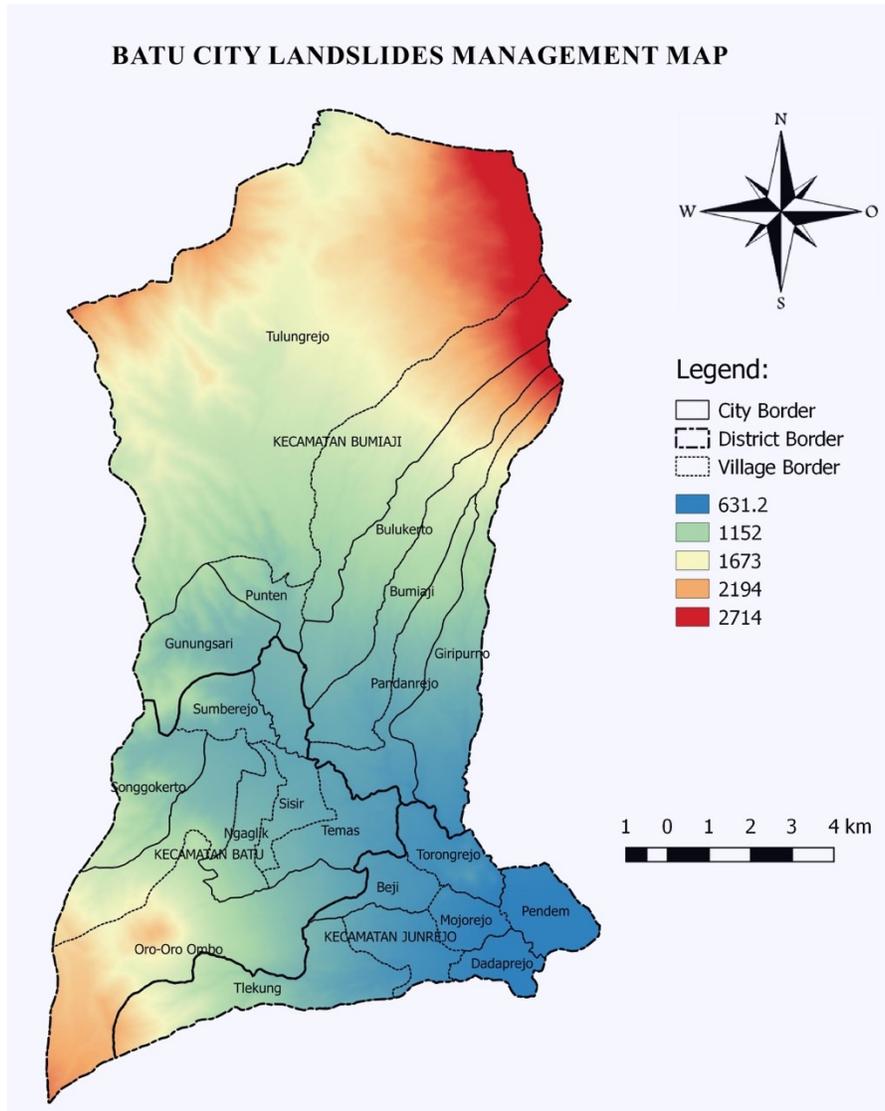


Fig. 1. Batu City administration and landslides management map

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. The conceptual framework comprises of several points below:

3.1 Expected Outcome

Expected outcome point consist of the following aims to achieve in the upcoming years: a good understanding of landslides as well as systematic and comprehensive disaster risk reduction of landslides through good disaster management to avoid the impacts of loss on life, livelihoods, health, assets, physical, social, cultural, environmental, business and community.

3.2 Goal

This point consists of important things that is expected to be achieved in the future. Goal divided in of two points, i.e. general goal and specific goal. The general goal provides guidelines or guidance for BPBD related to landslides natural disaster management in Batu City. While specific goal prevents and reduce the risk of landslides through the implementation of systematic steps at the preparedness stage.

3.3 Targets

The target refers to the limitation of the conditions or provisions that have been set to be achieved in the future. The target of the framework consists of: (i) reducing mortality due to landslides, (ii) reducing the number of people directly affected, (iii) reducing economic losses due to landslides, (iv) reducing the impact of damage to infrastructure and increasing the availability of landslides disaster information.

