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An Assessment to Determine the Typology of Spaces for a Flood Evacuation Centre in Malaysia

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Abstract
Flooding is a yearly tragedy in Malaysia; hence the need for evacuation centres is paramount. However, most of Malaysia's evacuation centres in flood-prone areas have been criticized for having problems, particularly with space management. As a result, the study aims to develop a recommended typology of spaces model for a flood evacuation centre in Malaysia based on local agreement and perception. This paper uses Likert scale questionnaires as a quantitative strategy to fulfil the research purpose. Overall, the study suggests nine typologies of space that must be provided for flood evacuation centres in Malaysia.

Keywords: Flood disaster, evacuation centre, typology of space.

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1.0 Introduction

Due to the impact of flooding, the number of vulnerable cities and populations continues to grow worldwide (Mabahwi et al., 2021). According to Noor Diyana, Fakhru'l-Razi, Aini, Ahmad, & Muhaimin (2020), Malaysia is also one of the countries affected by monsoonal floods yearly, causing a significant amount of casualties, displacement of communities, damages to property, and crops. As a result, flood evacuation centres have become a demanding facility for the locals during the disaster. W Seman et al. (2021) claimed that physical spaces play the most important role in developing or selecting a flood evacuation centre to bring satisfaction to the occupant. However, due to the government's use of public facilities such as schools, mosques, and community halls as temporary evacuation centres, many evacuees have complained that the majority of the evacuation centres in Malaysia's flood-prone areas are unsuitable in terms of space, physical facilities, management, and other factors (Suhardi, 2017; W Seman et al., 2021). The study by Zahari and Hashim (2018), on the other hand, indicated that there is no implementation of standards or guidelines for flood relief shelters in Malaysia. With the challenges posed by the frequency of flood events, Zahari & Hashim (2018) stressed that there is a critical need to develop criteria for design guidelines to optimise the public space usage in terms of design and spatial condition. As a result, the study aims to develop a recommended typology of spaces model for a flood evacuation centre in Malaysia to satisfy users during a flood crisis.

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2.0 Literature Review

2.1 Understanding Flood Vulnerability in Malaysia

Flooding is a disaster that occurs yearly in Malaysia and has dominated since the 1880s. The Malaysian National Security Council (MNSC) directive 20 (2003) defines disasters as "an emergency that will cause the loss of lives, damage property and the environment, and impede local, social, and economic activity".

Flood disasters have historically occurred in Malaysia during the monsoon season, which lasts from November to March and includes above-average rainfall. As a result, the states of Kelantan, Terengganu, and Pahang are frequently affected by the monsoon season, which results in catastrophic flooding. On the other hand, flood disasters are caused by bad weather and pollution, ineffective drainage systems, uncontrolled deforestation of hill slopes, and poor urban management. As a result, the calamity's main impact has been mortality, physical injury, and infrastructural destruction.

2.2 The Flood Evacuation Centre

Emergency sheltering or evacuation centres are critical components of disaster response for affected areas. Evacuation centres are facilities where the community of the disaster-affected areas is assembled. The researchers also emphasised that this is the where all vital services offered to evacuees, such as food, accommodation, information, and other services, are provided over a while, days or weeks.

However, due to the government's use of public buildings such as schools as temporary evacuation centres, many evacuees have complained that evacuation centres in Malaysia's flood-prone areas are unsuitable in terms of space, physical facilities, management, and other factors (Suhardi, 2017; W Seman et al., 2021). According to the findings of a study conducted by Fakrulhazri, Hassan & Ahmad (2018), the locals are extremely dissatisfied with Temporary Flood Transfer Centres (TFTCs), such as a school hall that was not designed to be a flood evacuation centre but was gazetted as one by the government. Mohd Subri, Wan Razali & Mohd Said (2018) also mentioned that the majority of infrastructure facilities in flood-prone areas are not designed for those circumstances. Thus, the shortage of the previously mentioned resources and facilities, combined with tension, worry, and depression, will impact the quality of life of flood victims during the crisis.

2.3 Parameter 1: Human Motivation and Needs

Human motivation and needs are critical during a catastrophe, especially for flood victims. Hence, the Hierarchy of Needs model by Maslow is studied to describe the major needs of victims, while the model possibilities are shown in many works of literature on the past, current, and future emergency shelter designs (Suhardi, 2017). Simply expressed, this theory of psychology defined by Abraham Maslow helps understand what a person needs to motivate themselves and continue to move forward during a crisis (Onainor, 2019). Hence, this theory will be explored in this research to abstract what typology of space is needed to fulfil the theory during a crisis.

Consequently, numerous researchers from prior catastrophe studies have extensively examined how this theory of human motivation is regulated to understand the needs of victims in a disaster context fully (Bozyiğit, 2021; Ha, 2017; Hopper, 2020; Ryan, 2018). The model categorises human motivation and needs into five layers: physiological needs, safety needs, love and belonging needs, esteem needs, and self-actualization.

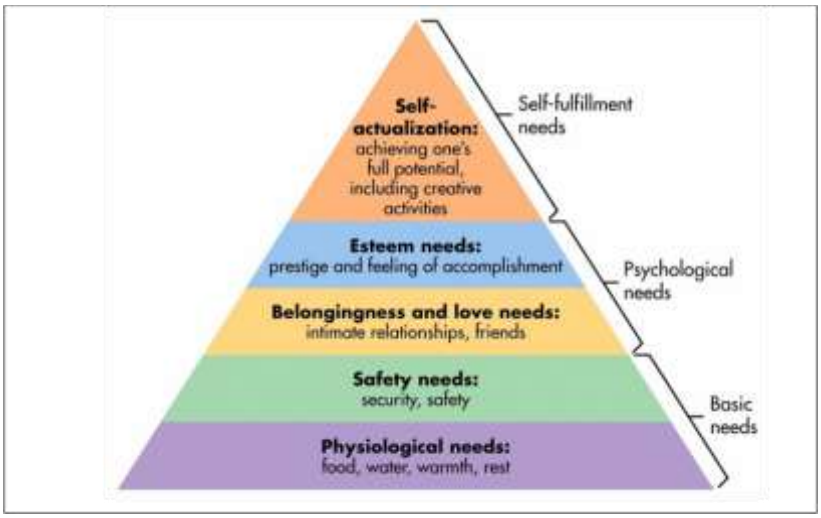


Fig. 1: Maslow's Hierarchy of Needs
(Source: McLeod, 2018)

2.4 Parameter 2: Disaster Management Cycle

According to research findings by Azimi, Zakaria & Majid (2019), the researchers identified that previous studies on disaster management in Malaysia have been encouraging, with several articles covering flood risk and disaster risk reduction as the go-to strategy for minimising disaster threats. On top of that, there are specific priority areas such as climate change adaptation, community resilience to disaster, and

how flood management procedures are carried out in Malaysia. The above statement is supported by several other researchers, for example, (Chong et al., 2018; Samsuddin et al., 2018)

Based on the study by Nojavan et al., (2018), the disaster management literature is full of frameworks, models, and procedures for dealing with disasters. The Disaster Management Cycle framework, which encompasses the phases of mitigation/prevention, preparedness, response, and recovery, is possibly the most popular framework that dominates the literature (Alexander, 2019). According to a comprehensive study and publication by Haigh (2018), disaster management aims to reduce or prevent potential losses from hazards, provide fast and appropriate aid to disaster victims, and accomplish rapid and successful recovery.

