DISASTER RESILIENCE PARTNERSHIP ON INCLUSIVE EARLY WARNING SYSTEM AND SIBAR (FLOOD INFORMATION SYSTEM) IN RT. 13, PONDOK BETUNG, SOUTH TANGERANG

Anggun PUSPITASARI[1*], Arin FITHRIANA[2], Taqwa Putra Budi Purnomo Sidi HIRAM[3], Rezvia Sharla A[4], Jeremy Putra PRATAMA[5]
[1,2,3,4,5] ***Universitas Budi Luhur, Jakarta, INDONESIA***
[*]***anggun.puspitasari@budiluhur.ac.id***

ABSTRACT

RT. 13 Pondok Betung, Pondok Aren, South Tangerang is a disaster-prone area, especially flooding. Flooding occurs almost every heavy rain. One of the main problems faced by residents is the lack of knowledge and understanding on disasters which influences unpreparedness and mitigation. This community service program – PKM aims to improve disaster preparedness in RT. 13 through a technology-based and educational approach. This program introduces an inclusive Early Warning System (EWS) and a technology-based flood information system- SIBAR. The technology is integrated with the WhatsApp application. The PKM method includes several stages. First, socialization and education for residents about the importance of disaster preparedness, including how to understand and respond for early warnings. Second, an introduction to the inclusive EWS (Early Warning System) SIBAR (Submerged Flood Information System) so that all residents, especially vulnerable groups such as the elderly and people with disabilities, can utilize it effectively. Next, an evaluation was conducted based on the results of pre- and post-tests using questionnaires administered to participants. This PKM activity resulted in increased understanding among residents of RT 13, as partners and participants, regarding flood mitigation through the use of technology, partnerships, and the importance of strengthening community resilience

Keywords: Disaster Resilience, Early Warning System (EWS), Flood, Flood Information System (SIBAR),

1. INTRODUCTION

RT. 13 Pondok Betung, located in Pondok Aren District, South Tangerang, is an area with a high population density and environmental conditions that are prone to disasters, especially flooding. This area is located in a basin with a suboptimal drainage system, so during heavy rainfall, water cannot drain smoothly, causing pooling that leads to flooding. (Tempo, 2025) Based on observations and interviews with local residents, major flooding occurs almost every year, especially during the rainy season. The organizing team also conducted field research in the form of interviews with RT (neighbourhood association) administrators and the South Tangerang Regional Disaster Management Agency (BPBD). Flood Potential in Banten Province, based on data analysis from the Banten Regional Disaster Management Agency (KRB) Document, indicates that the South Tangerang City area has a high potential for hazards. (KRB, 2021) In addition, a Geographic Information System (GIS)-based analysis was conducted to more accurately map flood-prone areas.

Figure 1. Geographic Information System (GIS) Flood Hazard Mapping in Pondok Betung

Figure 1. GIS Mapping of Flood Hazard in Pondok Betung. Mapping shows that RT. 13 Pondok Betung is in the red zone due to a combination of high rainfall, minimal water absorption, and an inadequate drainage system. (Detik, 2025) In addition to geographic factors, limited public knowledge about disaster mitigation exacerbates the impact of flooding. Most residents do not have an early warning system (EWS) to anticipate disasters. Residents rely solely on information from neighbours or social media, which is not always accurate and timely. Therefore, a technology-based information system is needed that can provide early warnings and assist residents in taking appropriate mitigation measures.

Target Partner Condition: Pondok Betung is one of eleven sub-districts in Pondok Aren. In 2023, the population was approximately 33,372, with 16,611 males and 16,761 females. Pondok Betung Village is an area bordering Jakarta, consisting of 8 Community Units (Rukun Warga) and 72 Neighbourhood Units (Rukun Tetangga). Socio-economically, the majority of residents in RT. 13 earn their living as informal workers and small traders. (Sipitung, 2025) In terms of accessibility, RT. 13 has limited road and drainage infrastructure. During floods, the main road in RT. 13 Pondok Betung is often inundated to a depth of 30–50 cm, making it difficult for vehicles to pass. As a result, residents' economic activities are disrupted and access to health facilities is limited. According to data from the South Tangerang Regional Disaster Management Agency (BPBD), the major flooding that occurred in early 2025 affected more than 70 houses, with 25 houses suffering minor to moderate damage, and around 150 residents were forced to evacuate to safety. (Amelia, 2025)

Furthermore, the suboptimal emergency communication system exacerbates the situation during disasters. Delays in information provide residents with insufficient time to secure valuables, important documents, or even evacuate to a safer location. Another impact is the increased risk of post-flood illnesses, such as diarrhea and skin infections, due to contaminated standing water. (Khaidir, 2019)

Figure 2. Condition of RT. 13 Pondok Betung during the January 2025 flood.

