Preparedness of Disaster Management of Landslides in the livelihoods of Kulon Progo district

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Abstract. A landslide is one of the natural disasters that frequently appear during the rainy season. Society has confronted this natural disaster, and it is important to decrease the vulnerable impact at the household level. Preparedness refers to the effort made to expand awareness and readiness for handling the dangers and preventative actions related to them. The aim of the paper is to analyze the correlations between livelihoods and preparedness stages in a landslide disaster area in Kulon Progo. The independent variables are defined as human-, social-, physical-, natural-, and financial capital and transformation in structure and process. Preparedness is the dependent variable. The Chi-squared analysis was applied to answer the objective. The unit analysis of this study is households, and we collected 300 households based on stratified random sampling at the research site. Kulon Progo has been chosen since the geographical pattern is hilly. Households appear to have the average level of disaster management preparedness (37.3%). Based on the strengthening of relations, the belief in keeping away from bad behavior based on ancestors' advice has the highest CC to preparedness phase (0.396) with χ^2 55.554**. It found that belief and religiosity levels have a strong contingency correlation among household capitals.

1 Introduction

Rapid growth and urbanization cause dramatic changes in land-use patterns, which could sharply decrease ecological land. Therefore, the natural water networks are fragmented and pose a vulnerability to urban ecological systems [1]. Moreover, the global climate brings extreme weather with an increasing tendency, which poses serious impacts and risks to the fragile ecological system. The rainfall-constrained landslide is the most serious disaster type for geological disasters, including in Indonesia.

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The implementation of disaster risk reduction policy offers several valuable lessons, such as the importance of government legislation, effective coordination and networking, active community involvement, the utilization of damage and loss assessment mechanisms, the post-disaster recovery process, and improved management of disaster funding. However, despite all the efforts made, the rehabilitation process has not been considerably accelerated [2]. According to [3], when catastrophic or apocalyptic events occur, they have a detrimental impact on a community's ability to effectively carry out its many duties. The potential for recovery, sustainability, and expansion is contingent upon the availability of resources within a community and the cultivation of existing strengths prior to the occurrence of an adverse event. According to [4], an examination of the existing literature on community resilience reveals that the level of individual achievement is closely tied to the overall well-being of their respective communities. This success is contingent upon the availability and accessibility of resources within the community. Included in these resources are both an individual's informal social supports as well as the formal social service systems, such as those pertaining to child welfare, education, corrections, and health care.

Disasters often happen without warning. It is a complex, multi-faceted, and global issue. Most disasters lead to consequences such as socio-economic, mental, and physical effects. According to [5] and [6], there are two types of disasters: natural and man-made. Natural disasters include volcano eruptions, tsunamis, flash floods, and earthquakes. Man-made disasters consist of human accidents, military conflicts, and political unrest. Based on a study by [7], developing countries are more susceptible to disaster due to poverty, resource deficiency, limited access to education, inadequate infrastructure, and a lack of awareness and knowledge.

Malaysia and Indonesia are vulnerable to both natural and man-made disasters and, therefore, experience tremendous losses. Hence, government intervention is imperative in the wake of the disaster. Government intervention has evolved in recent years from providing financial assistance to providing psychosocial interventions. In addition, psychosocial intervention is provided in the aftermath and prior to any disaster events by providing awareness, preparedness, and the necessary knowledge and skills to society. Furthermore, improving preparedness for adverse events is one of the efforts to reduce disaster risk [8]. The preparedness to handle oneself in the event of a disaster is necessary to minimize any disaster difficulties in the absence of immediate health care and emergency responders.

Floods and landslides are two of the most frequent natural disasters in Indonesia. In the past few years, these natural disasters have increased tremendously due to human activities. Despite being a natural disaster, human activities such as uninhibited development and haphazard land clearing boost the severity of floods, particularly at peak discharge and at times of concentration.

