

# Identifying the research of flooding in Kelantan, Malaysia: A review

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## Abstract

Flood is not inevitable in Malaysia as Monsoon annually occurs in Malaysia. The state of Kelantan is one of the affected among the other state of Malaysia where the Northeast Monsoon from October to March can cause flood because of the heavy rainfall. This article going to review a previous flood study in Kelantan to find out the research gap for the future. Based on the thematic review, the themes of floods study in Kelantan can be split into three that is the factor of the flood, impact of the flood, and flood resilience or mitigation. Further improvement can be made in the future study of floods in Kelantan.

## Introduction

Geographically, Malaysia is in a strategic location on the map, where Malaysia's location is outside of the Pacific Ring of Fire that makes it harder for Malaysia to get natural disasters such as an earthquake or volcanic eruptions. Even though, Malaysia is lucky to ought from the Pacific Ring of Fire, natural disaster such as flood is not inevitable in Malaysia. Flood, landslides, wildfires, oil spills, etc., are the five natural disasters that always happen in Malaysia (Department of Irrigation and Drainage Malaysia, 2018b, 2018c, 2018a, 2020a, 2020b). In fact, natural disasters like floods are occasionally happening every year in Malaysia. The flood can occur due to a few reasons such as heavy rain, ocean high tide, water flow obstruction in the drainage system, shallow rivers, land use, or heavy flow of water caused by rain or mud flood (Department of Irrigation and Drainage Malaysia, 2018a).

Three types of floods take place in Malaysia that is flash floods, monsoon floods, and coastal floods (Department of Irrigation and Drainage Malaysia, 2020b). Flash flood is a sudden flood that occurs because of the heavy rain that hits the dry land, and coastal flood usually happens when dry and low-lying land is flooded by seawater. While Monsoon flood usually happens in May to September (Southeast Monsoon) and October to March (Northeast Monsoon). Monsoon flood is different from the flash flood and coastal flood, where Monsoon flood is inevitable and has been happening annually in Malaysia especially the Northeast Monsoon that usually happens in the East Coast state of Malaysia. Monsoon flood-hit harder in states like Kelantan, Terengganu, Pahang, and Johor.

Each year, the Monsoon flood has caused a lot of damages to the community in Malaysia especially the community on the East Coast of Malaysia. The damages include destruction of crops, loss of livestock, damage of property, deterioration of health, and loss of human life. In 2000, floods caused by heavy rain in Kelantan and Terengganu have caused a Million USD loss and 15 deaths that year (Chan, 2012). Besides that, house damage, property damage, and vehicles damage are reported every time floods hit the victim. In addition to physical damage, mental health can also be a problem for the victims.

Every year, Malaysia never misses on getting hit by the floods and in 2014 particularly, the state of Kelantan is hit by the worst flood ever. In 2014, the worst flood was recorded in the four states of Malaysia including Kelantan, Terengganu, Pahang, and Johor. Furthermore, the 2014 flood consider as the worst flood ever to happen in 50 years as it causes a lot of damages and casualties. The loss due to this incident is estimated at almost RM2.9 billion including 2,076 houses destroyed and the other 6,696 houses are damaged by the floods (NADMA, 2019). Besides that, the incident also has caused the displacement of 541,896 victims from 136,447 families and 25 deaths in total.

While in 2021, Malaysia also has been hit by another big flood caused by the Northeast Monsoon that cause heavy rain for several days in a row that affected a few states in Malaysia including Pahang, Johor, Terengganu, Kelantan, Selangor, and Perak. There is a lot of casualties that have been recorded including physical damage and death caused by the flood and each state recorded different casualties, damages, and losses depending on the climate and environments that include the state of Kelantan.

Table 1 Frequency of flood events in Kelantan and maximum flood period

Year	Frequency of flood	Maximum flood duration (Day)
2016/2017	4	9
2017/2018	82	11
2018/2019	3	8
2019	18	7
2020	19	1

Source Jabatan Pengairan dan Saliran, (n.d.)

