Integration of Participatory Action Research Approaches in Realizing Disaster Preparedness

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Abstract
The research problem is that disaster-resilient villages (Destana) experience difficulties in realizing the parameters of an early warning system and mobilizing resources for disaster preparedness. The research aims to facilitate the Destana forum in realizing elements of an early warning system and resource mobilization in the disaster preparedness phase. These two parameters are priority parameters based on selection using the Quadrant of Difficulty and Usefulness analysis approach. The type of research that has been carried out is Action Research, with a Participatory Action Research (PAR) design. The research population was 150 Destana forum administrators. The research locations are in Ngelang and Jajar villages, Kartoharjo subdistrict, Alastuwo subdistrict, Poncol subdistrict and Randugede village, Plaosan subdistrict. The selection of research locations was based on the village disaster risk index. The object of the research is the forum's ability to prepare village resilience assessment documents, early warning system procedures and contingency plans and to establish a command structure for disaster emergency management, to develop disaster event scenarios and to prepare rehearsal operation plans for disaster emergency response simulations. The research was conducted from February to June 2024. Action research procedures include planning, implementation, observation and reflection stages. The research results illustrate that the integration of participatory action studies can empower the Destana forum in realizing disaster preparedness parameters. Participation of participants in each stage of the cycle was very good. The PAR approach can build collective responsibility in realizing community-based disaster preparedness.

Keywords: Preparedness, disaster, participatory, action research.

Introduction

Disaster preparedness parameters consist of: 1) Knowledge and attitudes, 2) Policy, 3) Emergency response plan, 4) Early warning system and 5) Resource mobilization[14]. Research on the priority of combined disaster preparedness parameters using the Quadrant of Difficulty-Usefulness (QoDU) method showed that resource mobilization parameters and early warning systems are priorities that must be realized by disaster-resilient villages (*Destana*)[29]. In terms of parameters forming elements, the main priorities are assessing village resilience, developing early warning system procedures, involving vulnerable groups in early warning outreach, submitting proposals for disaster management funding, realizing contingency plan documents, developing a command structure for disaster emergency management and preparing disaster event scenarios. for emergency response simulation. These preparedness elements are difficult for disaster-resilient villages to realize but have very high benefits.

During the period 2019-2022 in East Java, there have been 1,283 disasters. The disaster caused 142 deaths, 380 people were injured, 34,043 houses were damaged and 383,525 people were affected by the disaster[7]. Types of disasters include floods, strong winds, flash floods, droughts, earthquakes, landslides, volcanoes, forest and land fires, pandemics and liquefaction. The high incidence of disasters has not been offset by the formation of disaster-resilient villages. During the period 2019-2022 in East Java, a total of 1,542 Destana were formed[4]. In the Magetan district, out of 235 new villages, there are 31 Destana[4].

Geographically, Magetan district is located at an altitude of 660-1660 meters above sea level, has an area of 688.85 Km^2, a population of 670,810 people with a density level of 913/Km^2. The climate in the Magetan district which is in the highlands, has a temperature of around 16-20^oC while in the lowlands, the temperature is around 22-26^oC.

Rainfall is more than 299 mm per month, with a rainfall frequency of between 90 and 140 times per year[1]. Based on demographic and topographic aspects, Magetan district has a high disaster risk index, especially the threat of floods, strong winds and landslides. The Destana forum experienced many obstacles in realizing community-based disaster preparedness. This obstacle has an impact on the low level of community resilience in reducing disaster risks and resilience in facing disaster threats. This problem arises because not all forums know the priority activities to be implemented in building community preparedness to face disasters. Without a clear understanding of activity priorities, disaster education in the community is very lacking, infrastructure development without regard for disaster risk reduction, prevention and mitigation activities is not carried out, emergency response simulations are not carried out, there is a lack of coordination in emergency response and there is no collaboration with various parties in disaster management.