In fact, this impact could have been minimized if residents were more careful in recognizing early signs of flooding, such as a significant increase in rainfall, increased water discharge in drainage channels, or warning information from the BMKG (Meteorology, Climatology, and Geophysics Agency) and the Regional Disaster Management Agency (BPBD). Digital literacy remains low, especially regarding the use of technology for disaster mitigation. Many residents do not understand how to access or use online applications that can provide early warnings of disasters. This situation requires more systematic and integrated mitigation efforts to minimize the impact of disasters. (Husniawati, 2023)

Based on the partner's situational analysis, the problem was developed from two main focuses: understanding disaster literacy awareness and environmental preservation as part of social and humanities studies, and disaster risk management using appropriate technology and disaster standard operating procedures (SOPs) as part of management studies. From these two focuses, the problem was further categorized into four main issues:

1. Low Public Awareness and Understanding of Disaster Mitigation – RT Residents. 13 Pondok Betung residents still have minimal understanding of disaster prevention and preparedness measures, particularly flooding.
2. Lack of an Inclusive and Easily Accessible Early Warning System – The community does not yet have an integrated system for early detection and warning of potential disasters. Flood-related information is still delivered manually, making it ineffective and often delays warnings to residents.
3. Lack of a Flood Information System Integrated with Digital Technology – Currently, there is no platform that can connect the community with real-time information regarding flood conditions. Therefore, the development of a Flood Information System (SiBAR) that uses sensors for early flood detection is needed.

4. Lack of Active Community Role in Disaster Risk Management – There is no mechanism for organizing the community for disaster preparedness, including the structuring of disaster organizations at the neighbourhood (RT) level.

Community involvement in risk mapping and mitigation measures is still low. The PKM team consists of lecturers and students who aim to increase participants' understanding of disaster literacy, including the Early Warning System, regional planning that makes it easier for residents to anticipate the impact of disasters. This program is in line with SDG 11: Sustainable Cities and Human Settlements and SDG 13: Climate Change Management, by encouraging the use of technology in disaster mitigation and increasing community resilience to climate change. This activity also provides off-campus experience for students, lecturers' off-campus activities with work results in the form of the application of appropriate technology through the Flood Information System (SiBAR) equipped with sensors to detect flood levels. With this, residents can be better prepared to minimize the impact of disasters. This activity is also in line with Asta Cita, especially in efforts to build from the village and from the bottom up for economic equality and poverty eradication, by increasing community capacity in dealing with disasters so that economic impacts can be minimized. Within the context of the National Research Master Plan (RIRN), this program supports research in the fields of defense and security and the environment, by developing community-based disaster mitigation technology for national security.

Based on a partner situation analysis, the main problems faced by residents of RT 13 Pondok Betung, South Tangerang, are developed from two main focuses: understanding disaster awareness (Early Warning System), environmental preservation (social and humanities), and disaster risk management using appropriate technology (management). Based on these two focuses, the problems are further categorized into four main priorities that will be addressed in this program:

1. Low Public Awareness and Understanding of Disaster Mitigation. Residents still have minimal understanding of disaster mitigation and preparedness measures, particularly in recognizing early signs of flooding and how to reduce its impact. One approach that will be introduced is the use of hydroponic plants as a natural solution to reduce flood risk. Planting hydroponic plants in yards or vacant land can help increase water absorption while providing economic benefits for residents through independent vegetable production. Unfortunately, public understanding remains low, so this program will focus on educating residents about the role of plants in reducing waterlogging and the economic opportunities of urban agriculture. (Zubir, 2022)
2. Lack of an Inclusive Early Warning System. Residents still rely on manual word-of-mouth information or visual monitoring of waterways, which are ineffective in providing early warning of potential flooding. Therefore, this program will develop and introduce an Inclusive Early Warning System (EWS), providing knowledge about disaster signs and effective rescue systems. This system will be accessible to all residents, including vulnerable groups such as the elderly and people with disabilities. (Qurotaini, 2022)
3. Lack of a Flood Information System Integrated with Digital Technology. Residents lack access to real-time data regarding flood conditions in their neighborhoods. Therefore, this program will develop a Flood Information System (SiBAR) that can automatically monitor water levels and disseminate information directly to residents through digital devices. This system will utilize water sensors that can provide automatic notifications via WhatsApp and Telegram, allowing residents to prepare early for potential flooding. This system will allow for more efficient coordination between residents in flood preparedness, thereby reducing the risk of loss of life and economic losses due to flooding (Azizah, 2022).
4. Lack of Active Community Role in Disaster Risk Management. The lack of a clear organizational structure for disaster management at the neighborhood (RT) level is an obstacle to responding quickly and effectively to disasters. Therefore, this program will also initiate the formation and training of disaster preparedness communities, which will play a role in outreach, monitoring, and coordination when disasters occur. (Yasmin, 2023) Program Impact and Benefits: From a social perspective, this program will increase public awareness regarding disaster mitigation and create more resilient communities in the face of disasters. From an economic perspective, the use of hydroponics as an environmental solution not only reduces the impact of flooding but also provides economic benefits for residents by providing independent food sources and small business opportunities based on urban agriculture. Furthermore, the application of information technology in disaster mitigation will increase efficiency in flood management, thereby reducing material losses experienced by residents each time a disaster occurs.