Fig. 2: Disaster Management Cycle Implemented in Malaysia, Adapted from FEMA (2010)
(Source: Azimi et al., 2019)

2.5 Parameter 3: Type of Services for Flood Evacuation Centre

According to Padlee et al., (2018), there is a lack of studies identifying the type of services, as well as identifying local perceptions regarding existing flood evacuation centres in Malaysia. As a result, Padlee, Razali, Zulkiffli & Hussin (2018) conducted a study to identify the types of services required for a flood evacuation centre as a model for evaluating evacuees' perceptions of the service. The researchers went on to say that this study drew on various sources to determine the services offered at Malaysian evacuation centres, including websites, reports in local and international publications, and research journals.

The researchers identified seven aspects or services supplied at flood evacuation centres as a model for measuring perceived quality and satisfaction with those services. The seven services offered at evacuation centres are thus identified as (i) food, (ii) health and safety, (iii) transportation, (iv) volunteers, (v) site services, (vi) telecommunications and (vii) special facilities for people with special needs.

2.6 Summary of Literature Finding

In Malaysia, floods are regarded as the most significant natural disaster. Floods have become a common feature in the lives of a significant number of Malaysians due to natural factors such as heavy monsoon rainfalls, intense convection rain storms, increased runoff rates due to urbanisation, and poor drainage systems. However, due to the government's use of public facilities such as schools, mosques, and community halls as temporary evacuation centres, many evacuees have complained that the majority of the evacuation centres in Malaysia's flood-prone areas are unsuitable in terms of space, physical facilities, management, and other factors.

As a result, this article describes several principles, including Maslow's Theory, the Disaster Management Cycle, and the Type of Services for Flood Evacuation Centers, to assess and define the recommended typologies of space for a flood evacuation centre in Malaysia. The principles specify the criteria required for a flood evacuation centre. However, there is no explanation of the types of spaces required for the criteria to be performed. Hence, a few space typologies are abstracted as feasible and potential spaces to meet the criteria needs of the three principles in subchapters 2.3 - 2.5. Table 1 summarises the possible spaces abstracted from the three principles, which will be used as a model to gather data for this paper questionnaire.

Table 1. Summary of Possible Spaces Abstracted from the Three Principles/Framework

	Typology of Space	Example of Space	Parameter 1: Maslow's Human Motivation Theory	Parameter 2: Disaster Management Cycle	Parameter 3: Type of Services
1	**Shelter**	Shelter	√	√	√

		Bath Room; Toilet; Changing Room	√		√
		Laundry; Dry Area	√		√
2	**Medical Care**	Medical Supply Room	√	√	√
		Patient Room	√	√	√
3	**Volunteer**	Volunteers Room			√
4	**Food and Nutrition**	Food Court/ Hall; Kitchen	√	√	√
		Food Storage	√	√	√
5	**Community Area**	Recreation Area	√	√	
		Community Hall	√	√	
6	**Transportation**	Boat Deck/ Parking; Repair Area	√	√	√
		Boat Garage	√	√	√
7	**Storage**	Evacuee Storage; Volunteers Storage	√		√
8	**Management and Research**	Management Office; Research Room; Planning Office	√	√	√
9	**Rescue and Operation**	Operation Room; Monitoring Room	√	√	√

(Source: Author)

3.0 Methodology

3.1 Research Approach

In order to collect data for this paper, a quantitative approach was used in the form of a questionnaire survey. This research is divided into two data gathering methods for primary and secondary data sources, which are as follows: The primary data source is an online Linkert scale questionnaire, while the secondary data source is a literature study via online internet sources, journals, and books.

3.2 Overall Research Design

The research study is based on flood disasters and evacuation centres in Malaysia. Both primary and secondary data are collected to identify the factors that influence flood evacuation centre criteria and design, consequently recommending potential typology of spaces for a flood evacuation centre in Malaysia.

In this study, a quantitative approach was chosen as the research method. This strategy was chosen to better analyse the level of public agreement and perception of the recommended typology of spaces for a flood evacuation centre based on the finding from literature research. As a result, a Likert Scale Questionnaire was used in this study to identify and fulfil the above-mentioned goal. The closed-ended questionnaire was distributed online to the general public during Malaysia's flood disaster in December 2021. The intended participants are people who have been impacted by the tragedy, but it is also accessible to members of the general public who want to contribute their information and perceptions.

To reach the respondents, the questionnaire is generated using Google Form and thus distributed via prominent Malaysian online media such as WhatsApp, Twitter, and Facebook. Several posters will also be created as a catalyst to increase the number of respondents.

Thus, the data gathered from the respondents will be analysed to achieve the objectives of this research. Figure 3 shows the research framework of this study.