This study seeks to identify the relationship between disaster preparedness intention, which refers to flood risks, and attitude, perceived behavioral control, and social norm. As a result of the high costs of disaster assistance and the resulting damage to social structure and social determinants, disaster behavior studies have been conducted since 1940. Individual motivation determines intention, and intention in the disaster behavior tendency study is linked to perception and behavior. According to Ubaidillah, 2917 [9], there are three important aspects of motivational factors: attitude toward behavior or the degree of evaluation of favorable or unfavorable behavior; social factors (perceived social pressure to implement or not implement the behavior); and behavioral control (perceived ease or difficulty in showing behavior). If an individual's attitude and subjective norms favor behavior, the perceived behavioral control will be higher, and the person's desire to contemplate performing the behavior will be higher. Vinnel, Milfont, and McClurec (2021) divided attitudes into two types : experiential attitudes based on experience and instrumental attitudes based on consequence. In their research [10], Mariam et al. (2021) discovered a link between attitude

and disaster preparedness objectives. The study found that how people perceive and accept disaster risk has an impact on how prepared they are for disasters. People who have a strong sense of self-responsibility accept flood hazards with ease.

In terms of the relationship between social norms and disaster preparedness intentions, social norms are defined as the impacts on an individual's behavior that are based on what is considered typical by the individual's social group. The social norms have also been divided into injunctive norms, which deal with whether or not a behaviour is acceptable, and descriptive norms, which deal with the prevalence of the behaviour While self-efficacy, which is defined as confidence in performing a specific behavior, such as overcoming hurdles to achieve a specific habit, can be used to examine the relationship between perceived behavioral control and disaster preparedness intentions, Individuals' high acceptance of the crisis management scenario was due to their great self-efficacy [11]. Few studies were found in the context of developing countries to understand the behavioral factors in disaster preparedness. [12] revealed that a clear understanding of preparedness is important for future enhancements in reducing vulnerability and providing effective and accurate risk assistance.

Landslides in Indonesia have the risk of high rainfall, and the tropical climate conditions are worsening the risk. Landslide hazards define the annual probability of occurrence with potential destructive potential in a landslide in a village [13]. Disaster preparedness is applied to reduce the vulnerability and risk possibilities in an area. Strengthening the capacity of community by appointing full-time disaster managers and integrating formal and informal education, including training, is a sustainable investment in handling the disaster impact Sustainable Livelihoods Assets (SLA) is an approach to defining the priorities for development activities and involving the lives of the poor and vulnerable [14]. SLA consists of the interaction of capital assets and the transformation of structure and process to produce an outcome [15]. The objective of the study is to analyze the preparedness level of vulnerable areas in Kulon Progo, Indonesia, and to define the correlation between SLA and the preparedness phase of landslide disaster management. Previous studies have defined the relationship between components of livelihoods and disaster management. However, this study is designed to study the preparedness phase since it plays an important role in increasing households resilience through livelihoods.
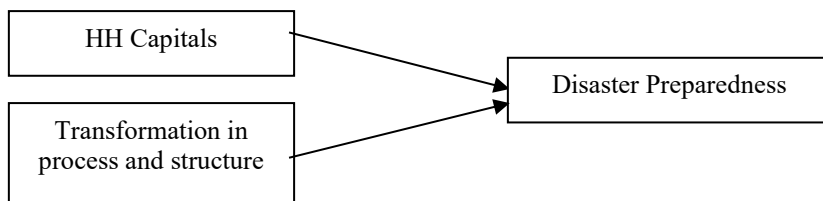
Fig. 1. The conceptual framework of this study

2 Method

To answer the objective of this study, quantitative research methodology was used by collecting primary data. The conceptual framework is designed to establish landslide guidelines in the adaptive phase based on community-based approaches. The data has been collected in Kulon Progo regency, especially in six villages, namely Banjarsari, Gerbosari,

Kebonhargo, Ngargosari, Purwoharjo, and Sinduharjo. The main reason for choosing the area is based on previous research that defined the rainfall-induced landslide in the area. It is a major geotechnical hazard during the rainy season [16]. The unit of analysis in this research is households. The dependent variable of this study is disaster preparedness, and the independent variables consist of household capital and transformation in structure and process (TSP). The household capitals are defined as human capital, social capital, natural capital, physical capital, and financial capital. The TSP consists of culture, implementation, and belief. The total sample size for this study is 300 households spread across six villages. The total sampling was carried out using stratified random sampling from six villages in Samigaluh district. The six villages are Banjarsari, Gerbosari, Kebonhargo, Ngargosari, Purwoharjo, and Sidoharjo village. However, since the last landslide was in Gerbosari, the data collection is focused on Gerbosari village.

