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Socio-Economic Analysis and Population Displacement Due to Natural Disasters in West Sumatra

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ABSTRACT

This research investigates the socio-economic impacts of population displacement due to natural disasters, focusing on floods in West Sumatra. The study areas include two affected locations: Padang Panjang and Agam, where 100 questionnaires were distributed in each. Logistic regression analysis was employed to identify the factors influencing residents' relocation decisions after the disaster. The study reveals notable differences between the two areas. In Padang Panjang, the loss of productive resources and other forms of wealth does not significantly affect the decision to move. However, losses involving housing, buildings, social facilities, community resources, the environment, cultural heritage, and additional assets show a significant impact. This suggests that aspects tied to daily life and social connections strongly influence relocation decisions in this area. Conversely, in Agam, the loss of productive resources, housing, buildings, systems, social facilities, and other wealth also significantly impact relocation decisions. Losing community resources, environmental factors, cultural heritage, and other valued assets is essential in encouraging relocation. These findings underscore the importance of social and environmental factors as primary motivators in resettlement decisions in disaster-affected areas, especially when losses involve resources with emotional and historical value to the community. This study offers more profound insight into the determinants of residents' willingness to relocate following a disaster in West Sumatra.

1. INTRODUCTION

A disaster is caused by natural or human factors, leading to loss of life, property damage, and disruption of social order [1] Indonesia's location on the equator, featuring diverse landscapes from lowlands to high mountains, and its position at the convergence of four tectonic plates—Eurasian, Indo-Australian, Philippine, and Pacific—makes it prone to earthquakes, volcanic eruptions, and landslides [2].

As a climatological center, Indonesia influences regional and global weather patterns due to its equatorial position. This location impacts weather through the convergence of Hadley and Walker circulations. Like other regions in Indonesia, West Sumatra faces high vulnerability to natural disasters. The Indonesian Disaster Information Data by BNPB shows a history of disasters, including floods, extreme weather, tsunamis, and earthquakes. Such diversity in potential disasters requires effective mitigation to reduce loss [3].

Law Number 24 of 2007 defines a disaster as an event disrupting lives and livelihoods due to natural or human factors, resulting in loss of life, environmental damage, and psychological impact. Survivors often face prolonged psychological effects, impacting daily activities [4].

Socio-economic impacts of displacement due to disasters are complex, especially in vulnerable regions. West Sumatra, for instance, experiences significant risks from earthquakes, tsunamis, and volcanic eruptions. Displacement due to these disasters can lead to physical, economic, and psychological challenges, with loss of shelter, assets, and employment potentially pushing people into poverty and exposing them to health risks, food insecurity, and trauma [5]. Disruption of social networks and community structures further hinders recovery.

In disaster-prone Indonesia, tsunamis, earthquakes, landslides, and volcanic eruptions threaten communities, making recovery complex due to losses and psychological impact [6]. The 2009 Padang earthquake in West Sumatra caused $2.3 billion in damage, exemplifies the economic vulnerabilities here, with widespread job and income losses, particularly in informal sectors [7].

Displacement impacts community networks, which are crucial for social support. Community breakdowns lead to isolation, reduced access to resources, and hinder recovery efforts. Prolonged displacement can also strain family

structures, causing mental health issues due to stress and uncertainty [8].

Health challenges are significant for displaced populations due to limited access to services, poor sanitation, and crowded conditions, increasing disease risk. The lack of clean water and nutrition in temporary shelters amplifies these issues, with psychological stress contributing to long-term health impacts [8].

Education is also disrupted, as educational facilities are often damaged, and displaced children struggle with consistent schooling, impacting long-term development and future opportunities [2]. Education stabilizes, yet displaced children in West Sumatra face barriers that affect future workforce potential [9].

Effective policy responses are crucial to address socio-economic challenges due to displacement. Local governance structures can mitigate impacts through disaster preparedness and risk reduction. Emphasizing resilient infrastructure and response protocols alongside financial aid can support post-disaster economic stability [2]. External assistance from international organizations helps but requires local engagement and sustainable policies focused on resilience [10].

The socio-economic impact of displacement in West Sumatra highlights the need for multi-faceted policies. Displacement exacerbates economic instability, disrupts social cohesion, increases health risks, and hampers education. As disaster frequency remains high, addressing these factors will support long-term resilience and recovery in affected communities.