Table 2 The total number of displaced flood victims and loss assessment estimation in Kelantan

Year	Number of displaced flood victim	Loss assessment (RM)
2016/2017	40,263	33,070,000.00
2017/2018	22,340	13,630,000.00
2018/2019	0	1,120,000.00
2019	18,683	18,290,400.00
2020	-	-

Source Jabatan Pengairan dan Saliran, (n.d.)

Kelantan is one of the states that has always been hit by floods every year. Each year, victims and the state government of Kelantan suffer great losses due to floods especially in the year 2014. According to Jabatan Pengairan dan Saliran, (n.d.), from 2016 to 2020, the average of floods that hit Kelantan is 25, while the highest recorded floods that hit Kelantan are in the year of 2017/2018 for almost 82 times (refer to Table 1). The maximum flood duration recorded in Kelantan is 11 days in the year 2017/2018 while the least period of a flood is in the year 2020. The frequency of floods hitting Kelantan can be either less or more depending on the climate and environment of the place.

Besides that, each year number of displaced flood victims is high in the Kelantan such as in 2016/2017 the number of flood victims that have been displaced is 40,236, while in 2017/2018 is 22,340, 2019 is 18,683, and none recorded in the year 2018/2019 and 2020 (refer to Table 2). The number of displaced victims in each year is still recorded high in Kelantan and it became worst if the impact of the flood is huge. The impact of flood in Kelantan has caused a lot of loss not only towards the victims but also the governments. Each year, the state of Kelantan recorded more than a million-ringgit loss caused by floods. As the highest recorded in 2016/2017 that cost almost RM 33,070,000.00 (Jabatan Pengairan dan Saliran, n.d.).

The increase in severity of floods every year in Malaysia has caused a lot of distress towards the community since the Monsoon flood cannot be avoided. For some Malaysian, flood has become a common tragedy in their lives. That is why adaptation, resilience, and mitigation are important for these people because they can decrease vulnerability among them. Therefore, study regarding floods is important in Malaysia, as it will increase the knowledge and understanding towards the flood and the community that has been affected by it. Besides that, a study regarding floods will give further understanding of natural disasters and the changes that the community needs to adapt to. This article going to review flood studies in Kelantan that have been made in the past years. Besides that, this review going to find the research gap that can be seen in the past study so that improvement can be made in the future study.

## Method

The method of the review study is based on the flood study that has been made in Kelantan. The analysis of the study focuses on the study that has been made in the past year regarding the flood in Kelantan. The study includes impacts of flood, community experience on the flood, the factor of a flood, community resilience, flood mitigation, flood vulnerability, and the impact of floods to the community.

## Themes of the Previous Study

One of the states that have always been hit by floods is Kelantan, Malaysia. Kelantan is on the East Coast of Malaysia and the capital city of Kelantan is Kota Bharu. Kelantan is one of the states that has always been hit by the Northeast Monsoon where the heavy rain caused by the Northeast wind flow across the South China Sea and bring a lot of moisture to the atmosphere. The flood becomes more prevalent when the state of Kelantan is near to the South China Sea where the Kelantan River or known as Sungai Kelantan flow northward towards the South China Sea. Kelantan River is the major river of state in Kelantan where a lot of social activity, and economic activity has been done in that river. This paper going to review flood into three themes, first the factor of the flood,

second is the impact of flood, third is flood resilience or flood mitigation, and lastly, flood vulnerability. The theme of the flood is a review and analyse based on the objective and the outcome of each study regarding flood in Kelantan.

