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Evaluation of Constraints and Obstacles to the Construction of Earthquake Resistant Houses (RTG) after the Lombok 2018 Earthquake Disaster in Central Lombok Regency, Indonesia

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ABSTRACT: *Constraints and obstacles can occur in every project, including in the implementation of earthquake-resistant housing assistance (RTG) due to the Lombok 2018 earthquake. This study aims to determine the constraints and obstacles in implementing the handling of RTG assistance due to the 2018 earthquake, to find out the factors that most influence the constraints and obstacles, and to provide recommendations to the Central Lombok District BPBD regarding the handling of RTG assistance so that it becomes more optimal if a disaster occurs in the following year. This study uses the Fault Tree Analysis (FTA) method as a research methodology and uses related sources as the theoretical basis. The results of the analysis using the FTA method obtained two main factors, namely the factor of "disturbances during the process of handling RTG assistance", and the factor of "poor management". While the most influential factor is the "poor management" factor with a probability value of 0.153, there are several solutions obtained, including: a) further increasing surveillance; b) rescheduling by prioritizing the sources of problems that have been analyzed; c) delays in disbursement can be overcome by preparing data earlier related to disbursement requirements so that delays in disbursement can be anticipated earlier.*
Keywords: *constraints, obstacles, Earthquake Resistant Houses (RTG), Fault Tree Analysis.*

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I. INTRODUCTION

Indonesia is located within the Pacific Ring of Fire. As a country situated at the intersection of four main tectonic plates, namely: i) the Pacific Plate; ii) the Eurasian Plate; iii) the Indian Ocean-Australian Plate; and iv) the Philippine Plate, the Philippines has a unique geological history [1]. The tectonic position of Indonesia has a close relationship with natural disasters, particularly geothermal natural disasters.

The Province of West Nusa Tenggara is also vulnerable to natural calamities such as earthquakes, tsunamis, volcanic eruptions, floods, and landslides due to the aforementioned conditions [2]. The 2018 Lombok earthquake is a rare occurrence, and it is essential to comprehend the behavior of the event pattern due to its unusual seismicity, which prompted panic and confusion among the inhabitants of Lombok, West Nusa Tenggara.

The following sequence of events can be described: A magnitude 6.4 earthquake occurred in Sembalun and Sambelia, East Lombok district, West Nusa Tenggara Province on Sunday, July 29, 2018. In addition to the magnitude 5 aftershocks, several large earthquakes followed the initial tremor, including a magnitude 7 quake on August 5, 2018 in Bayan, North Lombok, followed by magnitude 6.3 and magnitude 6.9 aftershocks on August 9, 2018. Natural disasters caused by these events or series of events threaten and disrupt people's lives by causing human deaths, damage to houses and public infrastructure, property loss, and psychological effects [3].

In handling the 2018 RTG in the district of Lombok, the district is currently undergoing stages/processes beginning with the formation of the District/City Technical Team, Community Assistance Team, Formation of Community Groups, Stimulant Assistance, Aid Disbursement Mechanism, Administrative Completion Preparation, and Construction Implementation. Control, Supervision, Administration, Reporting, and Accountability. Obviously, there are numerous factors that create obstacles and impede the progress of the accelerated management [4][5].

Based on the results of the verification of houses damaged by the Lombok earthquake in Central Lombok district in 2018, there were as many as 25,619 families, consisting of 2,855 families with heavy damage, 5,470 families with moderate damage, and 17,294 families with light damage. Based on the above data, BPBD Central Lombok Regency submitted a special fund request in stages of Rp. 452,440,000,000,-. From the verification results above, the Central Lombok district technical team validated the verification results for 14,714 families, consisting of 2,880 families with heavy damage, 1,660 families with moderate damage, and 1,017 families with light damage. The next validation of additional data is 10,119 families, consisting of 1,748 families with heavy damage, 1,483 families with moderate damage, and 6,888 families with light damage. So in first stage, the total recapitulation validation of verification results was 24,833 families, consisting of 4,627 families with heavy damage, 3,144 families with moderate damage, and 17,062 families with light damage spread across 12 sub-districts and 134 villages.

With the condition of imperfect data collection management, there are still victims of the earthquake that have not been recorded. This is caused by the insufficient number of identification and verification data workers and their inadequate competence, resulting in damaged house data that has not been handled. So that on August 27, 2020, the BPBD of Central Lombok Regency proposed phase II for handling RTGs with details of 2,329 families consisting of 776 families with heavy damage, 706 families with moderate damage, and 847 families with light damage. From the data from BNPB review, the proposed phase II consisted of 2,321 families, consisting of 768 families with heavy damage, 706 families with moderate damage, and 847 families with light damage [6].

The total number of RTGs handled in phases I and II was 26,370 households, consisting of 5,133 seriously damaged households with 480 community groups, 3,734 moderately damaged households with 304 community groups, and 17,503 lightly damaged households with 980 community groups. There is handling using RIKO (Conventional Instant House) and RISHA (Simple Healthy Instant House).