In this study, two research areas are used, namely Agam Regency and Padang Panjang City. Agam Regency, located in West Sumatra Province, has an area of 2,226.27 km² with a population of 525,348 people in 2022, with a density of 235.98 people per km². The region is divided into 16 sub-districts and 92 Nagari. Most of the population comes from the Minangkabau tribe, although Javanese and Batak tribes are also present. Socio-economically, Agam Regency has a leading sector in agriculture, primarily as a food barn, and is known as a center for traditional crafts that support the local economy. Tourism is also a significant attraction, with Maninjau Lake as a leading destination that presents the region's distinctive natural beauty. However, Agam Regency also faces potential natural disasters such as earthquakes and landslides, given its location in the ring of fire and hilly areas. In addition, the threat of flooding and erosion often occurs, especially in the rainy season, which can affect the community's economic activities and social life. Despite this, the people of Agam Regency have resilience based on local wisdom rooted in Minangkabau customs and continue to develop mitigation strategies to reduce the impact of natural disasters. The combination of economic potential, tourism, and disaster challenges makes Agam Regency a strategic region with complex dynamics.

Padang Panjang City, one of the smallest cities in West Sumatra Province with an area of about 2,300 hectares, has a strategic position as a link between Padang City and Bukittinggi City. In mid-2021, its population reached 59,998 people. Administratively, the city is divided into two sub-districts: Padang Panjang Barat and Padang Panjang Timur, each consisting of eight urban villages. From a socio-economic perspective, the economic growth of Padang Panjang City has experienced fluctuating development in recent years. Nevertheless, the city strives to improve community welfare through various development programs. However, Padang Panjang City also faces a significant risk of natural disasters.

The region's geographical, topographical, and climatological conditions make it vulnerable to earthquakes, landslides, and floods. In May 2024, for example, the Padang Panjang-Sicincin National Road section was cut off due to flash floods, successfully restored in July 2024. In addition, heavy rains in May 2022 caused small rivers to overflow and cause flooding in several areas. Recognizing the high potential for disaster, the government and community of Padang Panjang City continue to improve disaster preparedness and mitigation to minimize negative impacts on social and economic life.

This article explores the socio-economic impacts of natural disaster-induced displacement in West Sumatra, examining effects on livelihoods, social structures, and access to services. Addressing these consequences can improve disaster preparedness, response, and long-term resilience strategies.

2. METHODS

This study was conducted in two disaster-affected areas, Padang Panjang and Agam, where 100 questionnaires were distributed in each location. These areas were selected due to their exposure to disasters. Specifically, in Padang Panjang, the affected areas included Bukik Batabuah and Jorong Galuang. In Agam, the study focused on the sub-districts of Silaiang Bawah, Pasar Usang, Sigando, and Ekor Lubuk.

The research utilized logit regression or logistic regression, a statistical method for modeling a binary dependent variable, representing outcomes with two possible categories: success/failure, yes/no, or 0/1. Logistic regression estimates the probability of an event occurring based on one or more independent variables. This model employs the logistic (or sigmoid) function to map predicted values to probabilities. The logistic function is represented by:

$$P(Y = 1 \mid X) = \frac{1}{1 + e^{?(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + ? + \beta_k x_k)}} \quad (1)$$

In logistic regression, the "odds" refer to the ratio of the probability of an event occurring to the probability of it not occurring. The model's odds ratio, calculated by exponentiating the coefficients, helps interpret how the odds of the outcome change with a one-unit increase in a predictor. An odds ratio greater than 1 suggests a positive association, while an odds ratio less than 1 implies a negative association.

$$Odss = \frac{P(Y = 1|X)}{1 - P(Y = 1|X)} \quad (2)$$

The model's coefficients are estimated using maximum likelihood estimation (MLE), which identifies the set of coefficients that maximizes the likelihood of observing the actual outcomes. Each coefficient shows the change in the log odds of the dependent variable for a one-unit increase in a predictor, holding other variables constant. Predictor significance is evaluated using p-values, with a standard threshold for statistical significance being $p<0.05$.

