

# Analysis of Trust in Early Warning Information on Flood Response in Dayeuhkolot Using Linear Regression

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## **Abstract:**

Floods are common hydrometeorological disasters that significantly impact communities, especially in flood-prone areas like Dayeuhkolot Subdistrict, Bandung Regency. Community emergency response plays a crucial role in disaster risk reduction and is influenced by trust in early warning information. This study aims to analyze the effect of such trust on community flood emergency response using a quantitative, explanatory approach with linear regression analysis. The results show that trust in early warning information has a positive and significant effect on emergency response, with a regression coefficient of 0.506 and a significance value of 0.000 ( $<0.05$ ). The coefficient of determination ( $R^2$ ) of 0.213 indicates that trust contributes to shaping community responses. These findings highlight that strengthening public trust is essential to improving the effectiveness of community-based early warning systems in flood-prone areas.

## **1. Introduction**

Floods are hydrometeorological disasters characterized by high occurrence rates and far-reaching impacts on community life, with consequences extending beyond physical damage to the environment and infrastructure to include disruptions to social and economic activities (Kuller et al., 2021). Flood risk in the Bandung Regency, particularly in Dayeuhkolot District, tends to increase in line with climate change and regional development pressures (Adian Takwa, 2024). Based on field data from late 2025, Dayeuhkolot recorded at least 35,000 people affected by floodwaters reaching 1.5 meters in height, which severely disrupted economic activities (Bandung Regency Disaster Management Agency, 2025). The data indicates that Dayeuhkolot is the hardest-hit area, with 25,918 people from 9,246 households affected—a figure far exceeding neighboring areas such as Baleendah, which recorded 5,579 affected people, and Bojongsoang, with 3,000 affected people (Bandung Regency BPBD, 2025). Throughout 2025, this area has experienced 15 floods, causing economic losses to industry of up to Rp 1 billion per day (Bandung Regency BPBD, 2025). The main problem identified is the frequent delay in emergency response due to public skepticism regarding early warning information, as residents tend to wait until water actually enters their homes before deciding to evacuate (Afrilianti et al., 2025). This situation requires a comprehensive understanding of the factors determining factors of emergency response to strengthen disaster mitigation, which has so far faced challenges in the field (Afrilianti et al., 2025).

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Flood early warning systems serve as a means of conveying preliminary information about potential hazards; however, the effectiveness of these systems is determined not only by detection technology but also by public acceptance of such information (A'rachman et al., 2025). The problem-solving perspective in this study focuses on analyzing the influence of information credibility on emergency response through a quantitative approach with an explanatory design. Based on current knowledge, early warning solutions are now shifting toward the use of smart Internet of Things (IoT)-based technologies to improve data accuracy (Hermawan, 2024). However, there is a significant research gap because most previous studies have focused on descriptive approaches, technical aspects of hardware, or large-scale regions without addressing the psychological dimensions of message recipients (Sagay & Pangemanan, 2025; Nadifah et al., 2023). Many other authors have published on mitigation topics in South Bandung, but quantitative studies specifically measuring the magnitude of the influence of trust using regression models in chronically flood-prone areas remain very limited (Lahi & Suldani, 2024). Therefore, this study introduces a novel approach by applying a linear regression model to provide objective empirical evidence regarding the causal relationship among these variables. The primary objective of this paper is to analyze and empirically demonstrate the extent of the influence of trust in early warning information on the community's flood emergency response in Dayeuhkolot Subdistrict.

The summary of the theoretical review in this study is based on the principle that trust reflects confidence in the accuracy and reliability of information, whereby sources deemed credible tend to elicit a faster response (Hermawan, 2024). This is consistent with the Protective Action Decision Model (PADM), which asserts that trust in information sources is a primary prerequisite before individuals make self-protection decisions, including evacuation and emergency actions (Gunawan, 2025). The trust variable in this context is measured through indicators of perceived information accuracy, source credibility, message consistency, and timeliness of delivery (Parameswari & Warsono, 2021; Sagay & Pangemanan, 2025). Meanwhile, emergency response refers to the public's swift actions, encompassing decision-making processes, evacuation, and the protection of oneself, family, and essential property (Helmi et al., 2024; Islami et al., 2024). The recurring flood experiences in Dayeuhkolot have shaped risk perceptions that influence how the community responds to early warning information, where high levels of trust encourage the community to act more quickly and in a planned manner (Parameswari & Warsono, 2021). By understanding these theoretical dynamics, this research is expected to contribute to strengthening a more people-centered early warning system to mitigate potential losses from future disasters (Samansiri et al., 2023; Agustian et al., 2024).