3.4 Principles Guide

The principles guide is compiled to provide direction in accordance with the goals of the framework for landslide disaster management. The principles guide consists of:

- a. Responsibility in each village;
- b. The delegation of responsibilities;
- c. Landslide natural disaster management aims;
- d. Mechanism of communication and coordination;
- e. Empowering local communities;
- f. Approaches and decision making;
- g. Development, strengthening and application;
- h. Characteristic of landslide natural disaster understanding;
- i. Overcome landslides natural disasters in low cost;
- j. Landslides natural disasters community understanding.

3.5 Priorities Guide

The priorities guide refers to the preparation in landslides natural disaster management that takes precedence over the others. It consists of four priorities, i.e.

- a. Understand the risk of landslides in Batu City which have mountain and hilly topography;
 - b. Strengthening the risk management of landslides natural disasters in Batu City which have different characteristics and treatments in each district;
 - c. Invest in reducing the risk of landslide natural disaster management through structured steps to improve economic resilience;
 - d. Enhance preparedness for landslides that are effective and stable, including the increase of people and assets exposed and combined with learning of natural disasters of landslides in the past.
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3.6 Desa Tangguh Principles

The Desa Tangguh is a village that has the independence to adapt and face the threat of landslides and has the ability to recover from the impact of landslides immediately. The objectives of forming a landslide resilient village are:

- a. Protect people living in landslide prone areas and their impacts;
- b. Increasing community participation in the management of their resources for disaster risk reduction in landslides;
- c. Increasing the capacity of community institutions in managing resources and maintaining local wisdom for disaster risk reduction;
- d. Enhance government capacity in providing resource, technical and non-technical support for disaster risk reduction;
- e. Increase cooperation between stakeholders in disaster risk reduction such as local governments, the private sector, universities, non-governmental organizations and community organizations.

3.7 Relawan Tangguh Principles

The Relawan Tangguh is a person or group of people who have the ability and concern to work voluntarily and sincerely in efforts to overcome landslides. The purpose of establishing Tangguh Volunteers is to create individuals who have the ability and good care and can work voluntarily and sincerely for risk reduction and disaster management of landslides. The principles for establishing a Relawan Tangguh are as follows:

- a. Fast and precise in carrying out every action;
- b. Priority in carrying out every action;
- c. Good coordination between volunteers and community members;
- d. Efficient and effective in every action carried out;
- e. Transparent in every action and coordination that is carried out;
- f. Responsible for every action, decision and coordination;
- g. Good partnership between volunteers;
- h. Empowering the abilities of individuals and community members;
- i. Do not discriminate in any form towards residents or affected victims;
- j. Not aimed at spreading certain religions in every action carried out;
- k. Prioritizing a sense of humanity and gender equality;
- l. Respect local wisdom;

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?
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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.	H
	• 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.	H
	• Are there any factors that affects the framework?	The only factor that affects the framework development is the absence of the guideline in the preparedness phase.	H
	• 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.	H
Goal	• 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.	H
	• 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.	H
	• 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.	H

	<ul style="list-style-type: none"> • 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	H
	<ul style="list-style-type: none"> • Is the objective appropriate with the whole content? 	Yes, the objective is appropriate with the whole content	H
	<ul style="list-style-type: none"> • 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	H
Model	<ul style="list-style-type: none"> • Does the framework have a conceptual model? 	Yes, the framework has a conceptual model	H
	<ul style="list-style-type: none"> • Does the framework have a model in each point? 	Yes, the framework has a model in each point	M
	<ul style="list-style-type: none"> • Does the model appropriate with the content? 	Yes, the model is appropriate with the content	H
	<ul style="list-style-type: none"> • Does the framework provide a model in every step to deal with landslide management? 	Yes, the framework provides a model in every step to deal with landslide management	M
	<ul style="list-style-type: none"> • Is the model clearly visualized? 	Yes, the model is clearly visualized	M
Content	<ul style="list-style-type: none"> • 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	H
	<ul style="list-style-type: none"> • 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	H
	<ul style="list-style-type: none"> • What are the guidance principles of the framework? 	The guidance principles of the framework are: <ol style="list-style-type: none"> 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 	H
	<ul style="list-style-type: none"> • What is the main content of the framework? 	The main content of the framework <ol style="list-style-type: none"> 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 	H
	<ul style="list-style-type: none"> • What is the main priority of the framework? 	The main priority of the framework <ol style="list-style-type: none"> 1. Understanding the risk of landslide natural 	H