Logistic regression assumes a binary dependent variable and independent observations. The log-odds of the outcome should be a linear function of the predictors, and multicollinearity among independent variables should be minimal. Additionally, larger sample sizes improve logistic

regression model performance. Model evaluation can involve goodness-of-fit tests, such as the Pearson chi-square and Hosmer-Lemeshow tests, and pseudo-R-squared metrics to assess explanatory power. Classification accuracy can be evaluated using a confusion matrix, as well as sensitivity and specificity.

3. RESULT

The logistic regression analysis examines factors influencing an individual's decision to relocate to Padang Panjang City. The independent variables in this analysis include the impact of the loss of productive resources (X1), the impact of the loss of housing, structures, systems, and social facilities (X2), the impact of the loss of other assets (X3), and the impact of the loss of community resources, environment, cultural heritage, and other valuable assets (X4).

The logistic regression model is overall significant at the 5% level, as indicated by an LR Chi^2 value of 12.57 with Prob > Chi^2 = 0.0136. This suggests that the independent variables collectively influence the relocation decision. However, the Pseudo R-squared value of 0.0924 shows that these variables explain only about 9.24% of the variation in the relocation decision.

Table 1 examines the coefficients of each variable reveals that variable X1 (impact of loss of productive resources), with a p-value of 0.126, is not statistically significant, indicating that this variable does not significantly affect the relocation decision. In contrast, X2 (impact of loss of housing, structures, and social facilities), with a coefficient of -0.0946 and a p-value of 0.033, suggests that a more significant loss in housing and facilities reduces the likelihood of choosing relocation. This variable is statistically significant at the 5% level, indicating that the impact of losing housing and social facilities influences relocation decisions.

These findings align with the research of Peacock et al. [11], emphasizing that loss of economic assets significantly affects individuals' and families' relocation decisions after a disaster. Monetary assets, including property, savings, and livelihoods, often create financial uncertainty when lost, impacting the ability to move to safer areas.

X3 (impact of loss of other wealth) is not statistically significant (p = 0.881), suggesting that this variable does not affect relocation decisions. Meanwhile, X4 (impact of loss of community resources, environment, cultural heritage, and other assets), with a positive coefficient of 0.0905 and a p-value of 0.071, is significant at the 10% level. This suggests that a more substantial impact on community resources and the environment increases the likelihood of willingness to relocate.

These results are consistent with findings by Thiede and Brown [12], which showed that access to social facilities, such as community support or social and cultural networks, influences one's decision to stay. Individuals with strong community ties and social support in their home areas are generally more reluctant to relocate, even in disaster-prone areas. Therefore, this study highlights the need to consider economic factors and access to social facilities in post-disaster relocation policies, particularly for vulnerable groups.

Table 2 shows the goodness-of-fit test results suggesting that the estimated logistic regression model aligns well with the observed data. The Pearson chi-square statistic ($Chi^2(76)$ = 96.68) with 76 degrees of freedom measures how closely the model's predictions match the actual data. A chi-square value of 96.68 was tested to determine if there was a significant difference between the model's predictions and the observed data. With a p-value of 0.0549—slightly above the typical significance threshold of 0.05—this result indicates no significant difference between the model and the observed data. Therefore, the model is considered a good fit, and there is no substantial evidence to reject the null hypothesis that it fits the data well. Although the p-value is close to 0.05, the model is still considered adequate for predicting relocation decisions based on the variables included.

Table 3 shows the logistic regression results using odds ratios (OR) to shed light on the factors affecting a person's decision to relocate. For the variable X1 (impact of loss of productive resources), the odds ratio is 0.9396, indicating that an increase in the effects of this loss tends to decrease the likelihood of relocation by 6.04%. However, with a p-value of 0.126, this variable is not statistically significant, meaning its influence on relocation decisions is not strong.