Table 3 Themes of the articles

Theme	Author	Title	Content
Factor of flood	Alias et al., (2016)	Rainfall analysis of the Kelantan big yellow flood 2014	Study about 2014 rainfall analysis and flood in Kelantan
	Aminah Shakirah et al., (2016)	A review on flood events for Kelantan River watershed in Malaysia for last decade (2001-2010)	Analysis of the study of flood events in the last ten year (2001-2010) in Kelantan
	Pah et al., (2011)	Land-use changes analysis for Kelantan basin using spatial matrix technique “patch analyst” in relation to flood disaster	Study regarding the analysis of changes in land use and the relation to flood disaster in Kelantan
	Pah et al., (2017)	Land use change and the occurrence of floods. The case of the Kelantan River basin	Study regarding land use change and the relation to flood disaster in Kelantan
	Salleh & S Ahamad, (2019)	Flood risk map (case study in Kelantan)	Study regarding flood risk analysis during the December 2014 flood in Kelantan
	Sathiamurthy et al., (2019)	Kelantan central basin flood, December 2014: Cause and extend	Study regarding the analysis of causes and extend of Kelantan central basin flood in December 2014
	Udin et al., (2018)	GIS-based river flood hazard mapping in rural area: A case study in Dabong, Kelantan, Peninsular Malaysia	Study regarding flood hazard mapping to determine which area is exposed to floods and characterized the flood zone by using GIS
	Wan Ruslan Ismail, (2018)	Extreme weather and floods in Kelantan state, Malaysia in December 2014	Study regarding the 2014 flood by using secondary data on reports and articles on the 2014 floods
Impact of flood	Agamuthu et al., (2015)	Impact of flood on waste generation and composition in Kelantan	Study regarding waste composition generated from the flood that hit Malaysia in 2014. The study analysed the impact of a flood on waste generation and composition.
	Chan et al., (2016)	Assessing different types of flood losses in Kelantan state in Malaysia during the December 2014 flood	Study regarding types of flood losses that can be assessed in Kelantan during the 2014 flood.
	Nayan et al., (2017)	Flood aftermath impact on business: A case study of Kuala Krai, Kelantan, Malaysia	Study regarding the impact of flood toward the business in Kelantan
	Yahaya et al., (2015)	The December 2014 flood in Kelantan: A post-event perspective	Study regarding the after-effect of 2014 flood in Kelantan in terms of physical impacts
	Muqtada et al., (2014)	Flood impact assessment in Kota Bharu, Malaysia: A statistical analysis.	Study about the effect of flood towards the community in Kota Bharu, Kelantan
	Alias et al., (2020)	Community responses on effective flood dissemination warnings: A case study of	The effectiveness of warning issued to the public for the December 2014, Kelantan flood

Flood mitigation/ resilience		December 2014 Kelantan flood, Malaysia	
	Ang, (2018)	Residential perceptions towards external factor on Monsoon flood disaster: A case study in Kota Bharu, Kelantan	This study is regarding the perceptions towards external factors on Monsoon flood disaster in Kota Bharu Kelantan
	Ang, (2019)	Effectiveness of internal factors in confronts the Monsoon flood disaster in Kota Bharu, Kelantan. Case study: a research based on residential perception	Study regarding household perceptions on the effectiveness of internal factors in confronting the Monsoon flood disaster in Kota Bharu, Kelantan
	Ang, (2014)	Monsoon flood disaster in Kota Bharu, Kelantan case study: A comprehensive review	Study regarding the effectiveness of household in adapting the Monsoon flood disaster in Kota Bharu, Kelantan
	D/iya et al., (2012)	Floods in Malaysia: Historical reviews, causes, effects, and mitigation approach	Study regarding the causes, effects, and mitigation of floods in Malaysia
	Guat & Ming, (2020)	Introduction of flood insurance and flood hazard map in Kota Bharu, Malaysia	By using GIS, a flood hazard map is presented to determine which household in Kota Bharu, Kelantan is more prone to flood and flood insurance is introduced to the victims to prevent future loss.
	Ang, (2016)	Public perception of Monsoon floods in Malaysia: A case study of Kota Bharu, Kelantan	The study is regarding the understanding of a community in Kota Bharu, Kelantan that is affected by the flood on how they adapt and mitigates the aftereffect of a flood.
	Amir Zal, (2018)	Community resilience among flood victims in the East Coast of Peninsular Malaysia in the context of community capital	Study regarding community resilience in three states of Malaysia (Kelantan, Pahang, and Terengganu) in the context of community capitals
	Chan et al., (2017)	Social capital and community resilience in coping with flood disasters in Malaysia	Study regarding social capital and flood management engagement with the flood victims
	Khalid & Shafiai, (2015)	Flood disaster management in Malaysia: An evaluation of effectiveness flood delivery system	Study regarding flood disaster management and the role of government in providing help to the flood victims
Nurumal et al., (2017)	Community experiences at the aftermath of flood disaster based on cultural context	Study regarding the flood experience of flood victims based on cultural context	
Syed Ismail et al., (2018)	Disaster debris management during the 2014-2015 Malaysia flood incident	Study regarding the victim participation after flood incident (Disaster debris management)	
Tuan Soh et al., (2017)	Flood management using data driver index: A case study in Kelantan, Malaysia	Study regarding flood level of flood disaster management preparation in Kelantan state, December 2014.	
Flood vulnerability	Usman Kaoje et al., (2020)	Physical flood vulnerability assessment of buildings in Kota Bharu, Malaysia: an indicator-based approach	Study regarding physical flood vulnerability assessment in Kota Bharu, Kelantan