As a result, villages are not optimally prepared to face disasters, which can increase the risk of loss of property and life when a disaster occurs. Without proper priorities, public trust in the forum's existence will be lower. The solution offered to reduce the impact of disasters is the empowerment of forums for resilience and resilience in facing disasters[20]. This solution is carried out by increasing the capacity of volunteers who are members of forums to carry out prevention, mitigation and preparedness[21], providing sufficient funding[24], the commitment of all parties[26] and facilitating capacity to realize preparedness elements so that the community is ready and alert in anticipation disaster[33]. A suitable approach is a participatory action research model (PAR Models)[8,17].

The participatory action review stages are in the form of a cycle that begins with planning, implementing, observing and reflecting. This participatory action research is iterative, meaning plans are made, then implemented, corrected if something is not quite right, observed and reflected, the final result is not absolute but sustainable[9]. The novelty of this research lies in the integration of participatory action studies in empowering the Destana forum in realizing disaster preparedness without reducing local knowledge and culture in preparedness strategies. This approach not only involves the active participation of all elements of society but also allows them to continuously update and adapt preparedness strategies based on real experience. This differs from previous research in that it may not have fully utilized digital technologies, not deeply integrated local knowledge, or not provided room for ongoing evaluation and adjustment by the community.

Material and Methods

The type of research that has been carried out is action research, with a Participatory Action Research (PAR) design. The research cycle uses four stages from Kemmis and McTaggart, starting from planning, acting, observing and reflecting[34,30]. Research locations are in the villages of Randugede Plaosan, Alastuwo Poncol, Ngelang and Jajar Kartoharjo Magetan. The research location was selected using purposive sampling based on the frequency of disaster events, type of disaster, village resilience category and the activeness of the Destana forum. The research was conducted from February to August 2024. The research participants were 150 people consisting of 40 people from the Destana Ngelang forum, 40 people from the Destana Jajar forum, 40 people from the Destana Alastuwo forum and 30 people from the Destana Randugede forum.

The object of research was the ability of the Destana forum to realize elements of two disaster preparedness parameters, namely early warning system parameters and resource mobilization parameters. These two parameters are priority parameters based on the Quadrant of Difficulty and Usefulness (QoDU) model. The planning and implementation stages were carried out by the researchers and the participants. The observation stages were carried out by enumerators. The reflection stages were carried out by the researchers and the participants. If the results of observation and reflection do not produce results, carry out a second cycle and so on until successful.

The research procedure starts with planning activities: 1) determining the activity schedule, 2) agreeing on the activity objectives, 3) agreeing on the activity topic, 4) preparing observation sheets and reflection sheets and 5) compiling a participant activity rubric. The implementation stage is carried out based on the activity schedule. Participants complete the activity module that has been prepared by the researchers. In the observation stage, the researchers observe participant participation in activities, processes and output of activities completed by participants. The final stage is reflection, namely reflecting on the results of the activities carried out by the participants.

Data collection techniques were interviews, observation and secondary data. The research instrument is an observation sheet. Data obtained from interviews, observations and secondary data were analyzed qualitatively and descriptively. The data analysis steps go through the stages of data reduction, data presentation and data verification[25]. A series of research activities have been declared ethically appropriate by the Surabaya Ministry of Health Polytechnic Health Research Ethics Commission number: EA/2198 /KEPK-Poltekkes_Sby/V/2024.

Results

The results of the study of participatory action on the empowerment of the Destana forum in realizing village resilience assessments can be completed in one research cycle. The results are shown in table 1. The results of the reflection on the level of participants' understanding of how to assess village resilience in the four research locations, are categorized as good.

The results of the study of participatory action on the empowerment of the Destana forum in realizing procedures for disaster management budget proposals to the village government can be completed in one cycle. The level of participants' understanding of the content and template of the disaster management budget proposal form increased from an average of 4.3 to an average of 6.8 with a score range of 1-10 (Figure 1).

The results of the study of participatory actions to empower the Destana forum in realizing the availability of procedural documents for early warning systems for disaster threats can be completed in one cycle. Of the four research locations, only one location does not yet have an early warning system document, namely Alastuwo village. The results of secondary data observations are stated in table 2. The results of observations regarding the output of early warning system procedure documents produced by each participant in each village were very satisfying and could be understood by all participants during the plenary session. Activity output is

given in table 3. As a result of reflection on participants' understanding of the early warning system and early warning flow or procedures, the average score was very good (9.6) from a score range of 1-10.