Based on the problems identification above, the solutions offered by the PKM team are: (1) Increasing Public Awareness and Understanding of Disaster Mitigation. This program will increase public awareness of disaster mitigation through outreach, training, and evacuation simulations. Residents will be educated on the causes of flooding, how to recognize early warning signs of disaster, and preventative measures. Furthermore, the training covers the use of early warning systems and basic first aid techniques. As an ecologically based mitigation measure, the program also encourages reforestation through tree planting and hydroponic methods (Zubir, 2022). Tree planting

helps increase the soil's ability to absorb rainwater, while hydroponics can be utilized for food security and has economic value for residents. With this approach, it is hoped that communities will be better prepared for flooding and able to take effective preventative measures. (2) Development of an Inclusive Early Warning System (EWS). In disaster management efforts, local governments focus on flood management only on post-disaster measures, such as the construction of embankments or reservoirs, to prevent further spread of flooding. However, challenges remain related to pre-disaster prevention, such as the distribution of information regarding impending conditions. This delay can prevent residents from taking action to save themselves and their property, resulting in substantial losses. Therefore, in addition to reducing the area of inundation, it is also necessary to improve the early warning system and information dissemination to ensure a faster and more effective flood response. An early warning system will be developed using water sensors integrated with WhatsApp and Telegram. This system will provide automatic warnings to residents via text messages, voice messages, and warning lights at strategic points, making it accessible to all community groups, including the elderly and people with disabilities. (Farabi, 2024). (3) Development of a Digital Technology-Based Flood Information System (SiBAR). A web-based and mobile flood information system will be developed to provide real-time data on water conditions, rainfall, and recommended actions for residents. This system will be connected to installed water sensors and accessible to the public via their mobile phones. (4) Enhancing the Community's Role in Disaster Risk Management. Neighbourhood association (RT)-level disaster preparedness groups will be established, responsible for coordinating evacuations, environmental monitoring, and disseminating disaster information. These groups will receive training in disaster risk management and will be tasked with coordinating mitigation actions within the neighbourhood association (RT) 13.

Some of these solutions have achievement targets or output target as measurement for evaluation. The output Targets are: (1) To increase public understanding of flood disaster mitigation, educational modules and videos will be developed and made accessible to the public. A minimum of 50 participants will participate in the training and outreach, with evaluation through pre- and post-tests. It is hoped that residents' understanding of disaster mitigation will increase to 100%, so they can be better prepared for flood disasters. (2) As a concrete step to strengthen the early warning system, water sensors will be installed in flood-prone areas. These sensors will be integrated with the Early Warning System (EWS), which sends automatic warnings to residents via WhatsApp and Telegram. Fifty residents are expected to understand how this system works and its benefits so they can take immediate action when a warning is issued. (3) To increase the accessibility of flood information, a web- and mobile-based Flood Information System (SiBAR) will be developed. This system will provide real-time data on flood conditions and enable residents to report conditions in their neighbourhoods. The target is for 100% of residents to be able to access and understand the information provided by SiBAR, allowing them to coordinate more quickly in disaster response. (4) To strengthen community preparedness, a neighbourhood unit (RT) disaster preparedness organization with a minimum of 10 active members will be established. This organization will develop community-based evacuation standard operating procedures (SOPs) and post evacuation route maps in strategic locations. This organization is expected to improve community organization in disaster response and expedite the evacuation process if necessary.

Each achievement target solution got the completion target according to the empirical condition. The completion of target solution are: (1) To improve community capacity in disaster mitigation, it is expected that 100% of training participants will understand the concept of disaster mitigation, including early signs of flooding and effective prevention strategies. Furthermore, all participants are expected to be able to identify evacuation routes and understand safety procedures for flooding, enabling them to act quickly and appropriately in emergency situations. (2) In the implementation and testing of the Early Warning System (EWS), the target is for 100% of installed sensors to function optimally and provide high-accuracy early warnings. Furthermore, all residents of the disaster preparedness community are expected to understand how to receive and respond to warnings from the EWS system, enabling them to take faster mitigation and evacuation measures to minimize the risks posed by flooding. (3) Regarding the development and optimization of the Flood Information System (SiBAR), this system is expected to be fully integrated with the WhatsApp application, thus providing real-time information on flood conditions. All members of the disaster preparedness community are also expected to be able to use SiBAR to report flood conditions and monitor their neighbourhoods, allowing for more accurate and rapid decision-making. (4) In the formation and training of disaster preparedness organizations at the neighbourhood level, the target is for 100% of members to understand and be able to carry out established evacuation procedures. Furthermore, all evacuation route maps will be posted at strategic points in the community and used as the primary guide in disaster simulations, so that the community can be better prepared for potential floods or other disasters.

