

Improving Emergency Response and Community Resilience in Flood Disasters: A Hulu Langat Case Study

Linda Abd Hamid*¹, Muhammad Fadzlee Ghazali², Zulkifli Romli³, Muaz Asmadi⁴ and Erwin Rezasyah⁵

^{1,3}Industrial Design department, College of Creative Arts, Universiti Teknologi MARA, Malaysia

²Assistant Clerk, Lee Choon Wan & Co, Bukit Damansara, Kuala Lumpur, Malaysia

⁴Faculty of Creative Arts and Lifestyle, Lim K ok Wing University of Creative Technology, Malaysia

⁵Faculty of Engineering, BINUS University, Jakarta, Indonesia

DOI: <https://doi.org/10.51584/IJRIAS.2024.909014>

Received: 27 August 2024; Revised: 05 September 2024; Accepted: 11 September 2024; Published: 03 October 2024

ABSTRACT

This study investigates critical deficiencies in emergency response during the December 2021 Hulu Langat floods, aiming to develop and evaluate innovative solutions to enhance the efficiency and timeliness of disaster relief efforts. Utilizing a mixed-methods approach, including surveys, interviews, and field observations, the research identifies significant delays in coordination and response times among federal agencies and rescue teams. Key findings highlight the necessity for improved communication and resource management. In response, the study proposes a novel emergency response product, designed to address these issues. The implementation of these solutions is anticipated to improve response capabilities, reduce the human and material toll of floods, and bolster community resilience in Hulu Langat. The study's outcomes offer valuable insights into disaster management practices and hold potential benefits for other regions facing similar environmental challenges.

Keywords: Emergency response, Flood disasters management and Hulu Langat, Selangor

INTRODUCTION

The field of disaster management has extensively covered emergency response mechanisms, yet significant gaps remain in the context of flood disasters, particularly in rapidly urbanizing areas like Hulu Langat, Selangor. Existing research has largely concentrated on general emergency management strategies (Al-Wathinani, 2021; Sharika Tasnim, 2022). However, there is a notable lack of detailed studies addressing the specific challenges of mud flood scenarios, where timely and coordinated responses are crucial. The December 2021 flood disaster in Hulu Langat exposed critical deficiencies in the response capabilities of federal agencies and rescue teams (Rashid, 2021; Ram, 2021). Previous research has documented broad challenges in emergency response (Abdullahi, 2014; Tingsanchali, 2012) but has not adequately explored the specific delays encountered in complex flood conditions or provided actionable solutions tailored to these scenarios.

This gap is particularly significant given the flood's impact, exacerbated by construction-related water surges (Shari, 2021), which severely affected the physical, emotional, and psychological well-being of the community (Haziq Sarhan Rosmadi, 2023). While literature discusses general flood management strategies and their shortcomings (Hasan, 2021; Zhong, 2018; Twiddy, 2022), it often overlooks the intricacies of effective response during severe mud floods, including prolonged response times and operational challenges.

The need for this research is highlighted by persistent issues in disaster response coordination and the

emergence of additional problems such as looting due to delayed aid (Safiah Yusmah, 2020; Ahmadi, 2022). The key objectives of this study are: (1) identifying emergency response products that could mitigate risks faced by first responders during disaster rescue operations; (2) exploring the potential for public empowerment as first responders while awaiting official aid from authorities; and (3) assessing methods for facilitating self-rescue and assisting others in evacuating to safety during disasters (Buye, 2021; Ciarocco, 2012).

This study aims to address these gaps by providing a detailed analysis of emergency response delays specific to the 2021 Hulu Langat flood and proposing data-driven, innovative solutions. The findings have significant implications for disaster management practices, particularly in enhancing community resilience and preparedness in regions facing similar environmental challenges.