The results of the participatory action study show that the empowerment of the Destana forum in socializing the early warning system to vulnerable groups and people with disabilities in disaster-prone areas in each village has been successfully implemented. The early warning system team and socialization area for each village have also been determined. Each Destana has agreed to form an early warning system team consisting of three personnel, although the scope of the socialization area, the number of vulnerable groups and disabilities vary in each village.

The time required for socialization by each personnel also varies, but is still in one activity cycle. Destana Ngelang covers neighborhood units (RT) 9 and 17, Destana Jajar covers RT 17 and 18, Destana Alastuwo covers RT 3 and 27 and Destana Randugede covers RT 14. In addition, a risk area map has been prepared showing the location of early warning socialization for each village (Figure 2). Assistance and facilitation are carried out in one activity cycle.

Table 1
Village resilience assessment results

Disaster Resilience Component Index Score					
		Ngelang	**Jajar**	**Alastuwo**	**Randugede**
Component 1	Basic Services	0.91	0.84	0.79	0.74
Component 2	Disaster Management Regulations and Policies	1.00	0.96	0.68	0.84
Component 3	Prevention and Mitigation	0.87	0.93	0.47	0.60
Component 4	Emergency Preparedness	0.77	0.77	0.33	0.73
Component 5	Recovery Preparedness	0.70	0.70	0.60	0.20
Total Score		84.95	84.06	57.31	62.32
Village Resilience Category ≤58.33 = Primary 58.34-83.33 = Intermediate ≥83.33 = Main		Main Resilient	Main Resilient	Primary Resilient	Intermediate Resilient

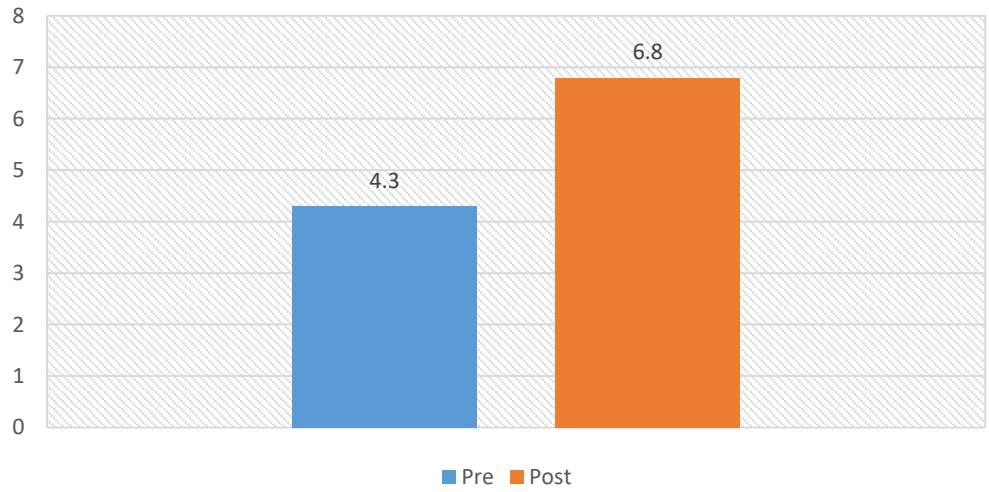

Figure 1: Average understanding of participants regarding the proposed disaster management budget

Table 2
Results of identifying the availability of early warning system procedure documents in each research location village

S.N.	**Village/Subdistrict**	**Availability of early warning procedure documents**	**Manufacturing**	**Information**
1	Ngelang	Available	Made in 2020	Needs updating
2	Jajar	Available	Made in 2020	Needs updating
3	Alastuwo	Not yet available		
4	Randugede	Available	Made in 2023	Needs updating

Source: Destana indicator documents for each village

Table 3
Observation results of participants' understanding of the technicalities of developing early warning system procedures