## 2. Literature Review

### 2.1 Concepts and Quality of Disaster Information

Information serves as the fundamental glue throughout the entire disaster management cycle, bridging government coordination with community actions on the ground. Sri Ati (2018) defines the quality of information in terms of accuracy, timeliness, and clarity of data to reduce uncertainty in critical situations. The quality of information is determined by the level of accuracy, timeliness, and clarity of data presentation, which play a role in reducing uncertainty during emergencies. High-quality information supports rapid, accurate, and coordinated decision-making, enabling disaster management to proceed more efficiently and respond effectively to changing conditions on the ground.

### 2.2 Early Warning Systems and Their Four Pillars

An Early Warning System (EWS) is a series of activities aimed at issuing warnings as soon as possible to minimize the risk of disaster impacts. UNDRR standards define the four main pillars of the EWS, which include risk knowledge, monitoring, message dissemination, and integrated community response capabilities. Agustian et al. (2024) explain that the effectiveness of this system heavily depends on accurate detection technology and communication strategies capable of reaching residents down to the local level.

### 2.3 Protective Action Decision Model and Trust

The Protective Action Decision Model (PADM) explains that stakeholders' perceptions form the primary basis for decision-making regarding self-protection. Gunawan (2025) emphasizes that trust in information sources is an absolute

prerequisite before individuals decide to undertake self-evacuation or take measures to secure their property. Hermawan (2024) states that the credibility of sources supported by accurate data will accelerate the transition from message reception to actual emergency action.

#### 2.4 Foundations of Linear Regression

Linear regression analysis was employed to examine the functional or causal relationship between a single independent variable ( $X$ ) and a dependent variable ( $Y$ ), as described by Sugiyono (2022). The linear regression model used in this study is expressed in Equation (1).

$$Y = a + bX \quad (1)$$

where  $Y$  represents the flood emergency response,  $X$  denotes trust in early warning information,  $a$  is the constant term, and  $b$  is the regression coefficient. Significance testing was conducted at a 95% confidence level with a significance value of  $\alpha = 0.05$ . The coefficient of determination was used to assess the contribution of the independent variable to the dependent variable. The results of the analysis serve as the basis for drawing the study's conclusions.

#### 2.5 Principles of Estimation and Classical Regression Assumptions

Model parameters were estimated using the Ordinary Least Squares (OLS) method, which minimizes the difference between observed values and predicted values to obtain unbiased estimates. A regression model is considered statistically valid when it satisfies the classical assumptions, including tests of normality, linearity, heteroscedasticity, and autocorrelation. Mardiatmoko (2020) emphasizes that testing these assumptions is essential to ensure the accuracy of parameter estimation and the validity of the resulting statistical inferences.

### 3. Research Method

#### 3.1 Research Framework

The research framework was systematically designed to ensure objectivity in establishing causal relationships among variables. The stages of the study are outlined as follows:

1. Identification Stage: This stage began with a literature review and field observations of flood events in Dayeuhkolot, as well as issues related to low emergency response due to skepticism toward early warning information.
2. Instrument Development Stage: A questionnaire was developed based on indicators of the trust variable ( $X$ ) and emergency response variable ( $Y$ ).
3. Pilot Testing Stage: Validity and reliability tests were conducted to ensure that each questionnaire item was appropriate for use.
4. Data Collection Stage: The questionnaire was distributed to 100 respondents selected using a simple random sampling technique in the affected areas.
5. Data Analysis Stage: Classical assumption tests (normality, linearity, and heteroscedasticity) were performed prior to conducting linear regression analysis.
6. Interpretation and Conclusion Stage: The regression coefficients and coefficient of determination ( $R^2$ ) were interpreted to address the research objectives.

#### 3.2 Type and Research Design

This study employed a quantitative approach with an explanatory research design. The explanatory design was used to examine the effect of trust in early warning information on flood emergency response. The research data consisted of numerical data obtained from questionnaire measurements. Hypothesis testing was conducted using inferential statistical analysis, with linear regression as the primary analytical method.

### 3.3 Research Location and Subjects

The study was conducted in Dayeuhkolot District, Bandung Regency. The research subjects were residents living in the area, with the unit of analysis being individuals within households. Respondents were selected from community members who had experienced flood events. The selection of the study area was based on its relatively high frequency of flooding.