METHOD

This study employed a comprehensive methodology to investigate the emergency response challenges faced by communities in Hulu Langat, Selangor, during the 2021 flood disaster. To achieve the study's objectives, a systematic approach combining quantitative and qualitative research methods was utilized. A key component was primary data collection to understand the delayed response issues. A questionnaire survey was conducted to gather data directly from individuals and respondents (Hamid, 2013). The survey addressed three main objectives, identifying emergency response products to mitigate risks for first responders. Exploring the potential for public empowerment as first responders while awaiting official aid and assessing methods for facilitating self-rescue and aiding others in evacuating to safety.

The questionnaire, created using Google Forms, included 21 questions divided into three sections: Section A on demographic information (9 questions), Section B on weaknesses in flood management response (5 questions), and Section C on the public's role as first responders (7 questions). This structure ensured comprehensive data collection relevant to the study's goals. Secondary data were sourced from academic journals, newspapers, and educational institutions, providing valuable context and background. A thorough literature review highlighted the complexities of disaster response and identified key influencing factors. Qualitative methods, including observation and interviews, were also employed. Observations offered direct insights into the conditions and challenges faced by responders and victims, while interviews provided deeper qualitative data and personal perspectives on emergency response shortcomings.

In addition to traditional methods, the study applied the PESTEL (Political, Economic, Social, Technological, Environmental, and Legal) framework (Buye, 2021) to analyze macro-environmental factors affecting emergency response in Hulu Langat. This analysis revealed external factors contributing to delayed responses. Remote research, including social media content analysis (Marieke Zielhuis, 2022), further informed the study by capturing user experiences during the disaster. Finally, the study evaluated existing emergency response products (Lin, 2014) in terms of functionality, cost, safety, and environmental impact, contributing to the development of tailored, innovative solutions for the specific conditions encountered during the Hulu Langat floods.

Data Collection

The literature review for this study incorporated articles from reputable sources such as "The Star" and "NST." These articles vividly depicted the flood management issues encountered by the communities in Hulu Langat, Selangor, especially in Taman Sri Nanding. They highlighted the severe conditions faced by flood victims, who were left stranded and had to rely on their own resources while awaiting official emergency responses. Notably, one article reported that around 100 residents in Taman Sri Nanding were stranded on the rooftop of Surau Al Munir for hours without receiving aid from relief agencies.

The literature review was crucial in shaping the research, aligning it with the study's scope, and providing critical insights into emergency response issues. This review led to the development of a novel solution to address the identified problems, consistent with the project's objectives. An additional article, "Stepping Up Relief Efforts," published by "The Star," highlighted the sluggish response from government and federal authorities during the disaster, emphasizing the challenges faced by victims stranded on rooftops.



Figure. 1. News titled Hulu Langat Residents Taking Shelter by NST.

Fig. 1 illustrates a newspaper article showing flood victims from Taman Sri Nanding taking refuge on rooftops during the December 2021 disaster. The image captures the pre-arrival situation of official emergency response teams.



Figure. 2. The Star e-Newspaper titled “Stepping up relief efforts

Fig. 2 features an e-newspaper article that was part of the literature review. This article facilitated the examination of response issues affecting Hulu Langat in December 2021.

This observation from the newspaper article was included in the research methodology as part of the literature review, contributing to the analysis of critical issues, problems, research aims, research questions, and research objectives within the study as shown in table in Fig. 3. This comprehensive approach to data collection allowed the researcher to gain a thorough understanding of the complex emergency response issue and formulate a concept design that addresses this concern, effectively enhancing the study's research objectives.