2. METHOD

The activity implementation method is tailored to the partner's challenges. The challenges are developed from two focus areas: understanding disaster awareness (Early Warning System), environmental conservation (social and humanities), and disaster risk management using appropriate technology (management). From these two focuses, the

challenges are further categorized into four main priorities to be addressed. The five stages of PKM implementation include the Socialization Method, which includes education on the Early Warning System and effective disaster management. The Training Method includes disaster simulation practices, which will be facilitated by the proposing team. Technology Implementation includes the creation of SiBAR and the Disaster Awareness Website. Mentoring and Evaluation consist of quizzes, questionnaires, and training on technology utilization and module understanding. The program's sustainability will also be monitored by the proposing team, including equipment maintenance assistance.

These methods are implemented in several stages. Implementation Stages:

1. Socialization The initial stage of the program is socialization, which aims to introduce the program to the community, increase their understanding of disaster mitigation, and map community needs and preparedness. Outreach was conducted through:
    a. Group discussions and Focus Group Discussions (FGDs) with community representatives, neighbourhood association (RT/RW) heads, and community leaders to identify key problems and appropriate solutions.
    b. Distribution of an initial questionnaire to residents to gauge their level of understanding regarding flood disasters, early warning systems, and reforestation methods such as hydroponics and tree planting. Data from this questionnaire was used as the basis for designing more effective training and program interventions.
    c. Initial education through community meetings, outreach, and distribution of information materials in the form of leaflets, infographics, and social media explaining the concept of disaster mitigation and the benefits of early warning technology.
2. Training: The training aimed to increase community capacity in responding to flood disasters and utilizing reforestation technology and methods as a form of mitigation. Training materials included:
    a. Interactive disaster simulations, where residents were involved in role-playing and acting out flood scenarios to understand proper evacuation steps. These simulations used tabletop exercises and live evacuation drills to train community preparedness in emergency situations.
    b. Training on the use of early warning technology, including an introduction and simulation of the use of the Flood Information System (SiBAR) that will be developed. Residents will be taught how to read data from water level sensors, as well as how to receive and disseminate information through digital applications such as Telegram and WhatsApp.
    c. Training on reforestation and environmental mitigation, covering effective tree planting methods to reduce the impact of flooding and hydroponic farming techniques as an environmentally friendly solution with the potential to boost residents' economic well-being.
3. Technology Implementation: At this stage, the disaster mitigation technology introduced in the training will be implemented in the community. Steps in this stage include: • Installing early warning sensors in flood-prone areas. These sensors will detect water levels and automatically send data to the Flood Information System (SiBAR).
    a. Integrating digital systems into community communication platforms, such as WhatsApp and Telegram, so residents can receive real-time warnings.
    b. Implementing reforestation methods, by planting trees and hydroponic systems in strategic areas to reduce the impact of flooding. Residents will be taught how to care for these plants to maintain their productivity.
4. Mentoring and Evaluation: Mentoring is provided to ensure that the implemented technology and mitigation methods are running optimally. Program evaluation is conducted periodically through:
    a. Post-training surveys and questionnaires, which are used to measure residents' level of understanding and preparedness after receiving education and training. The results are compared with baseline data to assess the program's effectiveness.
    b. Testing the early warning system, by conducting several test scenarios on the flood sensors and emergency communication system.
    c. Monitoring of reforestation and hydroponics, by evaluating plant growth and its impact on water absorption in the area.
5. Program Sustainability: To ensure the program's continued independence, several strategic steps are being taken for sustainability, there ara;
    a. Establishment of a Disaster Awareness Team consisting of representatives from neighborhood associations (RT) 13. This team is responsible for operating and maintaining the early warning system and disseminating information related to disaster mitigation.
    b. Further training for the Disaster Awareness Team to ensure they have sufficient capacity to provide ongoing education to other residents.
    c. Collaboration with local governments and NGOs to obtain further support in developing and maintaining the disaster mitigation system.