Table 1. Logistic regression results for Padang Panjang City

Variable	Coefficient	Std. Err.	Z	P >	95% Confidence Interval
The impact of the loss of productive resources (X1)	-0.0623	0.0407	-1.53	0.126	-0.1421 to 0.0175
The impact of the loss of housing, structures, systems, and social facilities (X2)	-0.0946	0.0443	-2.13	0.033	-0.1815 to -0.0077
The impact of the loss of other assets (X3)	0.0081	0.0542	0.15	0.881	-0.0983 to 0.1146
The impact of the loss of community resources, environment, cultural heritage, and other valuable assets (X4)	0.0905	0.0502	1.8	0.071	-0.0079 to 0.1889
Cons	0.9637	0.8262	1.17	0.243	-0.6555 to 2.5831
Observation: 100					
LR Chi-(4): 12.57					
Prob > Chi^2: 0,0136					
Log-Likelihood: -61.7467					
Pseudo R^2: 0.0924					

Source: Data is processed, 2024

Table 2. Goodness of fit test results for Padang Panjang City

Statistics	Value
Total observations	100
Total covariate pattern	81
Pearson Chi^2 (76)	96.68
Prob > Chi^2	0.0549

Source: Data is processed, 2024

In contrast, X2 (impact of loss of housing, structures, systems, and social facilities) has an odds ratio of 0.9098, suggesting that an increase in this impact lowers the likelihood of relocation by 9.02%. With a p-value of 0.033, this variable is statistically significant at the 5% level, confirming that the impact of losing housing and social facilities significantly affects relocation decisions.

Table 3. Odds ratio results for Padang Panjang City

Variable	Odds Ratio	Std. Err.	Z	P >	95% Confidence Interval
The impact of the loss of productive resources (X1)	0.9396	0.0382	-1.53	0.126	0.8675 to 1.0176
The impact of the loss of housing, structures, systems, and social facilities (X2)	0.9098	0.0403	-2.13	0.033	0.8340 to 0.9923
The impact of the loss of other assets (X3)	1.0082	0.0547	0.15	0.881	0.9064 to 1.1213
The impact of the loss of community resources, environment, cultural heritage, and other valuable assets (X4)	1.0948	0.0549	1.8	0.071	0.9921 to 1.2080
_cons	2.6216	2.1659	1.17	0.243	0.5191 to 13.2385

Source: Data is processed, 2024

Table 4. Logistic regression results for Agam Regency

Variable	Coefficient	Std. Err.	Z	P >	95% Confidence Interval
The impact of the loss of productive resources (X1)	-0.1097	0.0633	-1.73	0.083	-0.2338 to 0.0144
The impact of the loss of housing, structures, systems, and social facilities (X2)	-0.0908	0.0648	-1.4	0.161	-0.2178 to 0.0362
The impact of the loss of other assets (X3)	-0.0519	0.0476	-1.09	0.275	-0.1454 to 0.0414
The impact of the loss of community resources, environment, cultural heritage, and other valuable assets (X4)	0.1590	0.0691	2.3	0.021	0.0235 to 0.2944
_Cons	0.7566	1.4954	0.51	0.613	-2.1745 to 3.6877
Observation: 100					
LR chi (4): 9.23					
Prob > Chi^2					
Log-Likelihood: -55.598411					
Pseudo R^2: 0.0767					

Source: Data is processed, 2024

For X3 (impact of loss of other wealth), the odds ratio is 1.0082, showing a minimal increase of 0.82% in the likelihood of relocation. However, with a p-value of 0.881, this variable is not statistically significant, so there is no meaningful association between the loss of other wealth and the decision to relocate.

Lastly, X4 (impact of the loss of community resources, environment, cultural heritage, and other assets) has an odds ratio of 1.0948, which implies that an increase in this impact raises the likelihood of relocation by 9.48%. With a p-value of 0.071, this variable approaches significance at the 10% level, indicating a potential influence on the decision to relocate.

Table 4 shows the logistic regression analysis above examines the factors affecting relocation decisions in Agam Regency. The model shows an LR Chi^2 (4) value of 9.23 with a p-value of 0.0555, which is nearly significant at the 5% level and more important at the 10% level. This suggests that the independent variables collectively influence relocation decisions, though the significance is close to the 5% threshold. The Pseudo R^2 of 0.0767 indicates that the independent variables explain about 7.67% of the variation in relocation decisions.

Examining each variable, X1 (impact of loss of productive resources) has a negative coefficient of -0.1097, indicating that a more significant effect of loss in this area reduces the likelihood of choosing to relocate. With a p-value of 0.083, this variable is significant at the 10% level, suggesting an influence of productive resource loss on relocation decisions.