No.	Year Published	Full Title & Website Link	Author's name(s)	Issue/ Problems	Research Aim	Research Objective	Research Questions
3.	11 December 2021	Deputy IOP: Need for more resources based remanagement mechanisms https://www.mca.gov.my/mca/portal/berita/berita-keajaibanan/berita-keajaibanan-11-12-2021	Hondur Ham Maulud Noor	The article discussed the importance of emergency response in the context of the effectiveness of flood disaster management.	To improve the emergency response process with on immediate flight the aid for restoring the flood victims.	To study the coordination and efficiency related to flood disaster management.	What effective mechanism can apply in disaster response by the disaster relief agency?
4.	18 December 2021	Thousands evacuated as floods hit Malaysia https://www.mca.gov.my/mca/portal/berita/berita-keajaibanan/berita-keajaibanan-18-12-2021	Hulu Q	The news article states that thousands of people were displaced as a result of the heavy rain in Hulu Langat. The news states flood victims being sent to evacuation centers for flood victims due to the high number of victims.	To increase the effectiveness of flood disaster management in Hulu Langat. To provide more evacuation centers for flood victims to accommodate the high number of victims.	To identify the people affected by the floods in Hulu Langat that has been evacuated and assist by the rescue team. To estimate the evacuation process of flood victims during the disaster.	What are the tools used by the rescue team in evacuation operations of flood victims? How did the rescue teams evacuate the flood victims? Why evacuation process is an effective way to rescue the flood victims?
5.	19 January 2022	Malaysia's Floods of December 2021: Can Future Disasters be Avoided? https://www.mca.gov.my/mca/portal/berita/berita-keajaibanan/berita-keajaibanan-19-01-2022	Shena Polayem	Possible to suffer from water-borne diseases and other health problems after the floods. Flood victims suffered from water-borne diseases due to the high level of water in the evacuation centers.	To decrease the management of rescue and aid for flood victims involved in flood disasters.	To reduce the victims of water-borne diseases during floods. To clarify the flood victims' health status after the floods.	What is the major factor causing the rise of water-borne diseases? What types of water-borne diseases related to the floods?

Figure. 3. Sample Literature Review Process Table.

Fig. 3 displays a table summarizing the literature review process. It includes data extracted from online journals and newspapers, which was analyzed to identify key issues, and inform the research aims, objectives, and questions.

The study involved 51 respondents across four age groups: 18-23 (45.1%), 24-29 (29.4%), 36 and above (19.6%), and 30-35 (5.9%). Gender distribution was diverse, with respondents primarily from the general public (64.7%), followed by relief agency volunteers (19.6%), flood victims (11.8%), and NGOs and self-volunteers (2%). Experience with relief agencies varied, with 47.5% involved in one agency, while others had limited or no experience. Most respondents had 1-3 years of experience in charitable organizations, focusing on providing supplies and evacuation support. In Section B, which addressed flood management weaknesses, respondents cited "lack of resources, equipment, and unclear directions" as major issues. Suggested improvements included "identifying disaster areas and implementing effective communication systems." Survival strategies emphasized moving to higher ground or safe locations. The study also linked delayed emergency responses to insufficient awareness and preparation by authorities. Section C explored the public's role as first responders. A significant 92.1% recognized their potential, and 68% were willing to attend rescue classes. "Awareness campaigns" were recommended to encourage participation, and life jackets were identified as essential equipment. These findings offered a comprehensive analysis of demographics, relief agency involvement, flood management weaknesses, and public engagement, forming the basis for further results and discussions.

RESULTS AND DISCUSSION

The first objective was to identify emergency response products that could mitigate the risks faced by first responders during disaster rescue operations. The analysis revealed several gaps in the availability and effectiveness of existing products. Observational methods were employed to evaluate these products based on functionality, ease of use, and suitability for the specific conditions encountered during the Hulu Langat floods. The findings indicated that current products often fall short in addressing the unique challenges posed by such flood scenarios. Consequently, the study proposed the development of novel product concepts tailored specifically to the needs of first responders in high-stress, flood conditions. These proposed designs aim to enhance both safety and operational efficiency, underscoring the urgent need for innovative solutions in emergency response.

The second objective focused on exploring the potential for public empowerment as first responders while awaiting official aid. The research highlighted the role of new product concepts in educating and empowering individuals to act effectively during emergencies. Survey responses revealed a significant lack of public awareness and preparedness, which underscored the need for comprehensive training programs and community-driven initiatives. The study suggests that equipping local communities with essential emergency response skills and tools could significantly bridge the critical gap between the onset of a disaster and the arrival of official aid. By preparing the public to respond proactively, these products could enhance community resilience and improve overall emergency response effectiveness.