S.N.	Items Containing Early Warning System Procedures	Information
1	Early warning form	Understood
2	The reason the community did not respond to early warnings	Understood
3	Principles of Effective Early Warning	Understood
4	Time provides early warning of priority disaster threats	Understood
5	Danger warning source	Understood
6	How to monitor hazards	Understood
7	How to convey the presence of danger	Understood
8	How to ensure the correctness of warnings	Understood
9	Who has the authority to provide early warning	Understood
10	Who is the target of early warning?	Understood
11	How to deliver early warnings to inclusion groups	Understood
12	Community response to early warnings	Understood
13	Standar operating procedur templates	Understood
14	Responsible for preparing standar operating prosedure early warning system (SOP-SPD)	Understood
15	Description of early warning procedures	Understood
16	The official who determines the standar operating prosedure early warning system (SOP-SPD)	Understood

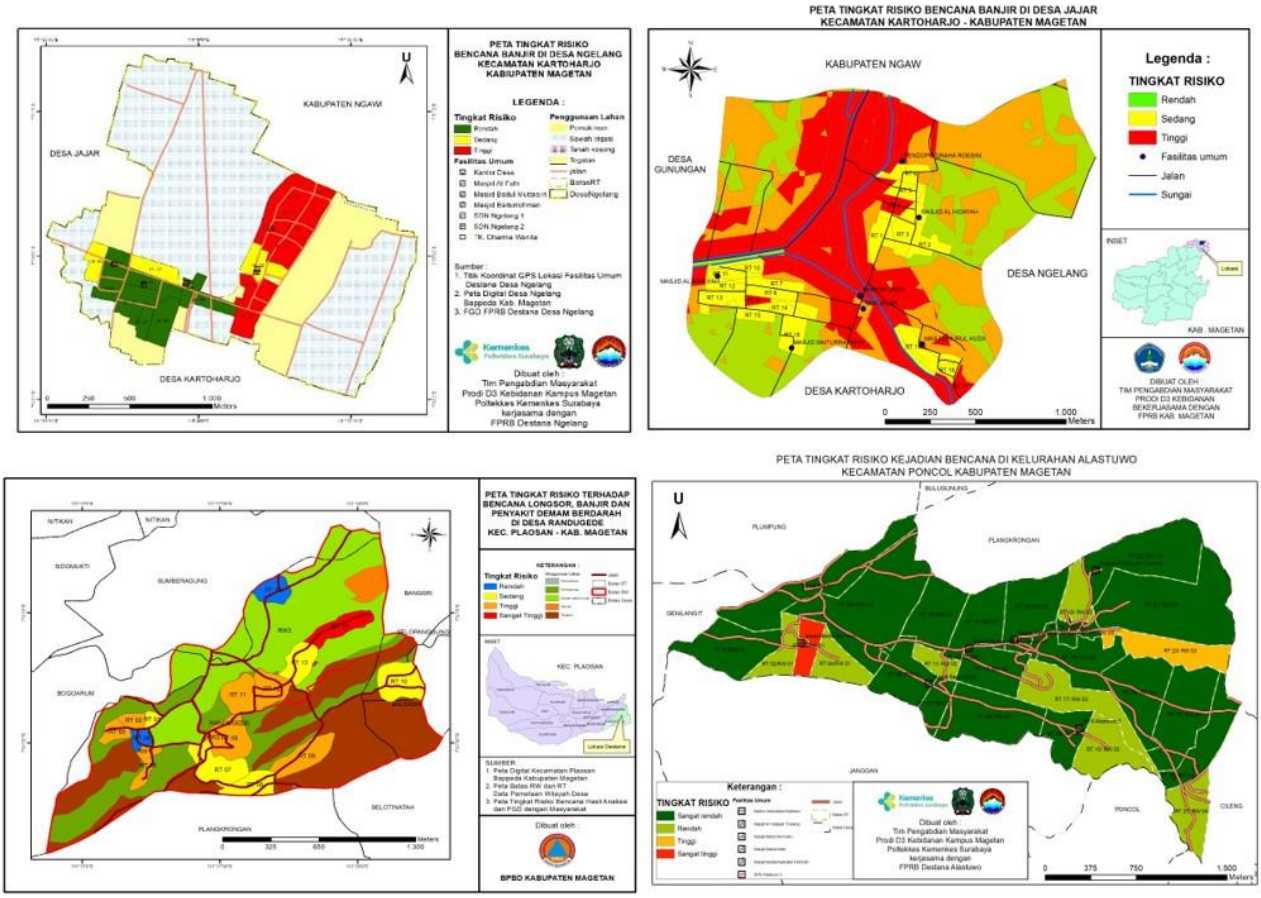

Figure 2: Disaster risk map in each village as a target for socialization of the early warning system