### The factor of a flood

There is a lot of factors that cause a flood to happen especially in the Monsoon season. Northeast Monsoon is not inevitable as the heavy rain brought by the northeast wind can trigger a flood. Even though Monsoon is one of the reasons for the flood happen, the

disastrous natural disaster becomes more severe every year. One of the factors of a flood is heavy rainfall that causes an increase in river water level (Aminah Shakirah et al., 2016). Besides that, according to Wan Ruslan Ismail, (2018), the factors of flood in December 2014 are the continuous heavy rain within a short amount of time, logging activities, massive agriculture, and soil erosion that causes Kelantan to have a very bad flood that year. If the activity such as deforestation and massive agriculture continue in the future, Kelantan might get another worst flood.

Human act towards the environment is one of the factors that increase community vulnerability towards the flood. For the sake of money and self-interest, human has exploited the environment. A study by Pah et al., (2017), found that development and changes in land use have increased the vulnerabilities of the community towards natural disasters such as a flood. The changes that have been made for a decade by human activity has increased the risk of soil erosion, floods, mudslide, and landslide. Before, the land is used for small agriculture, but as the year passed more and more development and big-scale agriculture have caused changes in land use. Besides that, an increase in population density is one of the factors that has caused the increase in the level of vulnerability (Pah et al., 2011, 2017). This is because when the population increases, it attracts development in that area.

Besides that, the factor of flood can also be caused by the increase in water level in a short amount of time. Nonstop heavy rain can be one of the causes that increase the vulnerability towards the flood. Pah et al., (2017), discovered that the community belief that heavy rainfall, low-lying area, drainage system, and land use is one of the factors that has caused a flood. Although, the location can also cause floods such as the distance between the house and the river, high elevation contour, and staying in the area that is always affected by a flood. Furthermore, the study by Pah shows that the increase in frequency and intensity of floods in Kelantan is caused by changes in land use (Pah et al., 2011, 2017). The changes that have been happening is influenced by human act towards the environments.

Although human activity can cause a flood to become extreme, other reasons can be looked at such as the weather and the environment. The atmosphere and environment of the place can also affect the local weather (Wan Ruslan Ismail, 2018). For instance, a study from Alias et al., (2016), regarding the rainfall analysis of the Kelantan big yellow flood in 2014 shows that there are two-phase of rainfall that cause the rise in the water level of the Kelantan river. Firstly, the heavy rain within the short amount of time is one of the causes, and second, the Monsoon rainfall that Kelantan experienced in 2014 is escalating due to the Madden-Julian Oscillation and the low temperature in Siberia (Alias et al., 2016)