The third objective was to assess methods for facilitating self-rescue and assisting others in evacuating to safety during disasters. Data analysis indicated that the proposed product concepts could aid both professional rescuers and the general public in evacuating individuals to safer areas. The study involved brainstorming sessions to identify and address clusters of issues related to self-rescue and evacuation. These sessions informed the design of new products aimed at overcoming the identified challenges. The research methodology integrated various approaches, including primary and secondary data collection, PESTEL analysis, remote field research, and product analysis. This comprehensive approach provided valuable insights into the emergency response issues specific to Hulu Langat and laid the foundation for practical, innovative solutions.

Overall, the research suggests that the proposed products have the potential to improve the efficiency of emergency response efforts, thereby reducing the impact of disasters on affected communities. By addressing gaps in current response practices and enhancing public preparedness, the study contributes to a more effective and resilient disaster management framework.

CONCLUSIONS

In response to the identified gaps and challenges in emergency response during the 2021 Hulu Langat flood disaster, this study has developed a set of innovative solutions aimed at enhancing the efficiency and coordination of relief agencies and rescuers. The research focused on three key objectives: (1) identifying emergency response products that could mitigate the risks faced by first responders; (2) exploring the potential for public empowerment as first responders while awaiting official aid; and (3) assessing methods for facilitating self-rescue and evacuating individuals to safety. To address these objectives, the study proposed three novel concepts: the Portable Lifesaver Tube, the Emergency Response Kit, and Multi-Function Emergency Life Savers. These products were designed to address various facets of emergency response, providing practical and effective solutions to improve the safety and effectiveness of both rescuers and victims. Detailed 3D models of these concepts were developed, highlighting their practical implementation.

The study also sought feedback from MERCY Malaysia representatives to ensure that the proposed solutions met user needs and could be effectively tested in real-world scenarios. This collaboration led to the design of additional products, such as a Telescopic Ladder and Stretcher for rescuing stranded flood victims, as well as an Emergency Rescue Drone and Multi-Functional Stretcher, integrating advanced technology and multi-purpose functionality.

Prototype testing of these solutions revealed promising results. The Portable Lifesaver Tube, Emergency Response Kit, and Multi-Function Emergency Life Savers demonstrated significant improvements in addressing the risks faced by first responders and flood victims. Field testing confirmed the effectiveness of these products in enhancing both safety and efficiency during rescue operations. The Telescopic Ladder and Stretcher effectively assisted in rescuing individuals from high places, while the Emergency Rescue Drone and Multi-Functional Stretcher showcased advanced technological integration, further improving rescue capabilities. The refined solutions were presented at the International Innovation and Design Expo (IIDEX) 2023, where they received gold awards for their innovative approach to enhancing emergency response capabilities (Fig. 4). This recognition underscores the potential impact of these products on improving disaster response effectiveness.



Figure 4. Award-winning for the proposed solutions in IIDEX 2023 - Title: Design Approach for Enhancing Emergency Response Capabilities in Flood Disasters.

Fig. 4 presents the award-winning solutions, which have demonstrated the potential to significantly improve response times, safety, and overall effectiveness of first responders in disaster situations. This research provides a valuable foundation for future developments in disaster management and emergency response.

The successful prototype testing validates the practical applications of the proposed solutions, confirming their

potential to significantly enhance emergency response efforts. This research provides a valuable foundation for future developments in disaster management, emphasizing the need for continued refinement, broader testing, and integration of these solutions into emergency response protocols. Future research should focus on long-term effectiveness, public training programs, and cost-benefit analyses to further enhance and validate these products. This study has made substantial contributions to the field of disaster management by developing and testing novel emergency response products. The findings confirm the potential of these solutions to enhance disaster response, improve the safety and efficiency of both rescuers and victims, and lay the groundwork for future advancements in community resilience and preparedness.

ACKNOWLEDGMENT

The researchers would like to express their gratitude to the College of Creative Arts for fostering a supportive environment that encourages enduring research practices among its academic staff. Special thanks are also due to ReNeu, UiTM, for their invaluable support and expertise, which greatly contributed to the preparation and quality of this manuscript.

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