### 3.4 Population, Sampling Technique, and Sample Size

The study population comprised all adult residents of Dayeuhkolot District. A probability sampling technique was employed using a simple random sampling approach. The sample size was determined to be 100 respondents to obtain more stable parameter estimates and to support instrument testing. This sample size satisfies the minimum requirement for linear regression analysis based on the rule of thumb  $N \geq 50 + 8m$ , where  $m = 1$ . When pure random sampling was difficult to implement, sampling was conducted through clustering based on neighborhood administrative units (RT/RW), followed by random selection of respondents within each cluster.

### 3.5 Respondent Criteria

The inclusion criteria were as follows: (1) residing in Dayeuhkolot District, (2) aged  $\geq 17$  years or married, (3) having lived in the area for at least one year, (4) having experienced flooding at least once, and (5) having received flood early warning information from formal or informal sources. The exclusion criteria included: (1) newcomers residing for less than one year, (2) individuals who had never experienced flooding in the area, (3) individuals who had never received flood early warning information, and (4) incomplete or inconsistent questionnaire responses. These criteria were applied to ensure the relevance of respondents' experiences to the study variables. Respondent selection was conducted prior to questionnaire administration.

### 3.6 Instruments and Data Collection Techniques

Primary data were collected using a structured questionnaire. The measurement scale employed a five-point Likert scale ranging from strongly disagree to strongly agree. The questionnaire was administered directly to respondents. Completion of the questionnaire was conducted with limited assistance to ensure a consistent understanding of the items. Secondary data were used as supporting information, including general regional data and records of flood events. To enhance data quality, respondents were given clear instructions prior to completing the questionnaire. Data collection was conducted within a specified time frame to ensure consistency across responses. All collected data were subsequently coded and prepared for statistical analysis in accordance with the research objectives.

### 3.7 Instrument Testing

Validity testing was conducted to assess the ability of each questionnaire item to measure the intended construct. Reliability testing was used to evaluate the internal consistency of the research instrument. The instrument was considered reliable if the Cronbach's Alpha value met the acceptable threshold. Items that did not meet validity and reliability criteria were excluded from further analysis. Only validated and reliable instruments were used in the regression analysis.

## 4. Results and Discussion

### 4.1. Instrument Validity and Reliability Testing

This section presents the results of instrument testing conducted to ensure that the questionnaire used in this study is capable of accurately and consistently measuring the research variables. The tests were performed on 100 respondents in Dayeuhkolot District.

**Table 1. Results of Instrument Validity Testing**

No	Item	Variable	Pearson Correlation (r calculated)	r table	Remarks
1	X1	Trust	0,604	0,195	Valid
2	X2	Trust	0,650	0,195	Valid
3	X3	Trust	0,483	0,195	Valid
4	X4	Trust	0,708	0,195	Valid

No	Item	Variable	Pearson Correlation (r calculated)	r table	Remarks
5	X5	Trust	0,554	0,195	Valid
6	X6	Trust	0,595	0,195	Valid
7	X7	Trust	0,643	0,195	Valid
8	X8	Trust	0,603	0,195	Valid
9	X9	Trust	0,660	0,195	Valid
10	X10	Trust	0,620	0,195	Valid
11	X11	Trust	0,486	0,195	Valid
12	X12	Trust	0,582	0,195	Valid
13	Y1	Emergency Response	0,673	0,195	Valid
14	Y2	Emergency Response	0,727	0,195	Valid
15	Y3	Emergency Response	0,705	0,195	Valid
16	Y4	Emergency Response	0,692	0,195	Valid
17	Y5	Emergency Response	0,661	0,195	Valid
18	Y6	Emergency Response	0,611	0,195	Valid
19	Y7	Emergency Response	0,675	0,195	Valid
20	Y8	Emergency Response	0,614	0,195	Valid
21	Y9	Emergency Response	0,666	0,195	Valid
22	Y10	Emergency Response	0,619	0,195	Valid
23	Y11	Emergency Response	0,650	0,195	Valid
24	Y12	Emergency Response	0,588	0,195	Valid

Based on Table 1, all questionnaire items measuring trust in early warning information and flood emergency response have calculated correlation coefficients ( $r_{\text{calculated}}$ ) greater than the critical value ( $r_{\text{table}} = 0.195$ ). Therefore, all items are considered valid and appropriate for use as research instruments.