Partner participation in the implementation of this program is crucial to ensure the sustainability and effectiveness of the activities. Partners, in this case residents of RT 13 Pondok Betung, community leaders, and local organizations, will be involved in various stages of the program, from planning, implementation, and evaluation.
In the Planning and Problem Identification stage, partners participate from the outset by providing information about their environmental conditions, including flood-prone areas, rainfall patterns, and challenges frequently encountered during disasters. Residents also participate in Focus Group Discussions (FGDs) to identify solutions best suited to their needs. In the Implementation and Training stage, partners play an active role in discussions and education on disaster mitigation. Residents will participate in various training sessions, such as flood evacuation simulations, early warning system training, and hydroponic reforestation techniques. Their participation in these interactive sessions is crucial to enhancing their understanding and preparedness for flooding. Next, in the Technology and Environmental Mitigation implementation stage, partners will be directly involved in the installation of early warning sensors, as well as in the utilization and maintenance of technology-based flood warning systems. In addition, residents also participate in tree planting and hydroponics, where they will receive training and independently develop green spaces that can help reduce the impact of flooding while increasing their economic resilience.

To ensure the sustainability of the agreed program, partners also play a role in establishing a Disaster Awareness and Program Sustainability Team. As part of the sustainability strategy, residents will form a Disaster Awareness Team, which will be responsible for monitoring and operating the early warning system, disseminating disaster information, and continuously educating other residents. This team will receive advanced training so that it can become a driving force for disaster mitigation in their community. Finally, in Program Evaluation and Monitoring, Partners will contribute to program evaluation by providing feedback on the effectiveness of the implemented solutions. They will also participate in post-program surveys and discussions to identify areas for improvement, ensuring that the implemented system can continue to operate sustainably. Proposers will evaluate participants to ensure program sustainability by conducting regular monitoring of the implementation of activity results. Partners play a role in granting permits and supporting monitoring of the sustainability of program implementation in their community. This evaluation includes an assessment of participant understanding, the effectiveness of the applied technology, and the social and economic impacts of the activities carried out.

3. RESULTS AND DISCUSSION

Based on the problem-solving implementation stages and the desired targets, the first stage of the program was outreach, aimed at introducing the program to the community. The program took place on August 17, 2025, at 9:00 a.m. Western Indonesian Time (WIB) at the community hall of RT. 13 Pondok Betung, Pondok Aren, South Tangerang. The event, which coincided with the commemoration of Indonesian Independence Day, was attended by over 50 residents. Like the solutions and methods offered, the program's implementation was based on disaster awareness and environmental stewardship. The partner locations, which are frequently flooded, have unwittingly fostered a sense of awareness among the residents. This awareness means they recognize the conditions they face, which can be expected to experience rising water levels every rainy season, causing flooding. Consequently, flooding has become a common occurrence for the partner communities. In fact, they perceive it as normal and commonplace, even accepting such environmental conditions. With this awareness, the community also takes simple preventive measures to facilitate the evacuation of affected goods or objects.

The outreach included knowledge sharing on flood mitigation and the formation of a disaster response team. Knowledge sharing was delivered by a resource person from disaster management. It began with an understanding of what is meant by a disaster. According to Law No. 24 of 2007, a disaster is an event or series of events that threaten and disrupt the lives and livelihoods of people caused by both natural and/or non-natural factors as well as human factors, resulting in human casualties, environmental damage, property losses, and psychological impacts. Through knowledge sharing on the definition and scope of disasters, it is hoped that participants can empirically identify conditions that occur in their environment. The knowledge sharing was carried out in a relaxed manner interspersed with discussions and questions and answers with participants. This was done to gain participants' experience and understanding of disasters they have experienced, the types of disasters and the impacts of various disasters caused. Based on the knowledge sharing, it is explained that according to Law No. 24 of 2007, a disaster is an event or series of events that threaten and disrupt the lives and livelihoods of people caused by both natural and/or non-natural factors as well as human factors, resulting in human casualties, environmental damage, property losses, and psychological impacts. The knowledge sharing gained a variety of information regarding the meaning and scope of disasters, opening participants' minds to the fact that the floods they experienced not only affected damaged property but also affected residents' behavior and psychology. Residents' habituation to flooding has unconsciously changed their behavior and perspective, making disasters a normal occurrence. This situation has unwittingly reduced their quality of life.

Therefore, the participants were also educated about mitigation. The presentation explained that mitigation is a series of efforts to reduce disaster risk, both through physical development and awareness-raising and capacity building to deal with disaster threats. Mitigation aims to minimize the impact of disasters on communities and the environment. With this understanding of mitigation, it is hoped that participants will recognize the need for a series of measures to prevent disasters, especially ongoing ones. The disaster faced by residents during this time was a flood. Until now, residents have only reacted to flooding, addressing the flood disaster only partially, without addressing the root cause. Although it is recognized that the environmental conditions in RT 13 Pondok Betung are complex, making it difficult to implement flood mitigation measures, with an understanding of mitigation, several simple measures can be taken to reduce losses caused by flooding. The resource person explained several simple mitigation measures, including:

An Early Warning System (EWS) is a system that provides information about potential natural disasters to the public so they can take preventative measures and evacuate. Until now, residents have relied solely on information shared through WhatsApp groups (WAGs), paying attention to environmental conditions during heavy rain and flooding. This can be described as a manual warning system that responds when water begins to inundate a resident's area. On this occasion, the team introduced a simple technology that functions as an Early Warning System (EWS). The existence of (WAGs) as a communication medium between residents has indeed been helpful in mitigation, although these mitigation measures are still rudimentary. On this occasion, the team introduced an inclusive EWS and flood information system (SiBaR). This simple technology will be handed over to residents as partners and will be monitored regularly by the team. The EWS technology consists of flood detectors that will be placed around waterways (rivers) that pass through the residential area of RT.13.