The results of the study of the participatory action of empowering the Destana forum in realizing the availability of contingency plan documents in each village were completed in two activity cycles. The results of secondary data identification showed that only Alastuwo village did not have a contingency plan document as shown in table 4. The level of participants' knowledge about the contents of the contingency plan document before and after mentoring

increased very significantly. Initially, the average score was 17.05 which increased to 47.03. This achievement score included 75% of participants understanding the contents of the contingency plan document. The results of participatory observations carried out by observers regarding the dynamics of group work are described in table 5. Completion of the contingency plan document required two mentoring cycles because the results of the first cycle were less than satisfactory. Summary of the assistance as shown in table 5.

Table 4
Results of document study regarding contingency plans for each village

S.N.	Destana Forum	Contingency Plan Document			
		Initial Conditions	Status	Determination by Village Head's Decision Letter	Threat of Disaster
1	Ngelang	There isn't any yet	New	188/36/Kept./403.415.6/2024	Flood
2	Jajar	Already available	Updates	188/37/Kept./403.415.5/2023	Flood
3	Alastuwo	There isn't any yet	New	07/188/403.401.1/2024	Landslide
4	Randugede	Already available	Updates	262 of 2023	Landslide

Table 5
Summary of the results of assistance in preparing contingency plan documents

S.N.	Destana Forum	Discussion Group	Task	First Cycle Observation Results	Second Cycle Observation Results
1	Ngelang	Group 1,2,3 and 4	1. Complete a worksheet on disaster history, types of threats, types of vulnerabilities, various capacities and risk assessments for each community unit 2. Create a risk map 3. Complete disaster event scenarios 4. Prepare the SKPDB structure, tasks and operational plan requirements	As expected	No need for second cycle
2	Jajar	Group 1,2,3 and 4	1. Complete a worksheet on disaster history, types of threats, types of vulnerabilities, various capacities and risk assessments for each community unit 2. Create a risk map 3. Complete disaster event scenarios 4. Prepare the SKPDB structure, tasks and operational plan requirements	As expected	No need for second cycle
1	Alastuwo	Group 2	Create a risk map	The risk map can be completed, but the results do not meet expectations and active participants	The risk map can be completed and the results are as expected
		Group 3	Complete threat scenarios, impact scenarios and disaster event scenario narratives	The worksheet can be completed, but the results are not as expected and the participants are active	Priority disaster event scenarios can be completed and the results are as expected
		Group 4	Complete SKPDB, tasks and operational plan requirements	The worksheet can be completed, but the results are not as expected and the participants are active	The operational team's needs plan can be completed and the results are as expected
4	Randugede	Group 3	Complete threat scenarios, impact scenarios and disaster event scenario narratives	The worksheet can be completed, but the results are not as expected and the participants are active	Priority disaster event scenarios can be completed and the results are as expected

Table 6
Observation results of participants' ability to prepare operational plans for disaster emergency response simulation rehearsals

S.N.	Destana Forum	Rehearsal Operation Plan	Disaster	TTX	Perpetrator
1	Ngelang	According to the template, there are 6 scenes	Flood	Agreed	SKPDB
2	Jajar	According to the template, there are 6 scenes	Flood	Agreed	SKPDB
3	Alastuwo	According to the template, there are 5 scenes	Landslide	Agreed	SKPDB
4	Randugede	According to the template, there are 5 scenes	Landslide	Agreed	SKPDB

Note: SKPDB stands for disaster emergency management command structure.

The results of the participatory action study showed that the empowerment of the Destana forum in preparing operational plan documents for disaster emergency response simulations was successfully completed in one cycle (table 6). The level of understanding of the participants was generally in the good and very good categories. All group discussion results from participants were considered appropriate and ready to be followed up to carry out scenario simulations in the room (TTX/table top exercise).