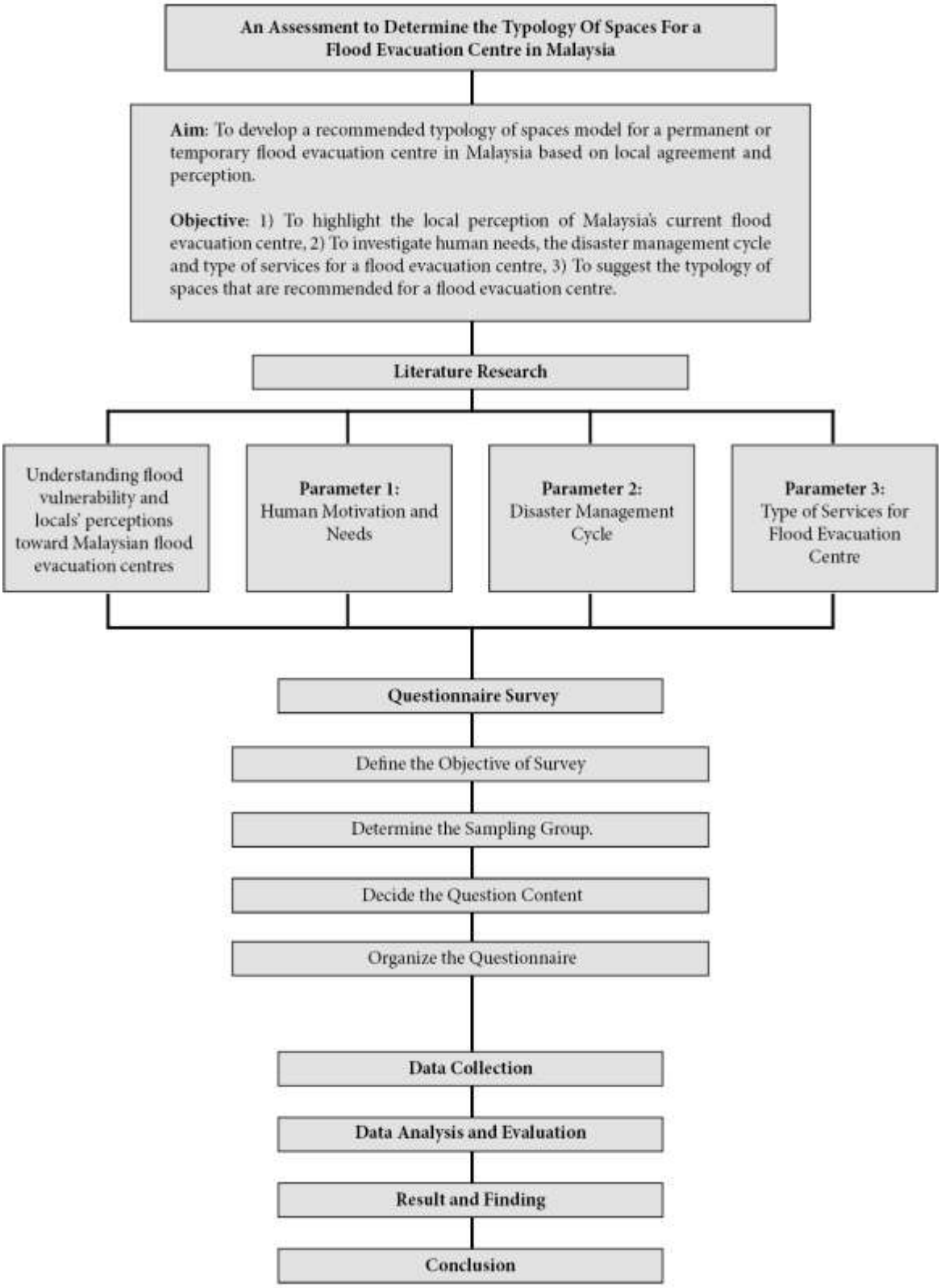


Fig. 3: Research Framework
(Source: Author)

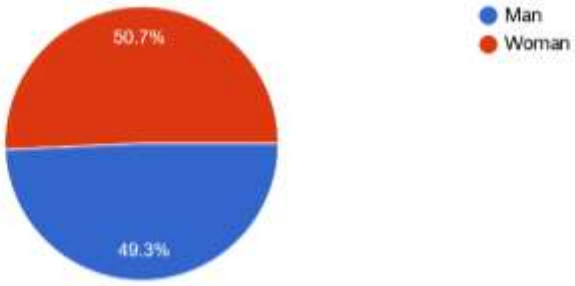
4.0 Findings

4.1 Section A- General Information

Table 2. The results of the Questionnaire Survey for Section A.

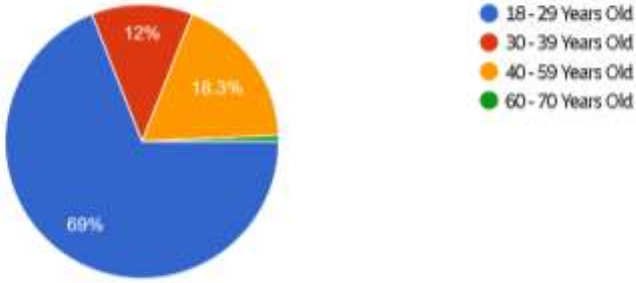
Question A1: What is your gender?

142 responses



Question A2: What is your age group?

142 responses

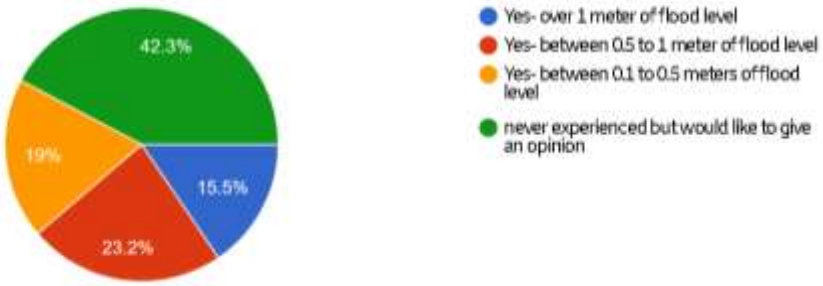


Question A3: Do you have a disability?

142 responses

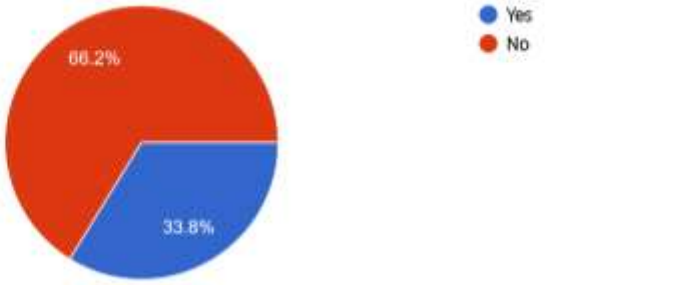
Question A4: Have you ever experienced flooding in the neighbourhood where you live in?