The analysis applied in this study is descriptive analysis and the chi-squared test. The Chi-square test measures the distribution of a categorical variable in another sample. This statistical test is used to compare the observed result with the expected result. The purpose of this test is to determine if a difference between observed and expected data is due to a relationship between the variables. Previous studies have been applied using chi square to observe the relationship between variables for several natural disasters [17]–[19] The variables have been identified as ordinal variables or categorical variables. Categorical variables belong to a subset of variables that can be divided into discrete categories, and they are known as qualitative variables because they depict the variable's quality or characteristics. The Chi square test has two main types, namely Independence and Goodness-of-Fit. In this study, we are using Independence. The chi-square test of independence is a derivable or inferential statistical test that examines whether the two sets of variables are likely to be related to each other or not.

3 Result and Discussion

In this study, disaster preparedness has been defined into five categories of questions: awareness of disaster warning alarms; preparedness during high rainfall seasons; knowledge of evacuation training; communication built with the local government; and the household's awareness of frequently checking the land condition. Based on these criteria, this study defines three levels of capability of households as low, medium, and high in terms of preparedness for disaster management (Table 1). It is found that the preparedness level has been focused on the medium level (37.3%), but mostly it is spread wisely in each phase. In further analysis, the low level (34.3%) of preparedness has been spread in Purwoharjo (50%), Banjarsari (47.2%), and The capacity of preparedness levels has been distributed almost the same for each level: low, medium, and high.

Table 1. Preparedness and Disaster Management Capability level

Preparedness Level	N (%)
Low Level	103 (34.3%)
Medium level	112 (37.3%)
High level	85 (28.3%)
TOTAL	300 (100%)

The descriptive analysis of preparedness for disaster management can be seen in Table 2, whereas the preparedness capability of the households is mostly at the medium level (5.76).

Based on each question, households mostly check the land condition occasionally (1.22) as part of their preparedness application. It is a strengthening reason that during the rainy fall season, households prepare themselves for the worst case of landslide possibility [20]. The lower the value of the standard deviation in comparison to the mean, the more homogeneous the data. It means the capabilities of households are at the same level and stage.

Table 2. Descriptive analysis of Preparedness and Disaster Management

Variable	N	Min	Max	Mean	St. Deviation
Preparedness	300	0.00	10.00	5.76	2.77
P1.1. Warning Alarm	300	0.00	2.00	1.06	0.87
P1.2. Water management	300	0.00	2.00	1.20	0.78
P1.3. Evacuation training	300	0.00	2.00	1.10	0.84
P1.4. Symmetric Information from the Government	300	0.00	2.00	1.18	0.81
P1.5. Checking the land condition	300	0.00	2.00	1.22	0.75

The chi-square test of independence has been tested in each of the variables of household capacities. Human capital identifies the importance of education from each household's perspective. Through eight questions, one statement has been significantly related to preparedness capability (Table 3). It is important to add the capacity of the children to have informal religious education ($\chi^2 = 10.683*$). The Contingency Coefficient (CC) is 0.185, which indicates a low level of relationships among two variables. A previous study that claimed that community-based religious organizations like mosques could support households' disaster preparedness supports this [21]. Moreover, human capacity and preparedness level have a strong relationship due to the rescue planning for households [22]. The strong local partnership is improving the risk reduction impact from the landslide occurrence [23]

Table 3. Chi-square test of Independence between Human Capital and Disaster Preparedness capacity

Human Capital 3	Preparedness			
	Low	Medium	High	Total
Not Important	60.0%	40.0%	0.0%	100% (103)
Important	36.6%	46.3%%	17.1%	100% (112)
Very Important	32.9%	33.8%	33.3%	100% (85)
Chi square = 10.683* CC = 0.185				