To improve preparedness for potential flooding, the proposing team presented an innovative solution in the form of a Flood Information System (SiBar), this tool integrates the NodeMCU esp8266 module and Arduino with a detection approach using a float switch system. SiBar works by detecting water levels using a float switch-based buoy. When the water exceeds the specified height limit, the buoy will be submerged so that the float switch is connected, triggering the system to automatically send information to the community through real-time notifications. With this mechanism, SiBar provides early warning to local residents when the potential for flooding increases, increasing their awareness and safety.

Figure 3. Example of a solar-powered flood detection device installation

Example of a Flood Detection Device Installation: Previous research related to the use of EWS sensors in the development of a Water Level Detection System has been extensively conducted, most of which involved the use of the NodeMCU esp8266 microcontroller and other supporting components (Wikantama, 2023). Based on the findings of this previous research, the proposing team developed and integrated this concept into a prototype for a Flood Monitoring and Early Warning Device & System. This development involved the use of a NodeMCU microcontroller and sensors with a floating system, plus the addition of an alarm warning and notification feature via WhatsApp. The use of the Internet of Things (IoT) in this case allows for real-time data transmission via WhatsApp directly to residents and rapid information dissemination. (Nofrialdi, 2023) These elements involve connectivity, small devices, and sensors. This device utilizes programming algorithms, which, when functional, enable the device to operate automatically without human intervention, although internet network quality is also important. Human monitoring is still required to monitor the system's operation.

At the socialization (knowledge-sharing) stage, the technology is still in the assembly stage. This inclusive EWS technology with SIBAR will warn residents through a siren as a warning signal. The siren as a warning signal will alert residents to be more vigilant in mitigating, thereby reducing the risk of material and immaterial losses. Although

the use of this technology does not solve the core value of the problem faced, it is expected to provide positive benefits for residents.

Figure 4. Presentation of material on EWS and discussion on Disaster Mitigation

A key element in mitigation as a solution is protecting the environment to prevent flooding. By maintaining a clean environment, especially waterways and rivers, and by reforesting, we can reduce the risk of flooding. This perspective is generally understood by residents, that maintaining a clean environment is key to addressing flooding. However, awareness and a dedicated mechanism are needed within the community to protect the environment. Community outreach and training on waste management and reforestation have been conducted by residents, including education on the circular economy and simple applications of circular economy principles. However, implementation and sustainability have not been fully realized. Therefore, the mitigation outreach provided is also ecologically based, encouraging reforestation through tree planting and hydroponic methods. Partner residents received education and training on composting and eco-enzyme production in 2024. The training has increased partners' knowledge and understanding of waste management towards zero waste and the development of a circular economy. The positive benefits achieved have encouraged sustainability. As of this writing, residents are still routinely processing compost and eco-enzymes, managed by neighbourhood unit (RT) mothers and youth organizations (Karang Taruna). This knowledge has also encouraged them to plant trees, and some have even implemented hydroponics. Although carried out independently and not as coordinated as compost and eco-enzyme production, these activities serve as a model for environmental stewardship, increasing the soil's ability to absorb rainwater, improving food security, and providing economic value for residents.

In addition to maintaining environmental cleanliness, reforestation, and food security, outreach programs also emphasize the importance of cleaning rivers and gutters to prevent flooding. A survey conducted in the problem analysis revealed that the drainage system in RT 13 Pondok Betung still lacks drainage in several locations. This condition triggers waterlogging and flooding. Residents need to ensure smooth water flow, reduce the risk of blockages that can cause flooding, and prevent the spread of waterborne diseases. This environmental condition presents a challenge to flood mitigation efforts. This is because transforming the residential environment requires funds and personal effort from each resident. In settlements or houses without drainage, installing drainage for these settlements or houses requires demolition or redesigning the existing building or settlement. Drainage is an infrastructure that functions to channel excess water from one location to another, such as a natural or artificial reservoir. The excess water then flows to the sea, rivers, lakes, wells, and other infiltration facilities. Therefore, a good drainage system is essential, especially in densely populated areas such as housing complexes and villages. Drainage plays a crucial role in populated areas. A good drainage system helps prevent many problems, such as reducing the likelihood of flooding, controlling groundwater levels, soil erosion, and preventing damage to roads and existing buildings.