142 responses



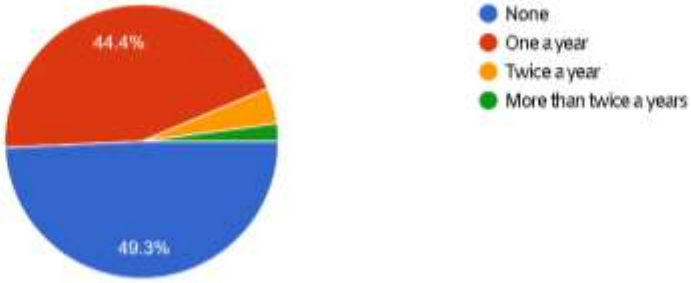
Question A5: Is your neighbourhood located in a flood-prone area in Malaysia?

142 responses



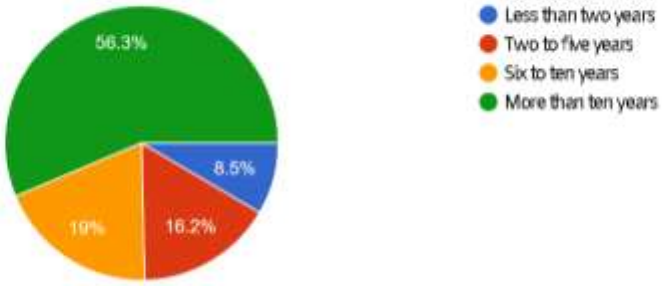
Question A6: How frequently does a flood calamity strike your neighbourhood?

142 responses



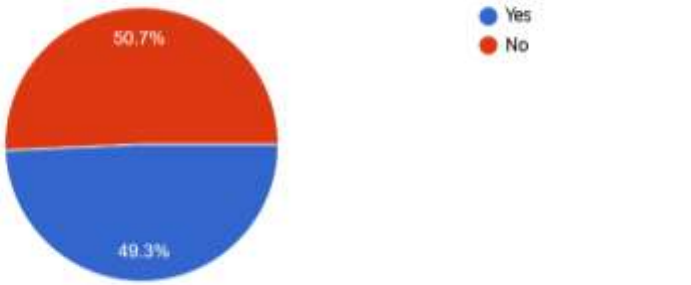
Question A7: How long have you lived in that area/ neighbourhood?

142 responses



Question A8: Is there a permanent or temporary flood evacuation centre in your area?

142 responses



(Source: Author)

The total number of persons who participated in this study is 142. As shown in Table 2, the number of female respondents (72, 50.7%) is higher than male respondents (70, 49.3%). The highest respondents were from the age ranges from 18-29 years old (98, 69%), followed by the age ranges from 40-59 years old (26, 18.3%) and the age ranges from 30-39 years old (17, 12%). The respondents' age ranges

from 60-70 years old (1, 0.7%) contribute the lowest. The survey is open to disabled individuals to analyse their opinions to design an optimal flood evacuation centre for all categories of people. However, just two people (1.4 %) who are disabled took part in this survey.

According to the results, the majority of participants (82, 57.7 %) have experienced floods in their neighbourhood. Hence, the remaining 60 participants are locals who want to contribute their knowledge and perceptions. 15.5% of the participants (22) have experienced floods exceeding 1m in height, followed by 23.2% of the participants (33) who have experienced floods between 0.5m and 1m in height, and 19% of them (27) have faced floods between 0.1m and 0.5m in height.

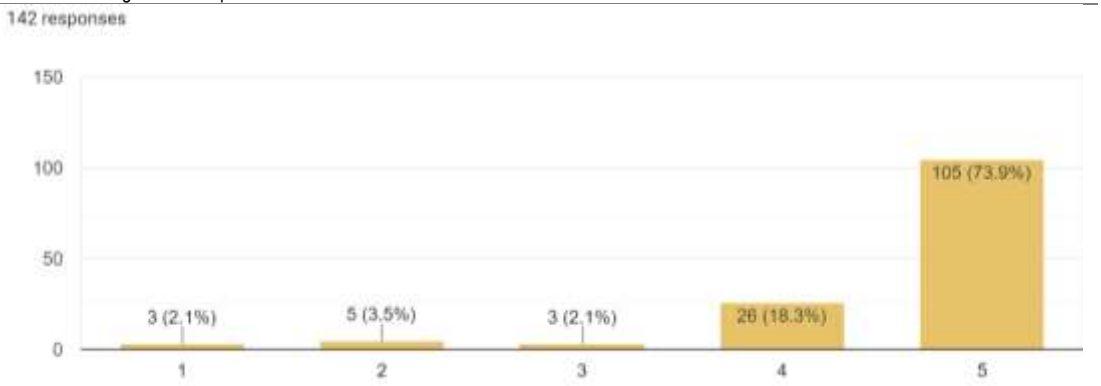
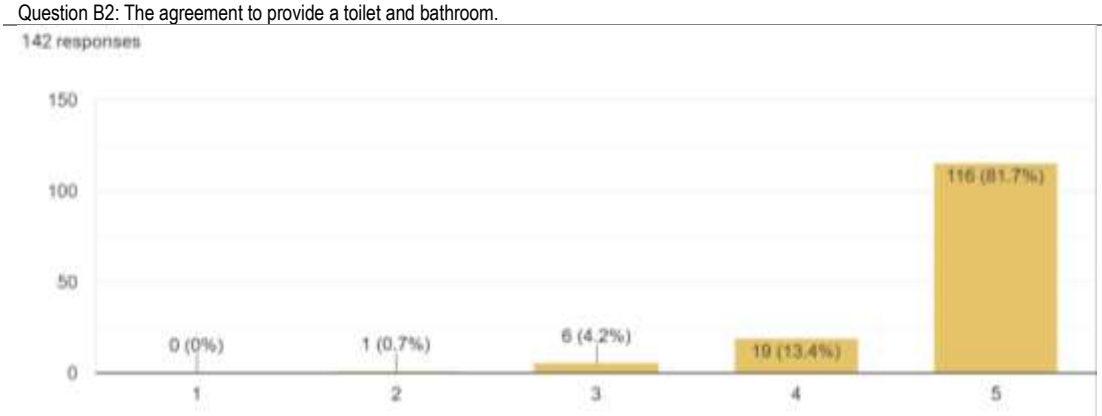
Moving on to question A6, the ratio of participants who encounter a flood disaster once a year (63, 44.4 %) is greater than the number of participants who suffer a flood twice a year (6, 4.2 %) or more (3, 2.1%). In Malaysia, 33% of them (48 participants) live in flood-prone areas. Additionally, the majority of them have lived in their neighbourhood for more than ten years (80, 56.3%), followed by participants who have lived in their neighbourhood for six to ten years (27, 19%), two to five years (23, 16.2%), and less than two years (12, 8.5%). As per the results in the above table, only 70 participants (49.3 %) had access to a flood evacuation centre in their neighbourhood.