For X2 (impact of loss of housing, structures, systems, and social facilities), the p-value is 0.161, which is not statistically significant, indicating no meaningful effect of housing loss on relocation decisions. X3 (impact of loss of other wealth) has a p-value of 0.275, indicating no significant relationship between other wealth loss and relocation decisions.

On the other hand, X4 (impact of loss of community resources, environment, cultural heritage, and other assets) has a positive coefficient of 0.1590, suggesting that the more significant the effect of loss in these areas, the higher the likelihood of relocation. This variable is statistically significant with a p-value of 0.021, indicating that the loss of community resources and environmental factors significantly impacts relocation decisions.

The finding that housing loss does not significantly affect relocation decisions contrasts with previous research. For instance, Peacock et al. [11] studied the aftermath of Hurricane Katrina. They found that economic losses, such as the loss of housing and reduced access to social support, were key factors influencing relocation. Their research suggests that individuals with better access to social networks and support facilities are more likely to consider relocating after a disaster. Similarly, Thiede and Brown [12] analyzed the relocation decisions of families impacted by Hurricane Katrina, concluding that economic factors, particularly housing loss and community connections, play an essential role in relocating or remaining despite disaster risks.

Furthermore, studies have shown that wealth loss alone may not significantly impact relocation decisions after a natural disaster. For example, Bhatia et al. [13] studied flood-affected communities in India, revealing that while wealth loss was considered, other factors like housing loss and access to social services were more influential in shaping relocation decisions.

Table 5 shows the Goodness-of-Fit (GOF) test results to assess how well the logistic regression model aligns with the observed data. The Pearson chi-square value, $Chi^2(93) = 99.44$, reflects the chi-square calculation with 93 degrees of freedom derived from the number of covariate patterns (98) and observations (100) minus the number of estimated parameters. This chi-square value tests whether a meaningful difference exists between the model's predicted and observed values. Additionally, the p-value of 0.3050 indicates the significance

level of this goodness-of-fit test. Since the p-value is considerably higher than the standard 0.05 threshold, the null hypothesis—that the model fits the data—cannot be rejected. This suggests no significant evidence indicates a poor fit between the model and the observed data. With a p-value of 0.3050, the GOF test results imply that this logistic regression model fits the data well and is appropriate for predicting relocation decisions based on the independent variables included. These findings suggest that the model provides a reasonably accurate prediction of relocation decisions, with no significant discrepancies between the observed and predicted values.

Table 5. The goodness of fit test results for Agam Regency

Statistics	Value
Total observations	100
Total covariate pattern	98
Pearson Chi^2 (93)	99.44
Prob > Chi^2	0.3050

Source: Data is processed, 2024

Table 6. Odds ratio results for Agam Regency

Variable	Odds Ratio	Std. Err.	Z	P >	95% Confidence Interval
The impact of the loss of productive resources (X1)	0.8961	0.0567	-1.73	0.083	0.7915 to 1.0145
The impact of the loss of housing, structures, systems, and social facilities (X2)	0.9132	0.0592	-1.4	0.161	0.8042 to 1.0369
The impact of the loss of other assets (X3)	0.9493	0.0452	-1.09	0.275	0.8647 to 1.0423
The impact of the loss of community resources, environment, cultural heritage, and other valuable assets (X4)	1.1723	0.0810	2.3	0.021	1.0238 to 1.3423
_Cons	2.1311	3.1869	0.51	0.613	0.1137 to 39.9537

Source: Data is processed, 2024

Table 6 shows the logistic regression results with odds ratios (OR) providing insights into the factors influencing relocation decisions. For variable X1 (Impact of loss of productive resources), the odds ratio of 0.8961 suggests that as the impact of losing productive resources increases, the likelihood of relocating decreases by 10.39% (1 - 0.8961). With a p-value of 0.083, this variable is statistically significant at the 10% level, though not at the 5% level.

For variable X2 (Impact of loss of housing, structures, systems, and social facilities), the odds ratio is 0.9132. Still, the p-value of 0.161 indicates that this factor is not statistically significant, showing no substantial effect on relocation decisions. Similarly, variable X3 (Impact of loss of other wealth) has an odds ratio of 0.9493 and a p-value of 0.275, meaning it is also not statistically significant.