**Table 2. Results of Instrument Reliability Testing**

Variable	Number of Items	Cronbach's Alpha	Remarks
Trust in Early Warning Information (X)	12	0,838	Reliable
Flood Emergency Response (Y)	12	0,880	Reliable

he reliability test results indicate that the variable of trust in early warning information has a Cronbach's Alpha value of 0.838, while the flood emergency response variable has a Cronbach's Alpha value of 0.880. Both values exceed the acceptable threshold of 0.70, indicating that the research instrument is reliable and demonstrates internal consistency in measuring the studied variables.

#### 4.2. Classical Assumption Testing

Prior to conducting linear regression analysis, classical assumption tests were performed to ensure that the regression model satisfied the required statistical assumptions. These tests are essential to ensure that the estimated regression parameters are unbiased, efficient, and consistent. One of the key assumptions is the normality of the data, which was assessed using the Kolmogorov–Smirnov and Shapiro–Wilk tests.

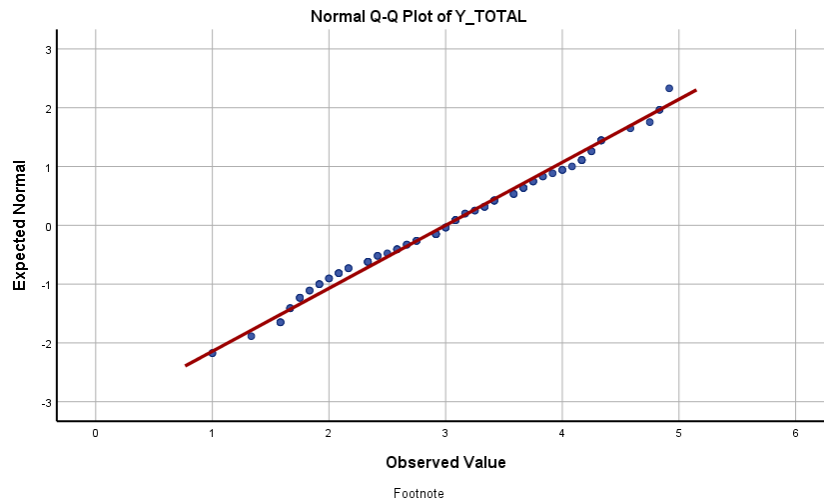
##### Tests of Normality

	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Y_TOTAL	.057	100	.200*	.983	100	.227
X_TOTAL	.062	100	.200*	.984	100	.269

**Figure 1. Normality Test**

Based on Figure 1, the Kolmogorov–Smirnov test results show a significance value of 0.200 for both X\_TOTAL and Y\_TOTAL variables. Meanwhile, the Shapiro–Wilk test results indicate significance values of 0.269 for X\_TOTAL

and 0.227 for Y\_TOTAL. All significance values exceed 0.05, indicating that the data are normally distributed. Therefore, the normality assumption in linear regression analysis is satisfied.



**Figure 2.** P–Plot Graph

Based on the Normal Q–Q Plot of Y\_TOTAL, the observed data points are distributed around and follow the direction of the diagonal line. The diagonal line represents the theoretical normal distribution, while the points represent the actual observed data. No extreme deviations or clear curvilinear patterns are observed in the distribution of points. This indicates that the data distribution approximates normality.

Visually, the proximity of the data points to the diagonal line in the P–Plot suggests that most residual values fall within the expected range of a theoretical normal distribution. There is no evidence of systematic deviations, such as sharp curvature or extreme clustering in specific areas of the plot. This condition indicates that the regression model is not influenced by significant outliers and that the prediction errors are reasonably distributed. Therefore, the assumption of residual normality is visually satisfied, supporting the reliability of the linear regression estimates used in this study.

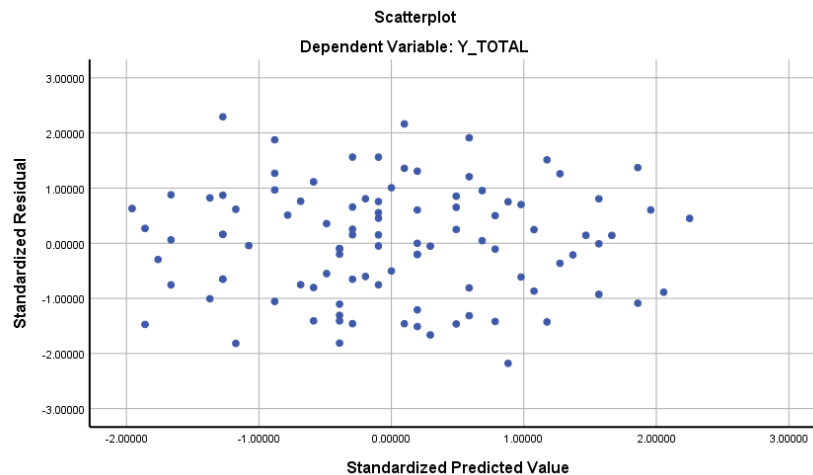
		Mean		
		Square	F	Sig.
Y_TOTAL	*Between (Combined)	.855	.971	.530
X_TOTAL	Groups	Linearity	18.399	20.891.000
		Deviation from Linearity	.368	.417 .997
	Within Groups	.881		
	Total			