With the existence of various factors that influence the handling of RTGs that result in these constraints and obstacles, it is necessary to carry out further research to find out what factors cause constraints and obstacles to the handling project so that they can be used as evaluation materials and solutions for further development projects.

According to Hijah [3], the factors that influence efforts to optimize management in handling earthquake-resistant houses are the need for technical guidance for technical facilitators and community assistants in carrying out the mechanism for making earthquake-resistant houses through guidelines for implementing earthquake-resistant houses. Rini [7] proved that earthquake-resistant housing infrastructure management is carried out through short-term technical programs that focus on providing products and long-term technical assistance that focuses on sustainable development. Implementation is gradual and flexible, learning from experience, beneficiary participation, and institutional support.

Constraints and obstacles in project management

Project management is the planning, organizing, leading, and controlling of an organization's resources to accomplish predetermined short-term objectives. In addition, project management employs a systems-based methodology and a vertical and horizontal hierarchy (activity flow) [8]. Project implementation requires coordination and cooperation between organizations in a solid and structured manner. And this is the main key to ensuring that the final goal of the project can be completed according to the planned schedule.

The concept of project management, of course, has various obstacles that have the potential to hinder the achievement of project work. There are six obstacles to project management, which are: 1) Cost; 2) Time; 3) Scope (scope of work); 4) Risk; 5) Quality; 6) Resources.

Fault Tree Analysis (FTA)

According to Kocecioglu [9], Fault Tree Analysis (FTA) is a simple analysis that can be described as an analytical technique. A fault tree is a graphical model involving various parallels and various pilot combinations of errors that will result in the occurrence of unwanted events that have been defined previously or can also be interpreted as a picture of the logical interrelationships of basic events that lead to undesirable events [10], [11]. It is desired to be the culmination event of the fault tree. Fault tree analysis has important value in solving the following:

1) Analyze system failures.
2) Look for the aspects of the system involved in the primary failure.
3) Helping management know about changes in the system.
4) Help allocate the analyzer to concentrate on failure areas in the system.
5) Help provide a qualitative choice as well as a quantitative one in the analysis of system reliability.
6) Help the analyzer use his knowledge to understand the behavior of the system.

According to Brown [12], there are several basic definitions that must be known in discussing fault tree analysis, including:

1) Event is something that happens in the system. It has two modes: happening or not.

2) Fault event is an event where one of the two modes is an abnormal event, resulting in a failure or error.

3) Normal event is an event that both modes expect and tends to occur at a certain time.

4) Basic event is an event that both modes expect and tends to occur at a certain time.

5) The primary event is an event caused by the nature of the component itself.

6) Secondary events are events caused by external sources.

7) Head event is an event at the top of the fault tree being analyzed, that results in a failure.

To determine the minimum cut set used to provide answers to FTA problems using MOCUS (Method to Obtain Cut Set). MOCUS is an algorithm used to obtain a minimum cut set. According to Clemens [13], a cut set is a fault tree-forming combination that, if all occur, will cause the top event to occur. Cut sets are used to evaluate fault tree diagrams and are obtained by drawing a line through the blocks in the system to indicate the minimum number of failed blocks that cause the entire system to fail.

II. RESEARCH PROGRAM

The research was carried out in 2 sub-districts, each sub-district consisting of 6 villages, which represented the distribution of the categories of heavy damage, moderate damage, and light damage. In Table 1, the determination of villages for each sub-district as representatives to represent the results of the research comprehensively discusses the constraints and obstacles in handling the 2018 RTG in Central Lombok district.

Table 1. List of research locations by subdistrict and level of damage.

Subdistrict	Village	Level of Damage	Amount
Batukliang	1. Selebung/ Montong goak	heavy damage	69 houses
	2. Selebung / Tojong ojong timuk		164 houses
	3. Barabali/Barabali II	moderate damage	9 houses
	4. Bujak / Gunung Mujur		14 houses
	5. Mantang/ Jantuk	light damage	61 houses
	6. Mantang / Otak Desa Timur		119 houses
North Batukliang	7. Aik Bukaq/ Batu Ngerensek Lauk	heavy damage	25 houses
	8. Aik Berik /Seganteng		41 houses
	9. Teratak/ Montong Dao	moderate damage	29 houses
	10. Teratak/ Jengguar		18 houses
	11. Setiling/ Gunung Borok	light damage	23 houses
	12. Setiling / Lingkok Lime		164 houses

The following are the procedures and steps of this thesis research, which can be explained as follows:

1) Problem formulation. Identifying problems is followed by setting research objectives so that the research becomes clear and directed. Furthermore, literature studies and field studies were carried out to find references and previous research that could then be used as comparisons in carrying out this research.

2) Literature study. Several stages of the literature study that will be carried out include: a) Study of the development process of RTG handling; b) Study on project management in the development process Handling of RTG and risk assessment; c) Studies on checklist analysis and event tree analysis.

3) Secondary data collection.

4) Collection of primary data.

5) Data processing. The data obtained is then processed using the event tree analysis (ETA) method.

6) Discussion

7) Conclusions and suggestions.

After all stages have been carried out, conclusions from the research can be drawn up, as can useful suggestions for improving local government performance in handling disaster victims if they occur again and for further research development.