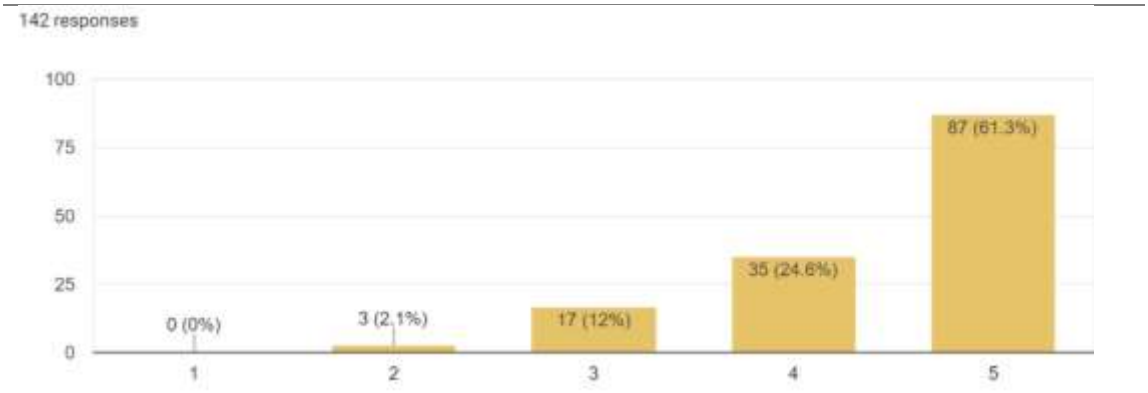
4.2 Section B- Proposal of Typology of Spaces for A Flood Evacuation Centre

This subchapter contains the most crucial findings to achieve the third objective of this research. This segment aims to determine the level of perception of locals toward the typology of spaces for a flood evacuation centre that has been addressed and extracted from literature research. The researcher identified nine typologies of spaces based on secondary data, including 1) shelter, 2) medical care, 3) volunteer, 4) food and nutritious, 5) community area, 6) transportation, 7) storage, 8) management and planning, and 9) warning and operation.

The participant will be asked to rate their level of agreement on a scale of 5 (strongly agree) to 1 (strongly disagree) with a 3 (neutral) response. Table 3 shows the results of this survey.

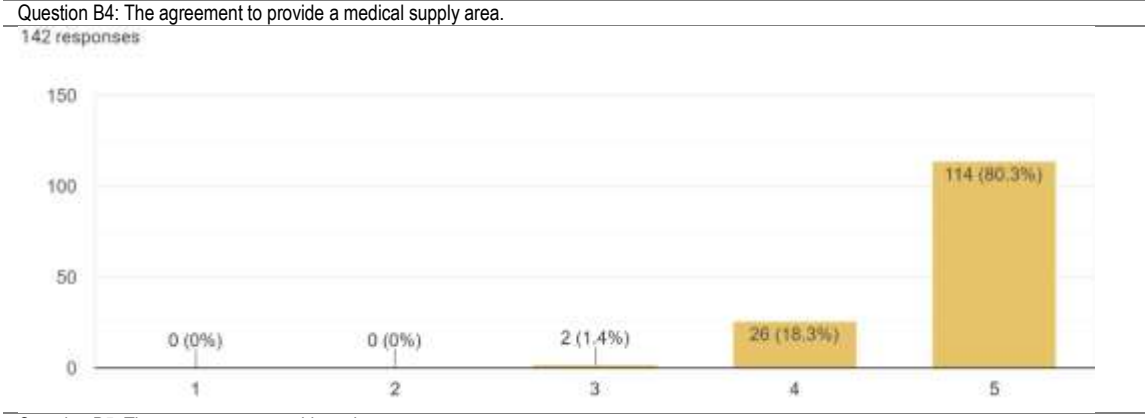
Table 3. The results of the Questionnaire Survey for Section B.

Typology 1: Shelter
Question B1: The agreement to provide shelter.

Question B2: The agreement to provide a toilet and bathroom.

Question B3: The agreement to provide laundry and dry area.

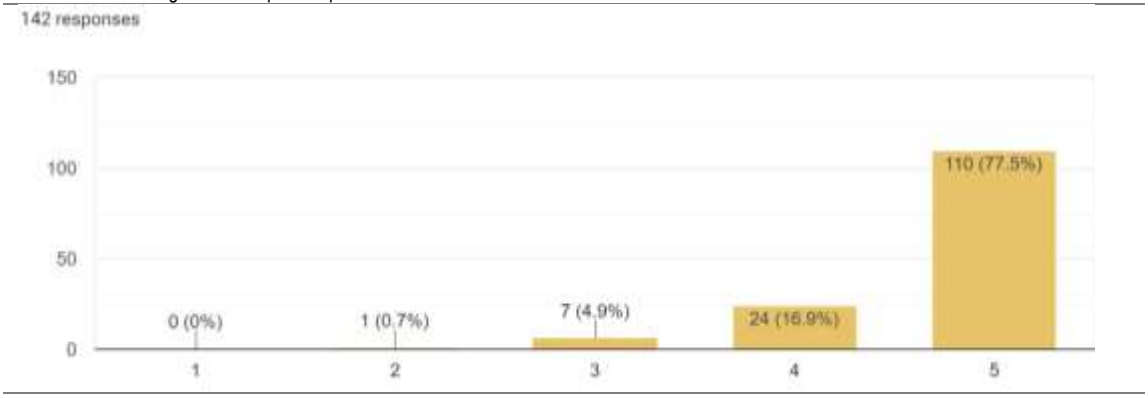


Typology 2: Medical Care

Question B4: The agreement to provide a medical supply area.