		<p>disaster</p> <ol style="list-style-type: none"> 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	M
	• Is the framework feasible being used as a guideline?	Yes, the framework is feasible to be used as a guideline	M
	• 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	M
	• 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	M
	• 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	M
Implementation	• Has the framework been implemented?	Yes, the framework has implemented by BPBD	L
	• 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	M
	• 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	M
	• 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	M
	• How to implement the framework in every village?	The framework is implemented in every village by building a landslide natural disaster Tough Village and Tough Volunteer	M
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	H
	• Is the contribution significant for future landslides management in Batu City?	Yes, the contribution is significant for future landslide management in Batu City	H
	• 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	H
	• 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	H
	• Is there any development of the next version of the framework?	Yes, in the future the framework will be improved and developed continuously	H

The evaluation checklist denotes as High (“H”) if the answer is complete and explain in detail. The Medium (“M”) represents the answer with short of lack in completeness and detail explanation. The Low (“L”) represent the very poor answer in completeness and detail explanation. While the None (“N”) means that there is no answer, or the framework cannot answer the question. The evaluation result on Table 1 above shows that the framework can answer all question in every criterion in different checklist as describe below:

- a. The background criteria evaluate the origin of the framework, the main motivation, the main factor, detail explanation and reference. The framework shows the good result by completely answer all the question in detail. In background criteria, the framework gets the High (“H”) checklist in all sub criteria which mean the framework has a good background based on the complete answer and detail explanation answer.
 - b. The goal criteria consist of general purpose, main target, appropriateness of purpose, objective and goal. General purpose of the framework is explaining the guidelines to manage landslides on preparedness phase, while the main target is explaining something to achieve in the future. The appropriateness of general and specific purpose, objective and goal, deliver the appropriate point among the content and condition in Batu City. The framework gets the High (“H”) checklist in all sub criteria which mean the framework has a good, clear and complete goal.
 - c. The model point delivers the visualization of developed framework, it consists of conceptual model, model in each point of the framework, model appropriateness, model in every step of landslides management and model clarity. The framework is providing all the conceptual models in every point and step to easier the understanding of the user, but the checklist result is different considering the completeness and detail explanation. The model gets the High (“H”) checklist in conceptual model and model appropriateness, while in other criteria the framework gets the Medium (“M”).
 - d. In the content criteria, the framework delivers the main point, i.e. expected result, guidance principles, main content and main priority. The framework gets the High (“H”) checklist in all sub criteria which mean the framework has a good, clear and complete content.
 - e. The legitimation criteria comprise of the appropriateness, feasibility, capability, validity and acknowledgment of the framework. The framework gets Medium (“M”) checklist, even it can answer all the sub criteria’s question the completeness and explanation is poor.
 - f. In the implementation criteria, the framework gets the Low (“L”) checklist in regarding the lack of implementation number in real world. While the implementation by BPBD, application in village, and how to implement the framework gets the Medium (“M”) regarding the existence of completeness and explanation.
 - g. The last evaluation is contribution criteria where the framework gets the High (“H”) in all sub criteria’s question. The main contribution, significance, contribution to BPBD, contribution to village and next version development is well explained in detail and complete.
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6 Conclusion

This paper proposes an evaluation of conceptual framework to manage landslides in preparedness phase in Batu City. We use the featured based analysis evaluation technique by using seven criteria, i.e. background, goal, model, content, legitimation, implementation and contribution. The evaluation gives sight of the strength and the weaknesses of the framework which can used by user to know the gap inside. The evaluation result shows that the framework is ready to be implemented by BPBD in every villages in Batu City considering the result shows above.

Despite our efforts to provide a comprehensive and objective evaluation, we acknowledge the following limitation such as the evaluation has been solely based on the available documentation of the framework and some evaluation criteria are subjective in nature. Further research is needed to learn and analyze 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. The framework also needs to compare with existing framework for landslides management in preparedness phase.

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