Social capital in this study consists of relationships between households and the community, village, and other networks, including the government. Through the three parts of social capital, there is one question that is not significantly related to the preparedness of disaster management, namely financial support from relatives when you want to start a business. Support from a relative who lived near you when you were sick ($\chi^2 = 6.740*$) with low-level correlation (CC = 0.148) When households have a medium or high level of preparedness capability, they will always give their time to support their relatives when they are sick. The strongest relationship to the preparedness phase of disaster management based on CC and significant correlation through Chi square The Pearson correlation is the participation rate at the weekly meeting in the village (CC = 0.316). This question has also been defined with a high chi square value of less than 1% ($\chi^2 = 33.336**$). The relationship

between participation in the weekly meeting in the village and the majority of households could be described as the symmetrical information given during the weekly meeting. It can be defined that households with a low level of preparedness will choose never to join the weekly meeting (58.5%); however, households with medium and high levels stated that they would sometimes and always join the weekly meeting in the village. It can be concluded that, based on their awareness of receiving information from villages, this is improving their preparedness for disaster management [24]. Communication and training could improve the preparedness capacity of individuals and households [25]. Moreover, having connections to government and private institutions in the village could strengthen the preparedness capability of the households [26]. This has been identified since, in the question of networking, all of the components have a significant relationship to the preparedness of disaster management (CC local government =0.301 and CC private = 0.306).

Table 4. Chi-square test of Independence between Social Capital and Disaster Preparedness Capability

Social Capital 1	Preparedness			
	Low	**Medium**	**High**	**Total**
Never	0.0%	0.0%	0.0%	100% (103)
Sometime	39.8%	41.9%	18.3%	100% (112)
Always	31.9%	35.3%	32.9%	100% (85)
Chi square = 6.740* CC = 0.148				
Social capital 3	**Low**	**Medium**	**High**	**Total**
Never	19.4%	41.9%	8.0%	100% (103)
Sometime	44.8%	32.0%	9.7%	100% (112)
Always	31.0%	40.7%	10.7%	100% (85)
Chi square = 13.579* CC = 0.208				
Social Capital 5	**Low**	**Medium**	**High**	**Total**
Never	58.5%	28.3%	13.2%	100% (103)
Sometime	23.6%	52.7%	8.7%	100% (112)
Always	33.6%	28.5%	17.3%	100% (85)
Chi square = 33.336** CC = 0.316				
Social Capital 6	**Low**	**Medium**	**High**	**Total**
Never	44.7%	44.7%	10.6%	100% (103)
Sometime	38.2%	38.2%	23.5%	100% (112)
Always	29.4%	35.0%	35.6%	100% (85)
Chi square = 11.695* CC = 0.194				
Social Capital 7	**Low**	**Medium**	**High**	**Total**
Never	56.1%	29.3%	14.6%	100% (103)
Sometime	31.6%	43.2%	25.0%	100% (112)

Always	30.4%	36.3%	33.3%	100% (85)
Chi square = 12.729* CC = 0.202				
Social Capital 8	**Low**	**Medium**	**High**	**Total**
Never	63.5%	32.7%	3.8%	100% (103)
Sometime	31.0%	38.0%	31.0%	100% (112)
Always	26.4%	38.5%	35.1%	100% (85)
Chi square = 29.960** CC = 0.301				
Social Capital 9	**Low**	**Medium**	**High**	**Total**
Never	57.3%	22.5%	20.2%	100% (103)
Sometime	27.5%	42.5%	30.0%	100% (112)
Always	20.9%	45.1%	34.1%	100% (85)
Chi square = 30,922** CC = 0.306				

The relationship between natural capital and preparedness for disaster management is defined in Table 5. Natural capital is the flow of resources made up of natural resource stocks to support livelihoods, including land, water, and other environmental resources [27]. In this study, the variables of natural capital have been defined as access to water resources and land utilization. The access and quality of water resources in their house have been significant factors in disaster management preparedness, except for the utilization of individual rain banks (*tadah hujan*). The high correlation on access to water resources is the highest correlation to the preparedness phase of disaster management (CC = 0.239), with a Pearson chi square equal to 18.096*. In Kulon Progo found that water resource access was a problem for livelihoods since water resource access is always a problem (54.5%) in low-level preparedness disaster management.