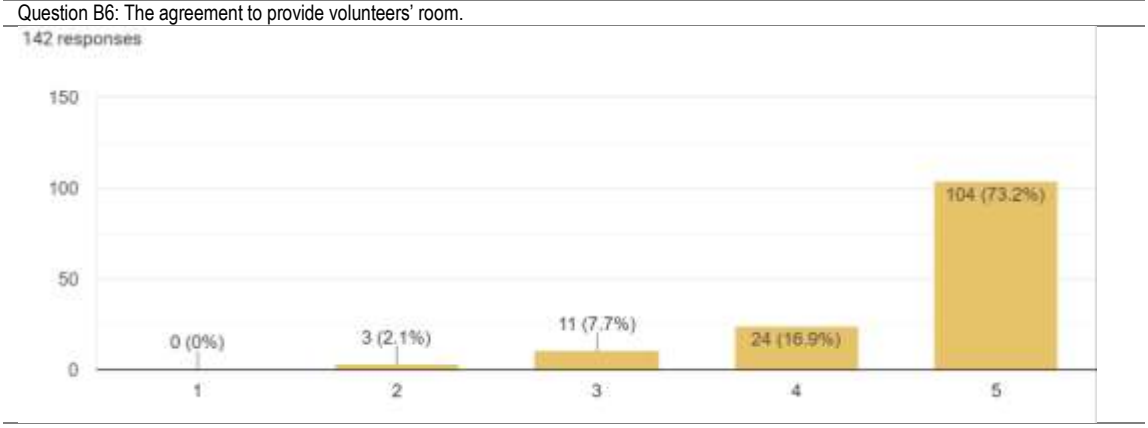


Question B5: The agreement to provide patient room.



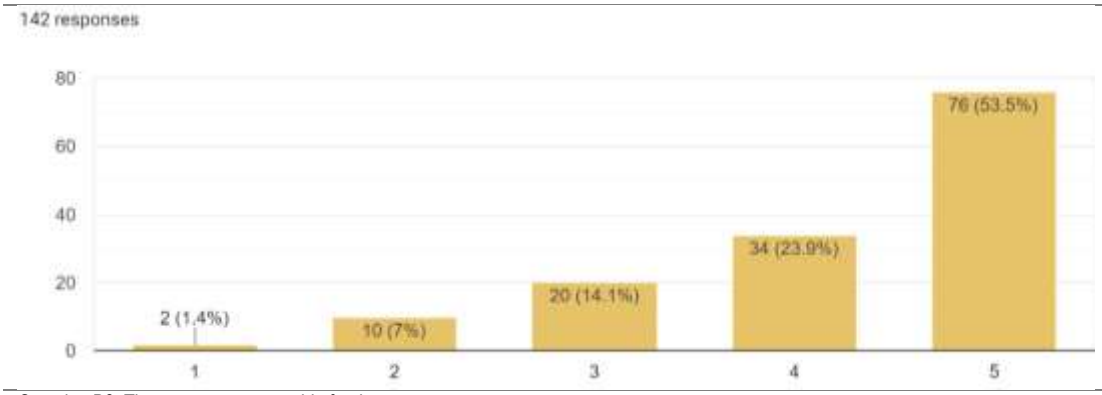
Typology 3: Volunteer

Question B6: The agreement to provide volunteers' room.

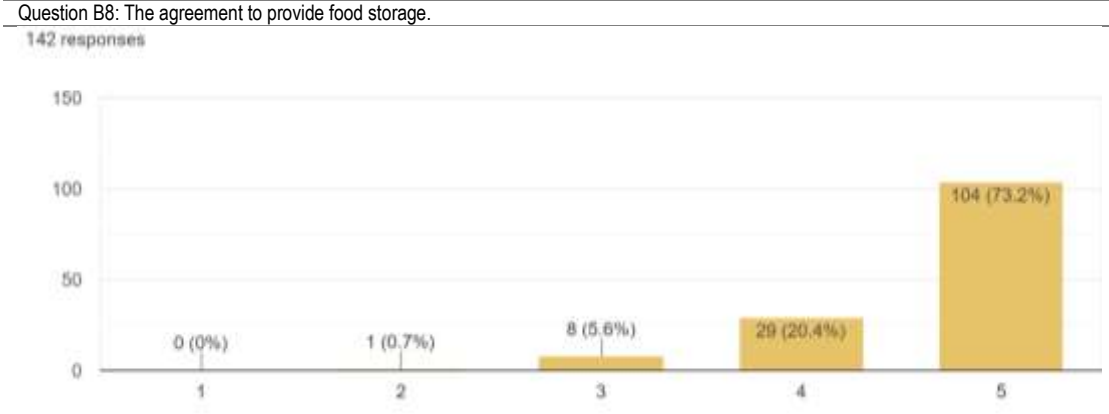


Typology 4: Food and Nutrition

Question B7: The agreement to provide a food hall and kitchen.

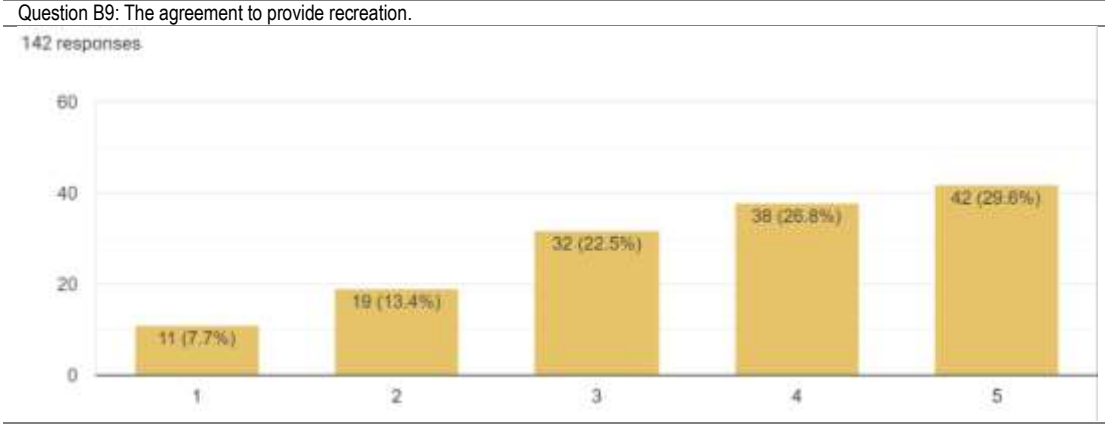


Question B8: The agreement to provide food storage.