### **Impact of flood**

Kelantan has been one of the states in Malaysia that have always been hit by floods. Even though each year Kelantan never misses the event of a flood, in 2014 Kelantan has experienced one of the worst floods in a century. The large flood that occurs in December 2014 was exceptional and the worst as the continuous rains that hit Kelantan from 14<sup>th</sup> to 19<sup>th</sup> December 2014 has caused a lot of damages and casualties (Yahaya et al., 2015). Besides that, the flood in 2014 also has cause a lot of physical damage and the estimated amount of losses is about 2.8 billion ringgit (Yahaya et al., 2015). In fact, a study from Muqtada et al., (2014), found that the impact of a flood on the community in Kota Bharu, Kelantan includes loss of money more than RM1000 and the loss of property.

Each household has a different kind of impact on livelihood. In 2014, Kelantan flood losses is very large both direct and indirect as well as tangible and intangible. According to Chan et al., (2016), one household suffered a loss of almost RM 3945 per family in terms of house damage, RM 5250.66 per family for losses in terms of house property, and RM 23427.09 per family for the damages on vehicles during a flood. The damages that happen have caused a lot of distress towards the community as the losses are a huge amount for some of the families and individuals.

For some low-income family, a flood can cause a lot of trouble since it cost a lot for them to build their life back. It becomes more noticeable when Kelantan is recorded as one of the poor states in Malaysia. From the Department of Statistics Malaysia, (2021), Kelantan recorded a decrease in growth in Gross Domestic Product (GDP) among the states in Malaysia (-1.1%). The contribution of Kelantan in terms of GDP shows the decrease of economic growth among the economic activity such as agriculture, mining and quarrying, manufacturing, construction, and services. The problem become more severe when COVID-19 hit Malaysia and another part of the world in 2020 that causes bankruptcies and losses for some individuals.

When the flood hits, loss of property is one of the unavoidable situations. Especially when the house is not high enough to avoid the flood. In fact, a community that is always hit by a flood or live near the river or sea will be built house high from the land. In the view of the fact that it will help those communities from becoming the victim of the flood. Besides that, when the flood hit, the depth of the water can be more than 1 meter (Muqtada et al., 2014). That is why the community needs to build houses higher from the ground, as it will help the community when the flood occurs (Ang, 2019).

Infrastructure and property are some of the unavoidable impacts. Research done by Udin et al., (2018), shows that more than 96% of the building is affected by flood. One of the reasons for that to happen is the building is near to a river, and the building is located within the flood area. In addition to that, the loss of electricity and telephone lines has caused a lot of distress to the community. As it is harder for the victim to communicate with the outside world. Communication is important for the community as it will help the victims to ask for bits of help.

On top of that, the impact of floods can be seen from the lack of water supply towards the victim. In fact, the members of the community had to use other alternatives such as the water from the river or flood for their water supply (Nurumal et al., 2017). This is not very clean and can increase vulnerability towards community health. Aside from that, an individual that doing business also losses money and property due to the flood. According to the study by Nayan et al., (2017), the effect of floods in Kuala Krai has caused a lot of damages especially in terms of sales in business. The need for the preparation by the business owner is important, as it helps to mitigate floods.

Besides physical damages and death, a health issue is also one of the most prominent subjects every time a flood occurs. According to Muqtada et al., (2014), more than 20% of the respondent in the community will fall ill due to the flood. Even though the study did not mention which kind of illness affected them, the event of flood has an impact not only on the property but also their health. The damages from the flood have affected the lives of the community and individuals not only physical damage but also mental damage. Natural disaster events such as floods can cause stress and depression to the individual and community that is affected by it. This suggests that floods can also affect the community's mental health.