In land utilization, the utilization of renting land without any ownership has been correlated with the preparedness of the disaster management phase (CC = 0.292). The households with low levels of preparedness capability mostly rent land without any ownership status. The community in this area has developed much land without being aware of its ownership status. Whether by the government or without any ownership ranting, the household has used the majority of the rented land.

Table 5. Chi-square test of Independence between Natural Capital and Disaster Preparedness capacity

Natural Capital 1.2	**Low**	**Medium**	**High**	**Total**
Never	32.4%	36.7%	30.9%	100% (103)
Sometime	23.2%	44.2%	32.6%	100% (112)
Always	54.5%	28.8%	16.7%	100% (85)
Chi square = 18.096* CC = 0.239				
Natural Capital 1.3	**Low**	**Medium**	**High**	**Total**
Never	33.3%	41.3%	25.4%	100% (103)
Sometime	28.4%	29.6%	42.0%	100% (112)
Always	40.9%	38.7%	20.4%	100% (85)

Chi square = 11.634* CC = 0.193				
Natural Capital 1.4	**Low**	**Medium**	**High**	**Total**
Never	34.1%	37.8%	28.1%	100% (103)
Sometime	50.9%	36.8%	12.3%	100% (112)
Always	19.3%	36.8%	43.9%	100% (85)
Chi square = 18.408* CC = 0.241				
Natural Capital 2.1	**Low**	**Medium**	**High**	**Total**
Never	20.4%	49.5%	30.1%	100% (103)
Sometime	39.1%	29.1%	31.8%	100% (112)
Always	45.5%	40.0%	14.5%	100% (85)
Chi square = 19.101* CC = 0.245				
Natural Capital 2.2	**Low**	**Medium**	**High**	**Total**
Never	54.8%	22.6%	22.6%	100% (103)
Sometime	35.3%	45.6%	19.1%	100% (112)
Always	26.2%	39.9%	33.9%	100% (85)
Chi square = 22.509* CC = 0.265				
Natural Capital 2.3	**Low**	**Medium**	**High**	**Total**
Never	37.2%	31.8%	30.9%	100% (103)
Sometime	44.4%	47.2%	8.3%	100% (112)
Always	10.0%	60.0%	30.0%	100% (85)
Chi square = 22.404** CC = 0.264				
Natural Capital 2.4	**Low**	**Medium**	**High**	**Total**
Never	26.5%	39.8%	33.6%	100% (103)
Sometime	50.0%	34.6%	15.4%	100% (112)
Always	45.8%	37.5%	16.7%	100% (85)
Chi square = 27.942** CC = 0.292				

The physical capital is recognized as the physical facilities found to support livelihood activities. Physical capital is defined as the quality and access to electricity, telecommunications, and road access. However, only the quality of telecommunications and asphalt roads has been significantly correlated with the preparedness phase of disaster management. The quality signal of telecommunication has a medium level of precorrelation with the intensity phase (CC = 0.231). It can be explained that when rainfall seasons occur, communication becomes important. A household that has medium-level capability in the preparedness phase stated that it has good-quality signals for communication ($\chi^2 = 16.817*$). Moreover, the appearance of asphalt roads is also correlated with preparedness level capability. Households that always access asphalt roads at medium and high levels are more numerous than households at low levels (CC = 0.205 and $\chi^2 = 13.050*$). Physical capital plays an important role on building communication facilities between government and community [4]

Table 6. Chi-square test of Independence between Physical Capital and Disaster Preparedness Capability

Physical Capital 1	Low	Medium	High	Total
Never	36.8%	36.8%	26.3%	100% (103)
Sometime	32.4%	28.6%	39.0%	100% (112)
Always	31.0%	49.1%	19.8%	100% (85)
Chi square = 16.817* CC = 0.231				
Physical Capital 2	Low	Medium	High	Total
Never	33.3%	66.7%	0.0%	100% (103)
Sometime	40.4%	32.6%	27.0%	100% (112)
Always	33.8%	35.8%	30.5%	100% (85)
Chi square = 13.050* CC = 0.205				