In contrast, variable X4 (Impact of loss of community resources, environment, cultural heritage, and other assets) has an odds ratio of 1.1723, implying that an increase in the impact of losing these resources raises the likelihood of relocation by 17.23% (1 - 1.1723). With a p-value of 0.021, this variable is significant at the 5% level, highlighting a notable effect on relocation decisions.

Following a series of surveys on the flash flood disaster in Agam Regency, particularly in Kenagarian Bukik Batabuah and Jorong Galuang, triggered by Mount Merapi's eruption, the survey team found that most residents experienced minor to moderate house damage. Most respondents, aged 35-60 and working mainly as farmers and traders, lost their primary source of income, making many unwilling to relocate. Their reasons include attachment to ancestral land (tanah pusako), difficulty finding employment in new areas, and challenges adapting to new environments.

Community involvement in relocation decision-making could have been higher. In interviews, most residents indicated reluctance to give up their homes and land even if forced to relocate. They preferred repairing or expanding waterways to prevent future flooding and hoped the government would prioritize business capital assistance over relocation.

The disaster also had a significant psychological impact, with many residents experiencing stress, especially during heavy rains. Those whose homes were severely damaged chose to live temporarily with family or rent elsewhere, citing uncertainty about relocation plans. Some residents who agreed to relocate have been moved to new housing in the Lubuk Basung and Matur areas.

The government's disaster response was generally well-received, especially in providing emergency assistance such as food, clothing, and medical supplies. However, some issues remain unresolved, such as leftover flood debris and non-permanent bridges. The community hopes for improved infrastructure and business capital support from the government as long-term assistance.

In Padang Panjang City, surveys conducted in Silaiang Bawah, Pasar Usang, Sigando, and Ekor Lubuk villages—where most respondents were aged 30-60 and engaged in farming—revealed that the flash floods caused severe damage to agricultural land, with many rice fields buried under sand and debris. The sand deposits hinder farmers from resuming their work due to limited resources to clear the fields, prompting the community to request government aid to remove the sand using heavy machinery.

This situation left many families without their primary livelihood, particularly those reliant on agriculture. To help, the government provided Rp 1,000,000 in cash assistance to affected farmers and fish pond owners. However, some residents who lost their shops and merchandise in the floods have yet to receive further assistance from the government.

Damage to houses in this area was primarily minor, except in Silaiang Bawah and Pasar Usang, where some homes suffered severe damage and became uninhabitable. Residents living in designated "red zones," high-risk areas identified by the government, were encouraged to evacuate. Assistance from the government included food, essential goods, medical supplies, and cash support. The community generally viewed the government's response as positive.

The government's relocation policy in Padang Panjang targets those in red zones. Residents in these areas, whose homes are in vulnerable locations, are given the option to relocate. If no legal land is available, the government offers rental subsidies for three months only. The relocation system requires residents to own private land with legal status, as the government provides only building materials. If residents

agree to relocate, their former homes must remain unoccupied; otherwise, government assistance will be revoked. So far, those who lost their shops in the floods have not received additional support from the government.

The study's findings emphasize the critical role of social and environmental factors in influencing decisions about relocation in the aftermath of natural disasters in West Sumatra. Communities often weigh these factors, such as cultural ties, community cohesion, and environmental safety, alongside economic considerations like livelihood opportunities and property values. The interplay between these dimensions reflects the complexity of decision-making processes, as highlighted in studies by Anderson et al. [12] and Turner [14], which discuss the relative importance of non-economic factors in shaping post-disaster migration patterns.

Exploring how these factors interact reveals that while economic opportunities may drive relocation decisions, strong social ties and a deep connection to ancestral lands often anchor communities in high-risk areas. This underscores the need for a holistic approach to disaster management, integrating social, environmental, and economic considerations. Policymakers should focus on inclusive planning that respects community preferences while providing viable economic alternatives in safer locations. For instance, relocation programs could include access to affordable housing, job training, and cultural preservation initiatives, ensuring that economic and non-economic needs are effectively met. This multifaceted strategy could enhance the acceptability and sustainability of relocation efforts, fostering resilience and long-term well-being for affected populations.

The comparison between Padang Panjang and Agam in the context of post-disaster relocation provides valuable insights into the factors influencing the decision to relocate. Differences in aspects such as geographical conditions, infrastructure, and local policies can impact the motivation of communities to move to new locations after a disaster. For instance, areas with better infrastructure or more adequate social facilities may be more attractive to disaster-affected populations. Therefore, it is essential to consider these reasons when designing relocation policies to better align with the specific needs of each region.