Discussion

The Participatory Action Research (PAR) approach has proven effective in various community empowerment contexts including efforts to improve disaster preparedness at the village level[32]. This method emphasizes collaboration and active participation of members of the disaster-resilient village forum (Destana) in every stage of research and action, from problem identification to solution implementation. The application of PAR in empowering the Destana Forum is very relevant, especially in preparing comprehensive and contextual disaster preparedness documents[5,31].

Disaster Resilient Villages is a concept that integrates various aspects of prevention, mitigation, preparedness, emergency response and disaster recovery in one community unit[2,11]. Empowering the Destana forum through a PAR approach allows the forum to become an active subject in the process of preparing preparedness documents, not just an object of an external program.

Factors causing participants to experience difficulties in providing preparedness documents that form the parameters of early warning systems and resource mobilization include: 1) lack of experience, 2) not having a budget, 3) do not know how to prepare them, 4) do not understand the contents of the document and 5) do not have activities in the preparedness sector. Some of these causal factors are very realistic considering that after the Destana forum was formed, they rarely carried out activities according to the work program that had been created. The involvement of the pentahelix elements in the forum is key to the forum's performance in the field of preparedness[27]. The role of academics, government, mass media, village-owned enterprises, non-governmental organizations and volunteers is very much needed to integrate PAR methods into prevention, mitigation and preparedness activities[22,28].

Participatory mentoring methods have proven effective in realizing village resilience assessment documents. This approach involves local stakeholders in the assessment process, ensuring that a variety of perspectives and local knowledge are included in the final document. This increases the sense of ownership and commitment to the implementation and follow-up of recommendations from the assessment results. The use of a participatory approach in assessing city resilience to climate change has succeeded in strengthening the implementation of sustainable urban drainage systems[19]. In addition, participatory approaches in assessing climate resilience have also been proven to increase the adaptation and resilience of agricultural communities to various shocks such as floods and droughts[10].

In conclusion, participatory mentoring methods play an important role in creating more accurate and implementable village resilience assessment documents, by increasing the involvement and commitment of local communities and identifying solutions that are more appropriate to the local context. The participatory approach in preparing early warning systems (EWS) documents is very effective in ensuring that the system is not only accurate but also acceptable and responsive to vulnerable and disabled groups. Through the active participation of the Destana forum in developing early warning system procedures, EWS documents become more relevant and are able to integrate local knowledge that is often not accessible by top-down methods. The participation of the Destana forum in this process allows the collection of more complete and contextual information.

By involving the Destana forum community in each village that is the research locus, early warning forms, socialization methods and socialization targets are truly appropriate. This statement is proven by the presence of vulnerable groups, especially the elderly, to receive outreach on the importance of early warning. Collaboration between Non-Governmental Organizations and local communities in developing EWS

can overcome obstacles caused by vulnerable socio-political conditions and territorial violence[22]. This approach ensures that the early warning system is built not only to prioritize technical but also social aspects. The EWS principle must pay attention to warning recipient groups such as vulnerable groups and people with disabilities. EWS procedures must be simple and acceptable to these vulnerable groups. Direct involvement of vulnerable groups in the planning and implementation of EWS strengthens their ownership and commitment to the system. Research shows that community-controlled systems are more likely to be long-lasting and effective in reducing disaster risk[26].

A participatory approach through the action study method has proven effective in making it easier for the Destana forum to prepare contingency plan documents and to rehearse operational plans for emergency response simulations. This approach not only empowers the community but also ensures that the contingency plan documents prepared are truly relevant and can be implemented in the field. The research results show that community participation in the contingency planning process allows for the collection of more accurate and contextual information. By involving local communities, the documents prepared can be more responsive to the specific needs and conditions of each village. A community-based approach to disaster risk management has resulted in more effective and operational planning documents at the local level[31].