In sustainable livelihoods, there is a transformation in structure and process that is mostly applied as the mediator variable between livelihood assets and strategies. The transformation of structure and process is defined as the external strengthening of individuals, households, communities, or institutions to support the livelihood outcome, for example, through policy, belief, norm, local rules, and so on. In this study, belief and culture implementation are defined as the transformation of structure and process (TSP), as seen in Table 7. Culture and belief implementation are significantly correlated with the preparedness and disaster management capabilities of each household. Each of the household beliefs has a significance level of 1% with a medium level of correlation (more than 0.250). The culture's belief implementation, namely celebration events by their own ($\chi^2 = 27.860$**) or held by the government ($\chi^2 = 46.493$**), is also significant ($\chi^2 = 55.554$**). This result describes that the culture, beliefs, and implementation of households have a strong relationship with the preparedness phase. However, it is seen that the majority of households that have a low level of preparedness have sometimes implemented cultural events and traditions. The religious or belief implementation consists of the explanation of household implementation on their behavior, namely, start their farming based on the good day belief of each religion; participate in Islamic praying or gathering; and hold this event and invite the neighbors. All this implementation has been significantly correlated to disaster preparedness, with a low-level correlation. Belief and culture strengthen household capacities in disaster management, including the preparedness phase [15], [28]

Table 7. Chi-square test of Independence between Transformation on Structure and Process and Disaster Preparedness Capability

Culture 1,	Low	Medium	High	Total
Never	47.1%	17.6%	35.3%	100% (103)
Sometime	42.0%	45.5%	12.5%	100% (112)
Always	28.9%	35.8%	35.3%	100% (85)
Chi square = 27.860** CC = 0.282				
Culture 2	Low	Medium	High	Total
Never	75.0%	18.2%	6.8%	100% (103)

Sometime	34.7%	43.9%	21.4%	100% (112)
Always	22.9%	38.9%	38.2%	100% (85)
Chi square = 46.943** CC = 0.368				
Culture 3.	**Low**	**Medium**	**High**	**Total**
Never	54.5%	27.3%	18.2%	100% (103)
Sometime	45.3%	48.0%	6.7%	100% (112)
Always	18.4%	37.4%	44.2%	100% (85)
Chi square = 55.554 ** CC = 0.396				
Belief 1	**Low**	**Medium**	**High**	**Total**
Never	50.0%	25.8%	24.2%	100% (103)
Sometime	40.6%	40.6%	18.8%	100% (112)
Always	26.6%	40.5%	32.9%	100% (85)
Chi square = 14.774* CC = 0.217				
Belief 2.	**Low**	**Medium**	**High**	**Total**
Never	46.5%	41.9%	11.6%	100% (103)
Sometime	35.9%	47.4%	16.7%	100% (112)
Always	30.9%	32.0%	37.1%	100% (85)
Chi square = 19.105* CC = 0.245				
Belief 3.	**Low**	**Medium**	**High**	**Total**
Never	46.9%	21.9%	31.3%	100% (103)
Sometime	31.2%	53.2%	15.6%	100% (112)
Always	33.7%	33.7%	32.6%	100% (85)
Chi square = 15.423* CC = 0.221				

4 Conclusion

Transformation in structure and process (TSP) has also been correlated to the preparedness phase. Social capital and natural capital are the two household capitals that most of the item questions correlated to the preparedness of disaster management. Based on previous research, the preparedness capability level has been identified as correlated to many aspects, including household capital (social capital, human capital, physical capital, and natural capital) and the transformation of structure. On the other hand, socioeconomics is also correlated with households' ability to prepare for disaster management. The socioeconomics, which have been correlated to the preparedness level, could be spread by the density of the village. Human capital is correlated to preparedness-level capabilities, as the same finding defines access to education, formal and informal. Moreover, the social capital took all questions correlated to the preparedness phase and, due to the strengthened collaboration and networking, could update the information to understand the status of landslides in prone areas. The capacity of communities to improve their preparedness skills could be based on self-efficacy and community-based development.

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