Therefore, the only temporary measure that can be taken under existing conditions is to strengthen community resilience. This outreach also emphasized the important role of residents in supporting community resilience, including the formation of a Disaster Resilience mitigation task force involving residents such as housewives and youth organizations. Involvement in partnerships, both among residents and with relevant parties, such as the National Search and Rescue Agency (Basarnas), the Fire Department, and ambulances, is directly involved in flood disaster management. Emergency numbers and contact information, including relevant authorities responsible for disaster management, are also provided. On this occasion, residents, represented by the neighbourhood association (RT) head, will allocate time to deliberate on the formation of a disaster mitigation task force. The designated party must be available for contact in emergencies, particularly during floods.

Although it was only a socialization session, the questionnaire administered to participants indicated an increase in knowledge and understanding of the need for partnerships and collaboration between communities in developing disaster-resilient communities. The questionnaire was kept simple, with only "yes" or "no" answers. This was done to facilitate participants' responses, given the diverse ages and backgrounds of the participants, and to save time. The following questions were asked:

1. Do you know what flood mitigation is?
2. Have you ever heard of an Early Warning System (EWS) for disasters?
3. Do you know how the flood information system (SIBAR) works?
4. Do you feel the importance of a flood early warning system in RT 13 Pondok Betung?
5. Are you aware of the community's role in disaster-resilient partnerships?
6. Are you aware of flood disaster response simulations?
7. Are you aware of flood evacuation routes in the neighborhood of RT 13?
8. Do you know who is involved in the Disaster Resilience partnership (government, community, volunteers, etc.)?
9. Do you feel ready to participate in the Disaster Resilience partnership system in your area?
10. Do you think SIBAR can help improve community preparedness for flooding?

Based on the pretest and posttest questionnaires with 48 respondents, the following results were obtained:

Tabel 1. Pre-test and Post test result

No	**Question**	**Pre-Test (Yes)**	**Pre-Test (No)**	**Post-Test (Yes)**	**Post-Test (No)**
1	Knowledge of flood mitigation	20	28	44	4
2	Knowledge of EWS	15	33	42	6
3	Knowledge of SIBAR	10	38	40	8
4	Understanding the importance of EWS	25	23	47	1
5	Importance of community role	18	30	45	3
6	Knowledge of simulation	12	36	39	9
7	Knowledge of evacuation routes	14	34	41	7
8	Knowledge of partnership actors	17	31	44	4
9	Readiness to participate	20	28	46	2
10	SIBAR helps with preparedness	22	26	47	1

The simulation results indicate that There was a significant increase in understanding and preparedness after the activity. This can be seen in the question about knowledge about SIBAR, which in the pre-test only answered "Yes" to 40 people (Yes) in the post-test. Of the total 48 respondents, almost all also felt confident that SIBAR helps residents' preparedness in facing disasters.

4. CONCLUSION

Comprehensive public knowledge and understanding of disasters and mitigation are crucial for reducing the impact of disaster risks and improving resilience and quality of life. Mitigation is not merely about preparing for and avoiding disasters, but also about the ability to survive in various conditions, especially the impacts of disasters. The mitigation measures implemented so far and the understanding gained through public awareness campaigns do not necessarily prevent residents from experiencing disasters. Therefore, community preparedness and resilience are crucial for the sustainability of life and the environment. Flood disaster mitigation in the environment encompasses interconnected and interconnected aspects of all aspects of life. Therefore, it's not just about maintaining environmental cleanliness, drainage, and implementing EWS and SIBAR, but also the ability of residents to collectively strengthen each other to survive and meet their needs, especially during disasters. Therefore, it's not just about the ability to utilize technology, as it will assist residents in mitigation measures. Furthermore, partnerships are needed not only within the community but also with relevant parties responsible for disaster management. Support from authorities and the government is significant for protecting residents.

ACKNOWLEDGMENT

Thank you to the Budi Luhur Cakti Foundation and Budi University for providing support for the implementation of community service activities. Thanks also to the authority of RT.013/RW.001 Pondok Betung, Pondok Aren, Tangerang Selatan and all participant who have given permission and actively participated in the community development program. This community development activity is one of a series of activities funded by the Ministry of

Higher Education, Science, and Technology of the Republic of Indonesia (Kemendiktisaintek) through the Community Service Grant under the Community Partnership Scheme under number 1041/LL3/DT.06.01/2025, June 4, 2025 and A/UBL/DRPM/000/117/06/25, June 5, 2025.

REFERENCES

Tempo.co. https://www.tempo.co/arsip/tangsel-dikepung-banjir-saat-hujan-deras-kemarin- terparah-di-ciputat-dan-pondok-aren--100677. 2025. *Tangsel Dikepung Banjir saat Hujan Deras Kemarin, Terparah di Ciputat dan Pondok Aren*.