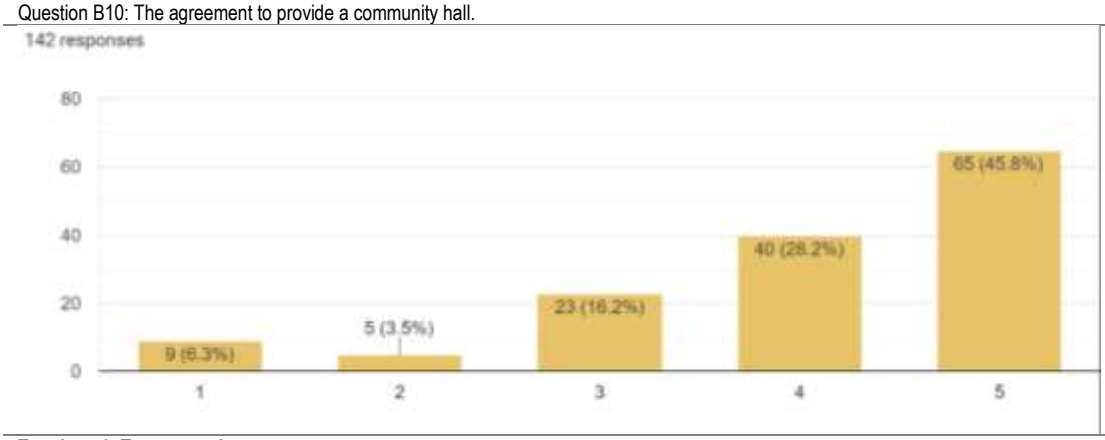


Typology 5: Community Area

Question B9: The agreement to provide recreation.

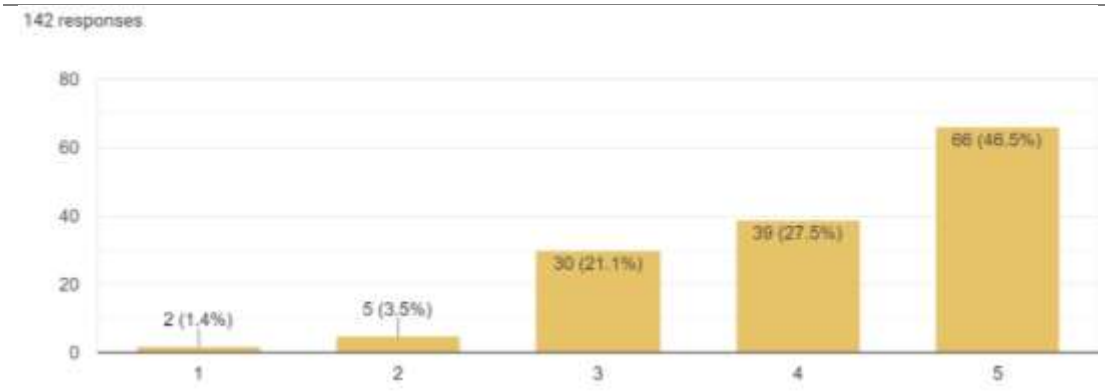


Question B10: The agreement to provide a community hall.

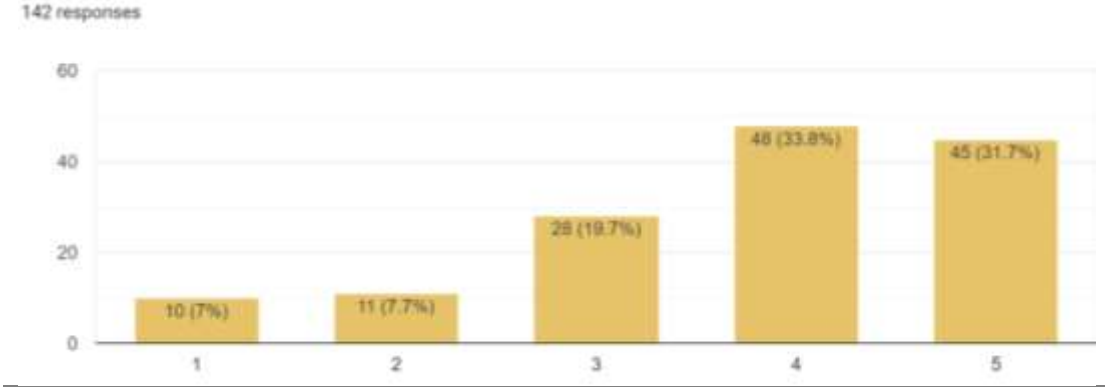


Typology 6: Transportation

Question B11: The agreement to provide a boat deck and repair area.

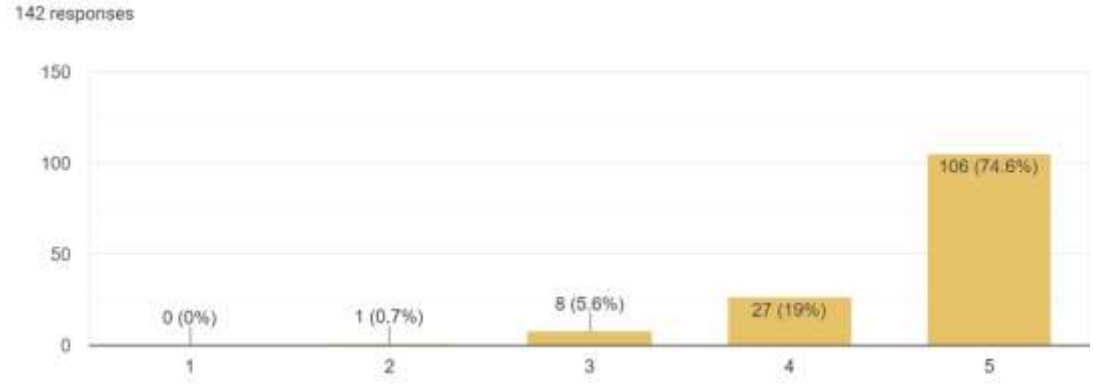


Question B12: The agreement to provide a boat garage.



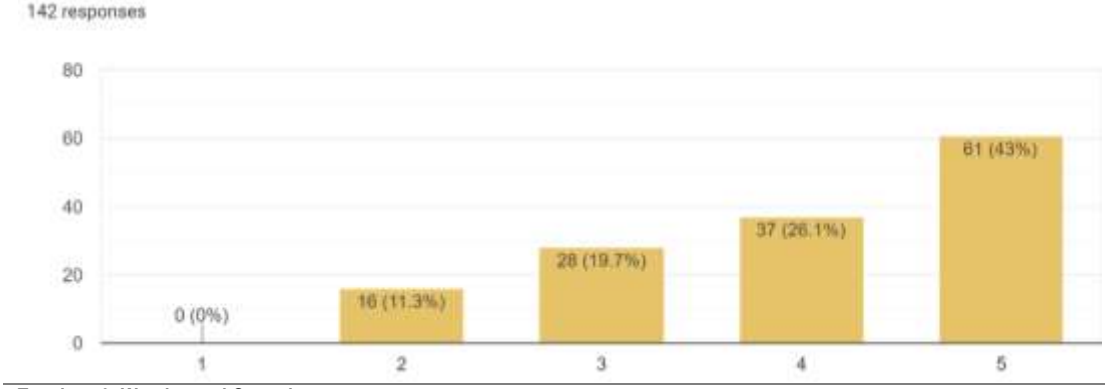
Typology 7: Storage

Question B13: The agreement to provide storage.