While the focus of this study on West Sumatra provides an in-depth analysis of the specific conditions and dynamics of the region, it also opens up the possibility for broader discussion on the relevance of these findings to other disaster-prone areas. The post-disaster relocation process in Indonesia, which varies significantly from one region to another, offers valuable lessons that can be adapted by different places, both within Indonesia and abroad, facing similar challenges. Generalizing these findings can provide broader insights into effective relocation strategies.

This research contributes to the growing literature on post-disaster relocation by highlighting the socio-economic factors influencing relocation decisions. New findings from this study, particularly those related to the interaction between economic and social factors in shaping migration patterns, significantly contribute to the current understanding of the topic. This research enriches the academic discourse and provides practical insights for policymakers in formulating more targeted and contextual policies.

The findings of this study provide a comprehensive understanding of the socio-economic impacts and patterns of population displacement resulting from natural disasters in West Sumatra. The region's vulnerability to earthquakes, floods, and landslides significantly affects livelihoods, particularly in rural and economically marginalized communities. Drawing on relevant literature, the study highlights how disaster-induced displacement exacerbates poverty and disrupts access to essential services, including education and healthcare, and the socio-economic consequences of natural disasters in Southeast Asia [15].

From a practical standpoint, these results underline the need for proactive disaster management policies tailored to the specific vulnerabilities of West Sumatra. Policymakers should prioritize integrating disaster risk reduction into regional development plans, focusing on strengthening infrastructure in high-risk areas and providing sustainable livelihoods for displaced populations [16]. For disaster management agencies, the findings suggest a critical need to enhance early warning systems and community-based disaster preparedness programs to minimize displacement and its adverse impacts. Furthermore, collaboration with academic institutions and NGOs can facilitate data-driven decision-making and implement evidence-based interventions, ensuring a resilient recovery for affected communities.

Natural disasters in West Sumatra have profound socio-economic impacts, particularly concerning population displacement. Studies indicate that economic factors significantly influence the frequency and severity of disasters in the region, with lower economic development correlating with higher disaster occurrences [17]. West Sumatra earthquake, for instance, not only caused extensive infrastructure damage but also disrupted educational services, necessitating substantial external assistance [18]. Research on displacement patterns post-disaster reveals that individuals from heavily damaged areas are more likely to relocate, with socio-economic status influencing the nature and destination of displacement [19]. Moreover, comprehensive analyses highlight that vulnerability to displacement is intricately linked to socio-economic variables, emphasizing the need for targeted policy interventions to mitigate such impacts [20].

4. CONCLUSIONS

The study's findings reveal that in Padang Panjang, the loss of productive resources did not significantly impact relocation decisions. In contrast, the loss of housing, buildings, and social facilities had a notable effect, suggesting that the greater the loss, the less likely people were to relocate. The loss of other forms of wealth also showed no significant influence. However, the loss of community resources, the environment, and cultural heritage did significantly affect relocation decisions. In Agam, the loss of productive resources had a substantial positive impact on the decision to relocate. In contrast, the loss of housing, structures, social facilities, and other assets had no significant effect. The loss of community resources, the environment, and cultural heritage had a considerable influence, indicating that such losses increased the likelihood of people choosing to relocate.

The study suggests several policy recommendations to support a successful relocation program. First, in Padang Panjang, the loss of housing and social facilities is crucial to relocation decisions. Therefore, the government should ensure sufficient housing and social facilities at the new relocation sites to reduce people's reluctance to move. Second, in Agam, the loss of productive resources positively affects relocation decisions. To address this, economic support in the form of

new skills training, job creation at relocation sites, and compensation for those losing land and livelihoods can help mitigate the financial impact of displacement. Third, preserving cultural and environmental heritage is critical, as both regions have shown that the loss of community resources, the environment, and cultural heritage significantly influences relocation choices. Incorporating critical cultural and environmental elements in the new locations will help communities maintain their local identity and traditions, facilitating better adaptation to the new environment.

REFERENCES

[1] Hermon, D. (2015). Geografi Bencana Alam. PT. RajaGrafindo Persada-Rajawali Pers.