**Figure 3.** Linearity Test of the Relationship between X and Y

Based on Figure 3, the linearity test results indicate that the significance value for Linearity is 0.000 ( $< 0.05$ ), suggesting a statistically significant linear relationship between trust in early warning information and flood emergency response. In addition, the significance value for Deviation from Linearity is 0.997 ( $> 0.05$ ), indicating that there is no deviation from a linear relationship. Therefore, the relationship between the independent and dependent variables can be considered linear, and the use of a linear regression model in this study is appropriate.

Statistically, fulfilling the linearity assumption is a crucial prerequisite before performing linear regression analysis, as the model can only produce accurate estimates when the relationship between variables is linear. The results of the linearity test in this study confirm that variations in flood emergency response can be proportionally explained by variations in the level of trust in early warning information. The absence of deviation from linearity indicates that changes in the trust variable are consistently followed by changes in emergency response in the same direction. Thus,

the linear regression model used in this study satisfies the necessary statistical requirements for further regression analysis and hypothesis testing.



**Figure 4.** Heteroscedasticity Test Plot

Based on the scatterplot of ZPRED and ZRESID, the residual points are randomly distributed above and below the zero line and do not form any discernible pattern, such as funnel-shaped, expanding, or wave-like distributions. The points are also relatively evenly spread across the entire range of predicted values. This indicates the absence of heteroscedasticity in the regression model. Therefore, it can be concluded that the model satisfies the homoscedasticity assumption and is appropriate for linear regression analysis.

#### 4.3. Linear Regression Analysis

To examine the effect of trust in early warning information on flood emergency response, linear regression analysis was conducted. This analysis aims to determine the direction, magnitude, and significance of the influence of the independent variable on the dependent variable. The results of the regression coefficient test using the t-test are presented in Figure 5.

**Coefficients<sup>a</sup>**

Model	Unstandardized Coefficients		Standardized Coefficients		Sig.	
	B	Std. Error	Beta	t		
1	(Constant)	1.481	.306		4.838	.000
	X_TOTA	.506	.098	.462	5.156	.000
	L					

**Figure 5.** Results of t-Test (Linear Regression Coefficients)

Berdasarkan Based on Figure 5, the t-test results show that the variable of trust in early warning information (X\_TOTAL) has a t-value of 5.156 with a significance level of 0.000 ( $< 0.05$ ). This indicates that trust in early warning information has a positive and significant effect on flood emergency response. The regression coefficient (B) of 0.506 implies that a one-unit increase in trust in early warning information leads to an increase of 0.506 units in flood emergency response, assuming other variables remain constant. The standardized coefficient (Beta) of 0.462 indicates that the effect of trust in early warning information on flood emergency response falls within the moderate category. Meanwhile, the constant value of 1.481 with a significance level of 0.000 indicates that when trust in early warning information is zero, the predicted value of flood emergency response is 1,481.

Hypothesis testing in this study was conducted using linear regression analysis to examine the effect of trust in early warning information (X) on flood emergency response (Y). Prior to further interpretation, the model was confirmed to satisfy the classical assumptions, including tests of normality, linearity, and heteroscedasticity. Based on the regression analysis results presented in Figure 5, the following equation was obtained (2):

$$Y = 1,481 + 0,506X \quad (2)$$

The regression equation indicates a positive relationship between trust in early warning information and flood emergency response. This suggests that increased public trust in the information received encourages a greater tendency to undertake emergency actions more promptly and in a more organized manner. Thus, these findings reinforce that trust is a critical factor in shaping the effectiveness of community emergency response in flood-prone areas.