Besides money and property loss, the other impact of floods is the waste generation and composition. After a flood happens waste generated from a flood is huge and a variety of waste compositions can be found depending on the severity of the flood. From the report, Kuala Krai generated most waste during flood events in 2014 that almost reach 30000.00 tonnes weight of waste (Agamuthu et al., 2015). In fact, Kuala Krai is one of the most severe districts hit by floods compare to the other districts in Kelantan and that might be the sole reason for the highest waste and composition. The event has caused a lot of damages to the infrastructures, buildings, and crops that it creates a lot of waste and proper management of disaster waste is very important.

From the study by Muqtada et al., (2014), the flood has also caused changes toward the river. Flood not only affects the community and their livelihood but also the environment that they live in. After the flood, not only the infrastructure is affected but also the environments that the community lives in. As can be seen, the flood has effects on the affected community. Therefore, it has also caused changes to human beings, communities, the environment, ways of life, and their livelihood (Muqtada et al., 2014). Even though flood has changed individual and communities that are affected, the level of vulnerability for everyone in the community is different. The reason for the different levels of vulnerability is that everyone has their way of living and surviving. That is why mitigation and adaptation are important among the community that becomes victims of the flood.

### **Flood mitigation/ resilience**

Flood resilience is a term used to describe the mitigation plan by the community to reduce or minimize the severity of the flood toward the community. Flood resilience can be in terms of the individual in the community or infrastructure that is affected by it. It is one of the important steps among the community to become flood-ready or prepared for the flood events. This is because flood resilience will help the community reduce the severity and property losses when a flood occurs. Besides that, mitigation, after a flood has occurred, is also one of the ways to increase flood resilience among the community.

From the past research, most of the studies regarding floods in Kelantan focus on mitigation, resilience, and flood management. The focus is more on resilience because the study shows how this victim mitigates from the disaster. Flood is not avoidable to the community in Kelantan as Monsoon is one of the factors that cause heavy rainfall and flood, so the only way for the communities is to live with the flood by minimizing the impact of the flood. Not only the community but also the role of the government is important in minimizing the impact of the flood.

Mitigation and adaptation are important parts of resilience among the community that has been affected by a natural disaster such as floods. When a flood has occurred, not all people in the community get an early warning of the flood. Community response towards the early warning of the flood is important as it gives the community to prepare before the flood hits them and acts as a precautions steps (Alias et al., 2020; Ang, 2018). An early warning system is very important as it gives the community to prepare before the flood-hit them. Even though, there is an early warning system for the community, not all the people in the community get the message beforehand (Alias et al., 2020). In fact, elderly people are seen as the group that did not receive an early warning. Compared to the youngster, elderly people have a hard time using technology, and the technology gap can be seen in the study by Alias. In addition, young people have more knowledge of the technology, and they use it to get faster information compared to the elderly. It will be harder for the elderly if they live alone without a companion.

Besides that, the government needs to upgrade the technology for the early warning system that is already available to make sure all the people get the early warning (Alias et al., 2020) and to ensure the safety of the community. The importance of early system warning is important as to helps the community to prepare for more extreme events and it gives time for them to prepare for the best. In fact, the weakness of the early warning system and forecasting system can be seen in the 2014 flood, where it does not help some people in the community (Ang, 2018). The warning system fails to inform the community about the disastrous event and has caused a lot of damage. The government is encouraged to look back at the warning system so that it will help the community in preparing for the flood as well as increase resilience.

The involvement of government agencies and Non-Government Organizations (NGOs) not only after the flood but also before and during the flood (Ang, 2018). The government is responsible to contain the flood, in fact, cooperation and involvement of all parties are needed to create better flood disaster management (Pah et al., 2017). The involvement of different stakeholders will further increase the trust between the community and other agencies. The role of different stakeholders will not only help the community to mitigate but also prepare, respond, and recover from the disaster. The involvement of government and NGOs is not enough if only provide food and shelter. The community affected also needs other kinds of non-material assistance such as counselling, healthcare, education, and also awareness training (Chan et al., 2016).

