

Empirical Insights: Location Data Sharing in Response to Flash Flood Disasters in Baling, Kedah, and Hulu Langat, Selangor

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Abstract

In the midst of the crisis, local authorities emerged as a beacon of support by seamlessly sharing real-time location data with relief agencies. This transformed chaos into coordinated efforts, expediting the delivery of much-needed aid to those grappling with the disaster's impact. Despite the significant role played by local governments in sharing real-time location data, it is intriguing that limited research has been conducted on the intricacies of location data sharing during humanitarian crisis responses. Consequently, an exploratory case study in the Kedah and Selangor areas utilized a qualitative method to investigate location data sharing relevant to addressing logistics needs during humanitarian disaster response. The central methodology employed was data triangulation, involving interviews with nine research participants grouped into humanitarian agencies and communities. The study suggests that the location of the disaster, alternative routes, and routes to the disaster zone are primary components of location data sharing, crucial for addressing logistics needs and facilitating inter-agency information sharing during flash flood disaster response. In conclusion, these factors are deemed essential in effectively addressing logistics needs.

Keywords: Logistics Needs, Humanitarian Disaster Response, Location Data Sharing, Real-Time Information, Inter-Agency Collaboration

Introduction

The Southern Malay Peninsula remains impacted by intense precipitation and extensive flooding, leading to the need for evacuations and causing significant damage. On February 28, 2023, Malaysia's Meteorological Department (MET Malaysia) released a range of alerts across regions. A danger warning was specifically issued for Johor, encompassing areas like Kluang, Mersing, Kulai, Kota Tinggi, and Johor Bahru, signifying the anticipation of persistent heavy

rainfall. According to the update of March 6, 2023, NADMA Malaysia has reported that 13,336 families, equating to 46,630 individuals, remain displaced and sheltered across 250 evacuation centers (AHA Centre, 2023). This situation is clear enough to give an impression that the ongoing natural disaster in Malaysia demands urgent attention from humanitarian agencies to ensure prompt delivery of logistical aid to the affected victims during disaster response.

Based on the Department of Statistics Malaysia (2022), total loss and damage in late 2021 and early 2022 caused by massive floods is RM 6.1 billion. The number of fatalities and affected people have been reported to have increased, especially during a heavy flood in Malaysia (Hana Naz Harun, 2021) which can relate into logistics readiness in humanitarian disaster response. It has become a hot topic around the world in natural disaster research (Shen et al., 2018; Whybark et al., 2010; Hashim et al., 2023).

Relief and rehabilitation agencies are encountering limited access to up-to-date and all-inclusive location data sharing, which impedes their capacity to provide supplies to victims of disasters. Furthermore, challenges in sharing location data between different agencies and governmental bodies has result in redundant efforts, duplication of resources, and a fragmented response. Current location data sharing leaving gaps in information which hinder a thorough understanding of local conditions, infrastructure, and vulnerability factors.

In light of Malaysia's struggle with floods, the acquisition of accurate data location is crucial in order to obtain exact and comprehensive information regarding the impacted regions. In response to Malaysia's ongoing struggle with floods, the critical need for accurate data location has motivated researchers to conduct studies focused on identifying the most important data locations essential for efficient logistics support to disaster victims. This data includes details such as surroundings, infrastructure, population density, and potential risks. Such precision facilitates more effective planning and allocation of resources by relief and rehabilitation agencies. It provides decision-makers with comprehensive insights into the geographic context of the disaster, aiding in making informed decisions about response strategies and resource deployment across a supply chain.

Hence, the present study aims to investigate location data sharing relevant to addressing logistics needs for inter-agency information sharing during flash flood disaster response in Baling, Kedah, and Hulu Langat, Selangor. The flash flood disaster on July, 4, 2022 in Baling, Kedah, has caused almost 100 homes to be inundated by flood waters and is considered one of the worst disasters in the affected region (Zulkifli, 2022). Whereas, a flash flood disaster on December 18, 2021, in Hulu Langat, Selangor, killed more than 50 people and was the worst-hit district in Selangor (Awang, 2022).