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.462 <sup>a</sup>	.213	.205	.83200

**Figure 6.** Model Summary

The R value of 0.462 indicates a positive relationship of moderate strength between trust in early warning information and flood emergency response. Meanwhile, the  $R^2$  value of 0.213 suggests that the regression model has relatively low explanatory power, as the trust variable accounts for only 21.3% of the variation in flood emergency response. This finding indicates that community emergency response is a complex phenomenon influenced by various other factors beyond trust in early warning information.

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	18.399	1	18.399	26.579	.000 <sup>b</sup>
	Residual	67.837	98	.692		
	Total	86.236	99			

**Figure 7.** Results of F-Test (Regression ANOVA)

Based on Figure 7, the F-test results show an F-value of 26.579 with a significance level of 0.000 ( $< 0.05$ ). This indicates that the linear regression model used in this study is statistically significant and appropriate. Therefore, it can be concluded that trust in early warning information simultaneously has a significant effect on flood emergency response.

#### 4.4 Analysis of Trust Dynamics in Enhancing Community Response

The findings of this study empirically demonstrate that trust in early warning information plays a crucial role in driving community emergency response in Dayeuhkolot District. Based on the regression results, the coefficient of 0.506 indicates a positive and significant causal relationship. This implies that improvements in trust—whether through message accuracy or source credibility—are associated with enhanced preparedness and more effective actions to safeguard individuals, families, and property.

A deeper analysis of field conditions reveals several key discussion points:

- **Trust as a Catalyst for Action:** The findings indicate that early warning information is not automatically translated into evacuation behavior; rather, it undergoes a cognitive evaluation process by the community regarding its reliability. In the context of Dayeuhkolot, which experiences recurrent flooding, trust in early warning information serves as a critical factor in reducing uncertainty when determining the timing and type of emergency response.
- **Significance of Empirical Experience:** Repeated exposure to flood events shapes the community's collective memory regarding the accuracy of previously received early warning information. Consistent and accurate

information tends to encourage faster responses in subsequent events, whereas discrepancies may influence risk perception. This suggests that trust is dynamic and evolves through the interaction between experience and information.

- Interpretation of the Coefficient of Determination ( $R^2$ ): The  $R^2$  value of 0.213 indicates that trust in early warning information contributes to the formation of community emergency response. This finding reflects that emergency response is a social behavior influenced by multiple interacting factors, making the presence of additional variables outside the model a natural characteristic in behavioral studies.
- Implications for Early Warning Systems: The findings highlight the importance of developing early warning systems that not only emphasize technical aspects but also consider the psychosocial dimensions of message recipients. Consistency of information, source credibility, and message clarity are essential elements in building public trust and promoting more effective emergency responses.
- The Importance of Human-Centered Systems: These findings reposition the paradigm of early warning systems to extend beyond technological sophistication such as sensor or IoT capabilities toward a stronger focus on the psychosocial characteristics of users. The effectiveness of mitigation efforts largely depends on the consistency of communicated messages to prevent confusion in critical situations.

Practically, these findings suggest that relevant authorities, such as the Regional Disaster Management Agency (BPBD), should not only strengthen detection infrastructure but also develop transparent communication channels to foster public trust. The establishment of strong trust is expected to enhance community preparedness in a more structured manner, ultimately reducing potential economic losses and casualties caused by flood disasters. Although the effect of trust on emergency response is statistically significant, the relatively low coefficient of determination indicates that the effectiveness of the early warning system cannot be considered optimal when assessed solely from the perspective of trust in information. Therefore, the existing early warning system has not yet fully succeeded in comprehensively motivating community response and requires reinforcement through additional supporting factors.

## 5. Conclusion

Based on the findings, it can be concluded that trust in early warning information has a positive and significant effect on community flood emergency response in Dayeuhkolot District. This is evidenced by a regression coefficient of 0.506 with a significance level of 0.000 ( $< 0.05$ ), indicating that increased trust in early warning information is associated with improved emergency response. The coefficient of determination ( $R^2 = 0.213$ ) shows that trust in early warning information explains 21.3% of the variation in flood emergency response, while the remaining 78.7% is influenced by other factors beyond the scope of this study. These findings suggest that community emergency response is a complex phenomenon that cannot be explained by a single variable. Nevertheless, trust remains a crucial initial factor that motivates individuals to respond to early warning information. The results are consistent with the Protective Action Decision Model (PADM), which emphasizes that trust in both the source and content of information is a critical stage in protective decision-making processes. Therefore, strengthening early warning systems should not only focus on the technical aspects of information provision but also on developing consistent and credible risk communication, ensuring that warning information can be effectively translated into emergency actions by the community.

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