III. RESULTS AND DISCUSSION

Based on the results of observations and interviews conducted with people involved in the development, namely community facilitators, POKMAS, village heads, and BPBD, project data was obtained. The data is identified so that it can be made into a schematic FTA diagram by determining the Top Event as the first step. After the FTA (Fault Tree Analysis) diagram has been completed, the next step is to carry out a quantitative Fault Tree analysis using logic gate laws.

Data collection methods used in this study were interviews and expert judgment; namely, the respondents who filled out the questionnaire were people who participated directly in the implementation of development and people who were experienced in their fields. The results of the analysis using the FTA method obtained a minimum cut set combination, which can be seen in Table 2.

Table 2. Recapitulation of minimal cut set analysis.

Event Code	Event Description	Probability
	Top Event	**0,22**
P1	**Disturbances during the process of handling RTG assistance**	**0,080**
A	Collection data of the beneficiary	0,537
B	Procedure for disbursing funds to the beneficiary	0,553
C	The number of human resources owned by both field facilitators (TFL) and community groups (Pokmas)	0,668
D	Poor worker productivity	0,865
E	The number of builders or workers is limited	0,905
F	Technical and non-technical conditions in the field	0,886
G	Design changes	0,668
H	Potential Supplier as Partners	0,876
P2	**Poor Management**	**0,153**
I	The execution didn't run well.	0,598
J	The original plan was not implemented	0,421
K	Poor finances	0,610

To find out the comparison of events between each of the main intermediate events in each village, see Figure 1.

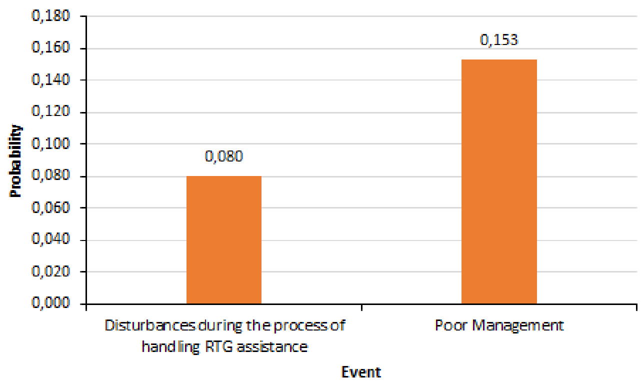

Fig. 1 Comparison of the minimal cut set analysis between the main intermediate event Disturbances during the process of handling RTG assistance and Poor management.

Based on data analysis using the FTA method, two obstacles exist in the implementation of handling earthquake-resistant housing (RTG) assistance as a result of the 2018 earthquake, as shown in Table 2. The first factor is disturbances during the process of handling RTG assistance, which is caused by several events including the process of collecting data on recipients of aid, procedures for channeling beneficiary funds, the number of human resources both field facilitators (TFL) and community groups (Pokmas) have, poor worker productivity, and the number of human resources both field facilitators (TFL) and community groups (Pokmas) have. While the second factor is poor management, which is motivated by several events such as execution not going well, initial planning not being carried out, and not having good finances.

Based on Fig. 1, it can be seen that the probability of unfavorable management events is greater than the probability value of disturbance during the process of handling RTG assistance. The factor that has the most influence on the obstacles and obstacles in the implementation of handling earthquake-resistant housing assistance (RTG) due to the 2018 earthquake is the unfavorable management factor with a probability value of 0.153.

From the results of this analysis, poor management factors are the biggest factors causing constraints and obstacles in the implementation of handling earthquake-resistant housing (RTG) assistance due to the 2018 earthquake. Poor management factors are motivated by several events, such as execution not going well, initial plans not being accomplished, and being financially unfavorable. Therefore, some suggestions and recommendations to overcome these problems include:

1) Further increase the supervision of ongoing work.

2) Implementing a new rescheduling of the existing planned schedule by prioritizing the sources of problems that have been analyzed.

3) While the occurrence of unfavorable finances caused by delays in the disbursement of funds originating from APBN, BNPB, and BPBD and delays in the disbursement of funds at community groups (Pokmas) can be avoided by preparing data related to disbursement requirements in advance so that delays in the disbursement of funds can be anticipated in advance.

IV. CONCLUSION

Based on the results of research conducted using the FTA method, the following conclusions can be drawn:

1. There were two constraints and obstacles in the implementation of handling earthquake-resistant housing assistance (RTG) due to the 2018 Lombok earthquake, namely the first factor from disturbances during the process of handling RTG assistance and the second factor from poor management.
2. The factor that has the most influence on the constraints and obstacles in handling earthquake-resistant housing assistance (RTG) due to the 2018 earthquake is the unfavorable management factor, with a probability value of 0.153.
3. There are several solutions obtained to anticipate constraints and obstacles in development, including: a) further increase the supervision of ongoing work; b) implementing a new rescheduling of the existing planned schedule by prioritizing the sources of problems that have been analyzed; c) delays in the disbursement of funds can be overcome by preparing data earlier regarding disbursement requirements so that delays in disbursement can be anticipated earlier.

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