The objective of the study is to evaluate the types of location data sharing required to fulfill logistics needs during humanitarian disaster response. It examines the information-sharing experiences of relief and rehabilitation agencies involved in delivering supplies to disaster victims during flash flood disasters from both cases. Special attention is given to the real-time data acquisition by humanitarian agencies based on logistics needs during a flash flood disaster in delivering humanitarian aid to disaster victims. The study aims to answer following research questions (RQs)

- 1) What is the essential location-based data requirements for logistics planning and execution during humanitarian disaster responses?
- 2) How does information based on locations improve humanitarian logistical activities during disasters?

In order to obtain solutions to the research questions stated above, this study critically analyzes the scenario involved in dealing with the flash flood disaster in Kedah and Selangor areas. The subsequent sections of this article are structured as follows. Section 2 outlined the research methods employed in carrying out this study. Section 3 reviewed and critically analyzed the existing body of literature with regard to location data sharing in disaster response. Section 4 discussed the challenges uncovered in humanitarian logistics. Section 5 represents the research findings and detailed discussion on the findings based on the case study. Section 6 discussed the strategies for optimizing humanitarian logistics. Section 7 discussed the implications and future directions of the study. Ultimately, the study concludes succinctly in Section 8.

Research Methodology

This study is an exploratory research that aim to explore the location data sharing during humanitarian disaster response and it impact towards humanitarian logistical activities during disasters. The utilization of case studies has been extensively employed in research on humanitarian supply chains (Masudin et al., 2021; Abdul Munir et al., 2022; Stumpf et al., 2023). It enables researchers to investigate actual events in real-life contexts. This method is effective in examining the functioning and underlying causes of relationship mechanisms in current events (Yin, 2013).

Baxter and Jack (2008) suggested that multiple case studies provide more convincing theory when the suggestions are more intensely grounded in several empirical evidence. In addition, multiple case studies enable researchers to make a comparative analysis of different examples in order to comprehend the distinctions and similarities among them (Baxter & Jack, 2008; Stake, 1995). The validity of triangulation is enhanced when numerous data collections and multiple cases are used (Voss et al., 2002). In addition, method triangulation is the use of multiple methods of data collection about the same phenomenon (Polit & Beck, 2012).

In this study, a qualitative method was conducted and the objective was to extract valuable insights about location data sharing by humanitarian agencies during disaster response, focusing on the worst flash flood that occurred in Malaysia, specifically in Kedah and Selangor. By gaining insights into location data sharing, the aim was to enhance the transparency of information sharing among agencies responsible for providing logistics support to disaster victims during the crisis. Developing explanations during data analysis enhances internal validity of research outcome that address the research questions (Rowley, 2002). The research participants were from government humanitarian agencies that act as logistics providers and communities in affected locations.

Data Collection

According to Yin (2003), conducting a multiple case study allows the researcher to examine the data within each specific context as well as across other situations, which is not possible with a single case study. Thus, this research explores the nature of flooding in Baling's

Kampung Iboi, situated in a rural area, while addressing flooding in Hulu Langat, Selangor, which pertains to an urban setting.



Figure 1 Study area at Baling's Kampung Iboi



Figure 2 Study area at Hulu Langat, Selangor

The study area (see Fig. 1 and Fig. 2) experienced the worst flash flood that occurred in Malaysia. Flash floods that happened at Kampung Iboi on July 4, 2022 has impact 50 houses due to the strong current from the creek in the Gunung Inas range. Whereas at flash flood that happened at Hulu Langat, Selangor on December, 18, 2021 has affected many villagers' settlements due to the water reservoir in the mountainous area has flowed in Hulu Langat causing extraordinary floods. The different situations of case studies are utilised to enhance the validity of the input gathered from the research because differences in response times and accessibility might vary greatly between rural and urban locations in perspectives of infrastructure and resources limitations. Gaining a comprehensive understanding of these distinctions enables agencies to optimise their tactics in order to facilitate prompt and efficient exchange of location data, hence enhancing the efficacy of disaster response efforts.

A sample for this study was administered through purposive sampling, involving 9 research participants. A qualitative study may utilise a carefully selected sample that is relatively small in size (Miles & Huberman, 1994). The data collection was initiated in August 2023 and lasted for four months. The research participants were approached through semi structured interviews. Individual interviews were favoured over group discussions due to the diverse range of experiences reported by each participant.