Kedeputian Bidang Sistem Dan Strategi Direktorat Pemetaan dan Evaluasi Risiko Bencana. Dokumen Kajian Risiko Bencana Nasional Provinsi Banten 2022 - 2026. Kota Tangerang Selatan; 2021 Dec.

Yulida Medistiara. https://news.detik.com/berita/d-7805437/banjir-landa-5-kecamatan-di- tangerang-selatan-1-870-rumah-terdampak. 2025. *Banjir Landa 5 Kecamatan di Tangerang Selatan, 1.870 Rumah Terdampak*

https://kelpondokbetung.tangerangselatankota.go.id/ [Internet]. SIPITUNG (Sistem Informasi Kelurahan Pondok Betung).

Mei Amelia R. https://news.detik.com/berita/d-7813805/perumahan-di-tangsel-banjir-gara-gara- *kali-pesanggrahan-meluap. 2025. Perumahan di Tangsel Banjir gara-gara Kali Pesanggrahan Meluap*Putri, C. E., Damayanti, N., & Hamzah, R. E. (2020). Sadfishing Phenomenon of #Justiceforaudrey (Hashtag) on Twitter. *Mediator: Jurnal Komunikasi*, *13*(1), 58–67. https://doi.org/10.29313/mediator.v13i1.5598

Indra Khaidir. *Mitigasi Bencana Banjir Untuk Mengurangi Dampak Terhadap Lingkungan Dan Kehidupan Sosial Masyarakat*. Jurnal Rekayasa. 2019 Nov 24;8(2):154– 60.

Husniawati N, Herawati TM. *Pengaruh Pengetahuan dan Peran Individu terhadap Kesiapsiagaan Bencana Banjir pada Masyarakat*. Jurnal Ilmu Kesehatan Masyarakat. 2023 Jan 10;12(01):11–9.

Robiansyah A, Zubir E, Ratnawati N, Sukatmi S, Maulidia S, Riady Y. *Pemanfaatan Bahan untuk Penyerapan Lubang Resapan Biopori dan Membuat Tanaman Hidroponik di Perumahan Graha Harapan Mustika Jaya Bekasi*. Jurnal Abdimas Indonesia. 2022 Feb 5;2(1):1–8.

Qurrotaini L, Amanda Putri A, Susanto A, Sholehuddin S. *Edukasi Tanggap Bencana Melalui Sosialisasi Kebencanaan Sebagai Pengetahuan Anak Terhadap Mitigasi Bencana Banjir. An-Nas*: Jurnal Pengabdian Masyarakat. 2022 Jun 21;2(1):35.

Mutia Azizah S, Sumadyo A, Yuni Iswati T. *Respon Terhadap Banjir di Bandarharjo Sumatra Utara: Penerapan Arsitektur Amfibi* [Internet]. Juli. 2022. Availablefrom:https://jurnal.ft.uns.ac.id/index.php/senthong/index

Yasmin T, Khamis K, Ross A, Sen S, Sharma A, Sen D, et al. *Brief communication: Inclusiveness in designing an early warning system for flood resilience.* Natural Hazards and Earth System Sciences. 2023 Feb 14;23(2):667–74.

Farabi MR Al, Sintawati A. *Flood early warning system at Jakarta dam using internet of things (IoT)- based real-time fishbone method to support industrial revolution 4.0.* Journal of Soft Computing Exploration. 2024 May 4;5(2):99–106.

Khairul Rahmat H, Putra T, Purnomo B, Alamsyah AN, Bimantara MA. *Upaya Peningkatan Budaya Sadar Bencana Pada Siswa Guna Meningkatkan Kesiapsiagaan SMA Terpadu Baitul Hikmah Depok*. Vol. 2, Indonesian Journal of Emerging Trends in Community Engagement |. 2024.

Fithriana A, Annissa J. *Waste Creation On Achieving 12th Sustainable Development Goals (SDGs).* ICCD. 2018 Dec 22;1(1):617–27.

Puspitasari A, Fithriana A, Taqwa P. *Ecoenzym Workshop: A Step for Zero Waste at Housewives Group Rt.13 Pondok Betung, Tangerang Selatan*. ICCD. 2024 Nov 4;6(1):51–8.

Wikantama PT, Puspitasari R. *Perancangan Perangkat Pengukur Ketinggian Banjir dengan ESP32 dan Telegram Berbasis IoT*. Elektriese: Jurnal Sains dan Teknologi Elektro. 2023 Nov 7;13(02):107– 14.

Nofrialdi R, Ikhsan I. *Rancang Bangun Monitoring dan Peringatan Dini Banjir Berbasis Internet of Things (IoT) di Pusdaplops PB BPBD Sumatera Barat*. Jurnal Pustaka Robot Sister (Jurnal Pusat Akses Kajian Robotika, Sistem Tertanam, dan Sistem Terdistribusi). 2023 Jan 31;1(1):1–5.