[2] Hermon, D. (2017). Climate Change Mitigation. PT. Raja Grafindo Persada-Rajawali Press.

[3] Badan National Penanggulangan Bencana. (2020). Kajian Risiko Bencana, Peta Bahaya dan Kerentanan Provinsi Sumatera Barat.

[4] Ernawati, D., Utami Panjaitan, R. (2020). Gambaran Post Traumatic Stress Disorder Pada Korban Bencana Alam Post Erupsi Merapi Satu Dekade. Jurnal Ilmu Keperawatan Jiwa, 3: 101-112.

[5] Tangkudung, S.N. (2019). The impact of natural disaster on the economy. Jurnal Ekonomi & Studi Pembangunan, 20(1): 63-70. https://doi.org/10.18196/jesp.20.1.5014

[6] Basri, T.H., Raisa, S. (2019). Knowledge level of earthquake and tsunami disaster at disaster preparedness school and non-disaster preparedness school in Kuta Raja sub-district of Banda Aceh. In IOP Conference Series: Earth and Environmental Science, 273(1): 012029. https://doi.org/10.1088/1755-1315/273/1/012029

[7] World Bank. (2010). Post disaster needs assessment for Indonesia: Padang Earthquake.

[8] International Federation of Red Cross and Red Crescent Societies. (2018). Indonesia: Annual report 2018.

[9] UNICEF. (2016). Education in emergencies: A case study of Indonesia.

[10] Noy, I., Vu, T.B. (2010). The economics of natural disasters in a developing country: The case of Vietnam. Journal of Asian Economics, 21(4): 345-354. https://doi.org/10.1016/j.asieco.2010.03.002

[11] Peacock, W.G., Dash, N., Zhang, Y., Van Zandt, S. (2010). Hurricane Katrina and the flooding of new Orleans: Emergent issues in sheltering and housing. Journal of the American Planning Association, 76(2): 215-231. https://doi.org/10.1080/01944361003639497

[12] Thiede, B.C., Brown, D.L. (2013). Hurricane Katrina: Who stayed and why? Population Research and Policy Review, 32(6): 803-824. https://doi.org/10.1007/s11113-013-9302-9

[13] Bhatia, M., Dwivedi, L.K., Banerjee, K., Bansal, A., Ranjan, M., Dixit, P. (2021). Pro-poor policies and improvements in maternal health outcomes in India. BMC Pregnancy and Childbirth, 21(1): 389. https://doi.org/10.1186/s12884-021-03839-w

[14] Appleby-Arnold, S., Brockdorff, N., Jakovljev, I., Zdravković, S. (2021). Disaster preparedness and cultural factors: A comparative study in Romania and Malta. Disasters, 45(3): 664-690. https://doi.org/10.1111/disa.12433

[15] Turner, S. (2021). Balancing economic and social considerations in disaster-induced relocation: A case study from Indonesia. International Journal of Environmental and Social Resilience, 9(3): 45-68

[16] Topluoglu, S., Taylan-Ozkan, A., Alp, E. (2023). Impact of wars and natural disasters on emerging and re-emerging infectious diseases. Frontiers in Public Health, 11: 1215929. https://doi.org/10.3389/fpubh.2023.1215929

[17] Tasri, E.S., Karimi, K., Muslim, I. (2021). The effect of economic variables on natural disasters and the impact of disasters on economic variables. Heliyon, 8(1): e08678. https://doi.org/10.1016/j.heliyon.2021.e08678

[18] Setiadi, A. (2014). Socio-economic impacts of natural disasters on the education sector: A case study of Indonesia. Jurnal Dialog Penanggulangan Bencana, 5(2): 78-86. https://jdpb.bnpb.go.id/index.php/jurnal/article/view/80.

[19] Asad A.L. (2015). Contexts of reception, post-disaster migration, and socioeconomic mobility. Population and environment, 36(3): 279-310. https://doi.org/10.1007/s11111-014-0221-4

[20] Gray, C., Frankenberg, E., Gillespie, T., Sumantri, C., Thomas, D. (2014). Studying displacement after a disaster using large scale survey methods: Sumatra after the 2004 tsunami. Annals of the Association of American Geographers. Association of American Geographers, 104(3): 594-612. https://doi.org/10.1080/00045608.2014.892351