Table 1

Informant profile for the case study of the flood at Kampung Iboi, Baling, Kedah

Research Participants	Position	Gender	Experience (Years)
Research Participant 1	District Officer, Baling	Male	35
Research Participant 2	Civil Defence District (APM) Officer, Baling	Male	17
Research Participant 3	Civil Engineer Roads and Facilities (JKR) Officer, Baling	Female	14
Research Participant 4	Principal Assistant Director, Productive Welfare and Community (JKM) Division	Male	20
Research Participant 5	RELA District Officer, Baling	Male	12

Table 2

Background of research participants for the case study of the flood in Hulu Langat District, Selangor

Research Participants	Position	Gender	Experience (Years)
Research Participant 6	Village chief of Kampung Dusun Tua Batu 16	Male	9
Research Participant 7	Village chief of Kampung Sungai Lui	Male	12
Research Participant 8	Village headman of Hulu Langat District, Selangor	Male	5
Research Participant 9	Director of Productive Welfare Section, Social Welfare Department (JKM)	Male	23

The respondents were encouraged to share their personal experiences in delivering humanitarian relief aid for disaster victims through logistics support. They represented humanitarian agencies, logistics service providers, and committees in affected disaster areas. Most of the interviews lasted for 50–60 min with the participants' consent using a recording device.

The figure below shows the method used in this empirical research.

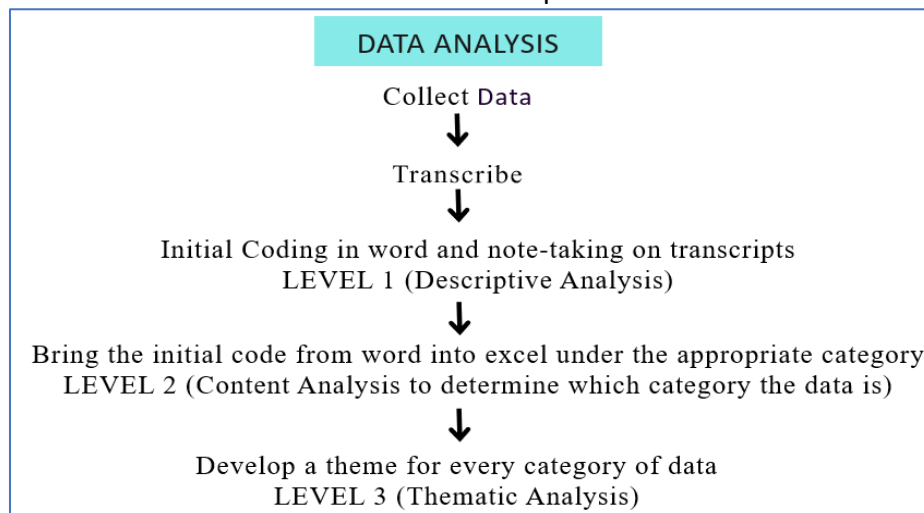


Figure 3 Method in Data Analysis

According to the figure 1.1, data is collected from the interviews and transcribe in form of written document to enable better review, make it easier to analyze the data systematically. The researcher code, categorize, and extract themes from data collected by apply Atlast ti software to support data analysis. By employing content analysis, the prevailing patterns were identified and subsequently compared and contrasted among the different groups. As a result, valuable data was gathered in the form of themes related to the sharing of location information during the disaster relief efforts in the Malaysian flash flood disaster.

Result and Findings

All respondents, consisting of community and humanitarian agencies involved in the immediate response phase of the flash flood, had firsthand experience in distributing logistics support. They dealt with challenges related to location data sharing among communities and humanitarian agencies to facilitate the efficient distribution of relief aid through logistics support for disaster victims. The participants' responses were compared to understand their perspectives on location data sharing which act as essential aspect for planning, coordinating, and executing effective and targeted response efforts during the disaster. Community and humanitarian agencies engagement in location data sharing are discussed and analysed.