The active participation of the Destana forum in preparing the rehearsal operation plan document helps to ensure that the emergency response simulation carried out follows the reality on the ground. In this way, the exercises held become more relevant and effective in preparing the community to face real emergencies. In several countries, this approach has been applied to integrate early warning systems into people's daily lives, improving preparedness and response to disasters[16]. Research using participatory action research methods strengthens coordination between various stakeholders including local governments, non-governmental organizations and communities. This good coordination is important to ensure that all parties are involved and contribute to the preparation and implementation of contingency plans. Programs that adopt participatory methods demonstrate success in sustaining long-term disaster risk reduction activities[12].

A participatory approach through the action study method has shown significant results in increasing community resilience to disasters in Indonesia. Experience from various case studies shows that active community involvement in the planning and implementation process of disaster risk reduction programs is very effective. The experience of disaster management in Aceh district and the application of participatory methods after the 2004 Tsunami, shows that community involvement in the reconstruction and rehabilitation process increases their sense of ownership and responsibility for the programs being implemented including the development of early warning systems and mapping of risk areas[6].

The implementation of participatory action research in Central Java and Lombok, Indonesia, in the disaster resilient village, shows that communities are better prepared to face emergencies. The community not only participates in preparing contingency plan documents but also in emergency response simulation exercises. A participatory approach increases community resilience in the reconstruction of earthquake-resistant houses. Overall, evidence from various regions in Indonesia shows that a participatory approach in disaster risk management not only increases the effectiveness and relevance of programs but also strengthens the capacity and resilience of communities in facing various disaster threats[18]. Communities that have direct experience with disasters or who have a high-risk perception tend to be more aware and active in participating in disaster mitigation and preparedness activities.

Government support and involvement are also a crucial factors. Support in the form of policies, funding and facilitation of disaster mitigation and preparedness activities by the Government can increase the effectiveness and participation of the community in Destana forum activities. Government that is proactive in supporting forum activities tends to increase people's motivation to get involved in forum activities. In addition, subjective norms and behavioral control also influence community participation. If people feel positive social support and have the correct perception regarding disaster prevention, mitigation and preparedness, their participation in disaster preparedness activities tends to be higher.

There are several obstacles faced in this participatory action research activity. Lack of knowledge and low attitude, lack of funding, high vulnerability, lack of capacity, unavailability of risk maps, lack of disaster risk warnings, lack of disaster outreach and education and rare emergency response simulations are some of the main obstacles in the participatory empowerment of the Destana forum[15]. Villages with financial and material limitations find it difficult to implement effective preparedness programs. Apart from that, public indifference or apathy is also an obstacle. Not all members of society have the same awareness regarding the importance of disaster preparedness, some may feel that disasters are something that cannot be avoided, so they feel there is no need to prepare themselves[13]. Geographical complexity and inadequate infrastructure also add to the challenges in implementing preparedness activities in several regions[4].

By understanding the influencing factors and existing constraints, more effective strategies can be designed to empower the Destana forum in a participatory manner to increase community awareness and preparedness for disasters. To increase community participation in the

Destana forum in a participatory manner, several strategic efforts can be made. First is to increase education and training through disaster management programs and community action plans[23]. This education can be done through disaster emergency response simulation exercises which can increase community knowledge and preparedness. The use of information technology such as mobile applications and social media is also effective in disseminating information and building awareness of the importance of early warning and in understanding the characteristics of various threats. Additionally, partnerships with governments and non-governmental organizations (NGOs) can strengthen support and resources for disaster preparedness programs[2,3].

Conclusion

A participatory action review approach to realizing disaster preparedness has been applied to the Destana forum. The research results were significantly able to create village resilience assessment documents and disaster management budget proposals, to develop early warning system procedures, to socialize early warning systems to vulnerable and disabled groups, to create contingency plan documents and to prepare operational plans for disaster emergency response simulation rehearsals. The Destana Forum and the community are fully involved in every stage, starting from the planning, implementation and reflection stages.

The participatory action review approach can build a sense of collective ownership and responsibility in realizing community-based disaster preparedness. Mentoring activities carried out by facilitators play an important role in increasing community awareness and participation. Support from the Government and non-government organizations in providing resources, budgets and policies as well as the involvement of community leaders are determining factors in the level of participation of the Destana forum in disaster preparedness activities.

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