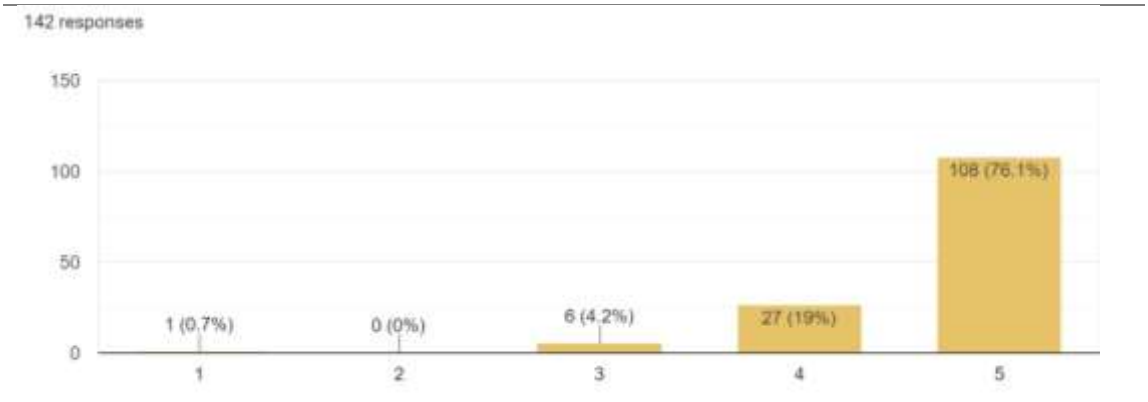
Typology 8: Management and Research

Question B14: The agreement to provide a management office, research and planning room.



Typology 9: Warning and Operation

Question B15: The agreement on providing warning and operation room.



(Source: Author)

5.0 Discussion and Conclusion

Overall, this paper is a compilation of a comprehensive study on the space typology for flood evacuation centres in Malaysia based on an understanding of human motivation and needs, the disaster management cycle, and the types of services that should be provided. The initial aim and objectives of the research have been achieved by providing an in-depth understanding of the topic through literature research and a questionnaire survey.

Evacuation centres are the main lifesaving shelters during flood events. Due to the importance of this support system during the crisis, an effective standard evacuation centre management is indeed vital so that all services can be accessed and used by evacuees conveniently. However, the victims are extremely dissatisfied with Malaysian Temporary Flood Transfer Centres (TFTCs), such as a school hall that was not designed to be a flood evacuation centre but was gazetted as one by the government. In conclusion, locals expressed that the majority of flood evacuation facilities in flood-prone areas are not prepared for a flood disaster, even though Malaysia has been dealing with this for many years.

According to the results from the primary data, which was completed by 142 people, the majority of respondents expressed they strongly agreed (on a scale of 5) with the model as described above, except the area of the boat garage, which was voted as agree (scale 4). There are no areas from the typologies that have been majority voted as neutral (scale 3), disagree (scale 2), or strongly disagree (scale 1). As a result, the model can be concluded as a recommended typology of space for flood evacuation centres in Malaysia based on local agreement and perception. Table 4 shows the study's compilation and summary.

Table 4. Compilation of Recommended Typology of Spaces for Flood Evacuation Centre

Typology of Space	Description	Architectural Illustration	Public Perception
1 Shelter	Shelter/ Rest Area. A space where flood victims and evacuees can take shelter from bad weather.		Strongly Agree
	Toilet and Bathroom. A sanitary area where flood victims can clean themselves and undertake sanitation activities.		Strongly Agree
	Laundry and Dry Area An area where flood evacuees can clean and dry their clothes.		Strongly Agree

2	Medical Care	Medical Supply Area A facilities area where flood victims can obtain medicine and other first-aid supplies.		Strongly Agree
		Patient Room The spaces where injured flood victims are treated and cared for by medical teams.		Strongly Agree
3	Volunteer	Volunteer's Room A place where the volunteers can rest after assisting the victims.		Strongly Agree
4	Food and Nutrition	Food Hall and Kitchen A location where food is prepared or received, allowing people to eat together.		Strongly Agree
		Food Storage A storage room where all of the food stock for the flood victims is kept.		Strongly Agree
5	Community Area	Recreation Area A social area or facilities where victims can assemble and engage in enjoyable activities to relieve stress.		Strongly Agree
		Community Hall A gathering hall where building users can assemble to conduct meetings or make announcements.		Strongly Agree

6	Transportation	Boat Deck and Repair Area An arrival area for the boat as well as a location for the boat to be parked.		Agree
		Boat Garage A garage where disaster relief agencies and flood victims can store their boats.		Strongly Agree
7	Storage	Evacuee and Volunteer Storage A location where evacuees and volunteers can store their belongings to avoid damage during flood days.		Strongly Agree
8	Management and Research	Management and Research Room Spaces where disaster management, research, and planning will be carried out for future improvement.		Strongly Agree
9	Warning and Operation	Warning and Operation Room A place where warning and operation activities will be conducted.		Strongly Agree

(Source: Author)

In this study, the researcher is only employing a closed-ended questionnaire survey approach to develop a recommended typology of spaces for a permanent or temporary flood evacuation centre in Malaysia. This is due to a research limitation, which is a lack of fieldwork because of Malaysian pandemic rules, which limit on-site involvement with locals. As a result, the findings of this study can be researched further in the future by conducting interviews with locals to have a thorough understanding of their needs in terms of the spaces of the flood evacuation centre. Furthermore, the research on this topic can be expanded by doing a case study and site visit of an actual flood evacuation centre in Malaysia, allowing the researcher to gain insight first-hand from the site.

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Paper Contribution to Related Field of Study

As claimed by Zahari & Hashim (2018), there is a critical need to develop criteria for design guidelines for a flood evacuation centre in Malaysia. Hence, the result from this study can be implemented as a simple guideline and model to design future flood evacuation centres for the locals. Furthermore, it can be used as an assessment to determine or identify existing buildings that have the potential to be converted into a temporary flood evacuation centre to meet the needs of evacuees and users in Malaysia.

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