Table 3
Data Requirements through Location Data Sharing

No.	Theme	Code
1	Geospatial Information	<ul style="list-style-type: none"> • Location of disaster • Alternative routes • Routes to the disaster zone

The exact location of affected areas is foundational for effective humanitarian disaster response. It is a fundamental piece of information for the disaster management committee at the district level to ensure logistics support reaches those in need at maximum speed and effectiveness. Again, engagement between community at affected area and humanitarian agencies is very important to enable data sharing about the exact location of disaster.

According to participant statement, it revealed that information of disaster location has travels through the established levels of authority in disaster management.

“...like the case in Iboi, the penghulu informed me of the location of the affected area which is on the road of Kampung Iboi, that several houses around Kampung Iboi have been affected” said by Research Participant 1.

The district officer, in their capacity as the chairman of the disaster management committee, will strategize and synchronise the provision of logistical support upon receiving precise information regarding the disaster's location, by mobilising the appropriate agencies.

“...After the APM receives the disaster location from Pusat Kawalan Operasi Bencana (PKOB), the APM will assess the situation, and the district officer will send a rescue team to the intended locations” said by Research Participant 2.

Nevertheless, it remains necessary to evaluate the situation from many viewpoints, as this enhances the assessment process for making decisions regarding logistics help. During the assessment stage, precise identification of the impacted area's location is crucial.

Besides that, alternative routes are considered location data as they relate to geographic features that show different roads that can be taken to reach affected areas.

“...We will look at alternative roads from the road structure for us to channel logistics assistance. We will look at other alternatives so that we don't get stuck in it. It is in the form of a map. Google map only” said by Research Participant 3.

The statement clearly shows that multiple alternative routes ensure greater resilience in providing logistics aid. It is because alternative routes provide backup options, allowing emergency responders to maintain the flow of aid even in challenging conditions. It's proven that Google Maps provides valuable data location that is widely used as a component of Geographic Information Systems (GIS).

Location data sharing is very important for responders to prepare logistics equipment needed on alternative routes to bypass congestion caused by debris or traffic delays during chaotic situations. Logistics equipment, such as heavy machinery like bulldozers, excavators, and backhoes, is furnished to facilitate tasks such as debris clearance, infrastructure restoration, and the creation of access routes in impacted areas. In addition, traffic management equipment such as traffic cones, barriers, and signs are utilised to regulate traffic movement and ensure road safety.

Primary routes are considered the key transportation arteries that connect emergency responders to the affected population. It refers to location data that enables efficient paths for responders to convey personnel, equipment, and supplies with minimal delay. However, first responders commonly confront blocked key roadways during logistical tasks in affected areas. Thus, alternative routes are vitally critical for personnel to manoeuvre past blockages, access damaged areas, and continue the flow of essential supplies and manpower. The alternative routes are considered very important by the responders to reach affected areas when the primary routes are blocked.

“...Sometimes the information is not so clear that we can use it this way. The temporary belly bridge is broken, and people don't know how to get in. Apparently, it can be entered through the alternative road of Highway Gerik” said by Research Participant 5.

This situation illustrates that there is still poor location data sharing between agencies, highlighting the need for improvement in information sharing between responders during humanitarian disaster response. Location data sharing that includes the location of a disaster, routes to the disaster zone, and alternative routes will enhance location awareness, route planning, and better logistics coordination to meet the needs of affected populations.

In a case study conducted in Hulu Langat, Selangor, it was observed that the village headman receives critical information, especially regarding the locations of disasters, from the village chief. It is to ensure that necessary logistics support can be directed to the affected areas. The data on flooded areas is shared with the disaster management committee at the district level. This highlights the importance of location data sharing in the context of disaster management, ensuring that relevant information is communicated and presented to higher authorities, such as the District Level Disaster Management Committee, for a coordinated response of logistics support. The relevant agency promptly responds by going directly to the scene as directed by the district officer.

“... Among the information received by the village headman from the village chief, the first is flood location information. Stating that this area has been flooded and if there is a movement of people to a safe place, it will usually be informed by the village chief. So that information will be taken and presented by the village headman to the District Level Disaster Management Committee” said by Research Participant 8.

This indicates a streamlined process of location data sharing, enabling swift and targeted actions based on the received information. The dialogue implies a well-organized system where the transmission of location data is effective in facilitating quick responses and interventions.

“... We inform the village headman about any information regarding the location, and humanitarian aid will be directly channeled to the scene by the humanitarian agency” said by Research Participant 6.

The village chief from Kampung Dusun Tua Batu 16 revealed that there is an immediate and responsive communication system in place regarding location data. The individual, noticing the rising water level, contacts the headman and provides specific location details. This indicates a form of location data sharing where the requester is able to convey precise information about the affected area to seek assistance.

“... Before that, when the water level had risen, I contacted the village headman. Can you send help in this area? said by Research Participant 7.

Another village chief from Kampung Sungai Lui comment on the same regarding the location data sharing. It clearly shows that notification of the location of the disaster is very important to ensure that the delivery of aid reaches the right location.

The activation of temporary evacuation centers depends on information received by district officials from the ground level. The need for an official order from the District Disaster Committee is emphasized before any action, such as opening a temporary evacuation center (PPS) or delivering supplies, can take place. The location data sharing is integral to this process, as it plays a crucial role in determining the areas affected by floods and the subsequent decision-making for relief operations. It underscores the importance of official channels and timely location-based information for coordinated disaster response efforts.

“... The initial information comes from district officials indicating the activation of the temporary evacuation center. Without an order from the District Disaster Committee, the temporary evacuation center cannot be activated, resulting in a delay in early actions and the delivery of supplies. When the district official declares a flood in a specific area and requests the Social Welfare Department (JKM) to open the Disaster Operations Control Center (PPS), we will initiate the operation to open PPS, followed by the supply of goods to the affected victims said by Research Participant 9.

The term 'initial information' refers to data related to a disaster, encompassing understanding the location of the disaster, identifying alternative routes for evacuation, and planning the most effective routes to access and respond to the disaster zone. This information is crucial for agencies to prepare and respond to disasters, particularly in organizing logistics support for the affected population. Based on the findings and above discussion, themes in location data sharing during disaster response are summarized (see Table 3). This information plays a major role in meeting the logistical requirements of humanitarian agencies.

Conclusion

Location data sharing during disaster response is closely related to the performance of logistics support for efficient and effective coordination. Furthermore, location data sharing provides a comprehensive view of the disaster scenario, including the geographical location of the incident. Both case studies highlight the crucial need of exchanging location data to enable efficient logistics for disaster response. The location data, which includes the exact location of the incident, alternative routes, and routes to the disaster zone, proved to be crucial elements for efficient and prompt disaster response operations. This information is vital for making well-informed decisions on disaster response and management. Precise information about the location of a disaster allows for the rapid deployment of logistics resources. Emergency responders can use accurate location data to identify the most strategic points for setting up humanitarian supply for disaster victims. Location data facilitates the optimisation of supply chain routes. Logistics personnel have the ability to strategize the optimal routes for transporting relief supplies, guaranteeing prompt delivery to impacted regions while avoiding obstacles like as road blockages or hazardous places.

Other than that, the utilisation of alternate routes and routes leading to the disaster area implies that the sharing of location data facilitates the process of strategizing and navigating through various pathways. This improves the effectiveness of emergency response teams in promptly accessing impacted regions and providing aid. Accurate location data enables authorities to optimise logistics resource allocation, ensuring that alternate routes are taken into account and the most efficient paths are selected for reaching the disaster zone. This can result in expedited and more efficient response operations.

In addition, familiarity with other routes and routes to the crisis area aids in the creation of safer pathways for both emergency personnel and evacuees. This highlights the role of location data in enhancing safety measures during disaster situations. In other perspective, it allows for the identification of safe routes and secure areas for storage and distribution, minimizing risks to both the logistics teams and the affected population. Sharing location data improves communication and coordination among various groups engaged in logistical

support. Authorities can offer precise instructions utilising up-to-date information, guaranteeing that logistics teams can successfully traverse and distribute goods.

Location sharing, which includes information on the location of a disaster, alternative routes, and routes to the disaster zone, is crucial for a comprehensive and efficient disaster response system. This information facilitates timely disaster response, efficient navigation of logistics support for disaster victims, enabling strategic resource planning, establishing safer pathways for both emergency responders and the affected population, and effective communication across the humanitarian supply chain.

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