In addition, government involvement in providing shelter when a flood hits the community is also one of the ways to help the community. The government needs to provide enough shelter to the victims, as well as provide the victims with utilities such as food, water, and electricity as one of the ways to help the community to rebuild their life back (Ang, 2018). Next, the involvement of other government and the non-government agency is needed when the flood is happening for example in terms of rescuing and helping the victims.

Besides the involvement of government agencies, the community and individuals are encouraged to mitigate and adapt to disasters. The community itself need to figure out how to mitigate flood. There are a few ways that have been used by the community to survive a flood. For example, the victims of the flood are encouraged to build houses high from the land as one of the ways to prepare for the flood (Ang, 2016, 2019). It is encouraged to build a higher house from the ground so that it can avoid floodwater when the flood happens especially for the community that lives near the river basin area. In addition to that, it is also important for the victim of the flood to prepare their mental in facing the flood (Ang, 2019). This is because there is a possibility for the worst to occur, so early preparation is encouraged for the community.

Aside from that, victims are encouraged to move important belongings such as documents to a higher place and the community is encouraged to move to a higher place as it will help to avoid risk (Ang, 2016). Early preparation of food is encouraged as the flood will disconnect the community from the outside world. Besides preparing mentally and physically to face a flood, the community that is prone to flooding is encouraged to purchase flood insurance as it will help them in the future when the disaster hits them (Guat & Ming, 2020). Even though not all people can afford insurance, but it is one of the solutions that can be incorporated to decrease vulnerability.

After the flood is one of the hardest times for some of the people in the community as the victim needs to rebuild back the property and struggle to get some aids from the government or NGO. Everyone in the community used a different method to survive and rebuild their life back. For instance, some of the individuals in the community rebuild their new life by recollecting all the items that can still be used and fixed rather than getting help from other people or agencies (Nurumal et al., 2017). Besides, recollecting items is better than buying a new one that will cost money. For some of the victims, rather than become dependent on help from other agencies, it is better for them to rebuild their life with their own hands.

Besides that, cleaning activity after the flood with the community members, NGO, and university students is also one of the ways for this victim to regain their life back (Nurumal et al., 2017). As the help and support from other people around them will increase determination and spirit for them to get their life back. Therefore, the relationship between the members and the community needs to be good. A good relationship between the members of the community will help to decrease vulnerability in terms of a social network.

Besides that, spiritual activity such as religious talk, and reciting Yasin is encouraged between the member of the community. This spiritual activity is important for the member of the community to self-reflect on what happened to them during the disastrous events (Nurumal et al., 2017). Cultural and spiritual among the community can be seen as one of the ways for the members of the community to comfort them after all the tragedy happens to them. Activity among the community is encouraged as it will help the community to recover from the disaster. Besides that, the relationship between resilience and geographical location also plays an important role, where each location may result in a different level of community resilience (Amir Zal, 2018).

Community resilience is important for the victim of floods to continue their life, as it will help to decrease the vulnerability of the community. According to Amir Zal, (2018), the level of community resilience among the Kelantan in all three dimensions that include retaining, recovery, and adaptation is mostly moderate with recovery recorded the highest. This shows that the recovery of the community after the disaster is still possible even though the damage is high. That is why flood management and mitigation is important as it will help not only the community but also different stakeholders in handling disasters.

## **Discussion**

Overall, the study regarding flood in Kelantan mostly focuses on the factor of a flood, the impact of a flood, and flood mitigation or flood resilience among the community. The analysis made by past studies merely focuses on the 2014 flood as it was the worst flood ever happened in Kelantan. The lack of study regarding flood in Kelantan for the other years can be seen in the past studies. Research regarding flood need to be addressed every year or every time flood hits the community as it will help to increase the knowledge regarding the flood.

Geographic Information System (GIS) is a system used by many researchers to map the flood hazard mapping including in Kelantan. Furthermore, mostly the use of GIS in Kelantan uses the data from the Departments of Irrigation and Drainage (DID) to create a flood hazard map and there is a lack of study that uses research data to create a flood hazard map. Most of the study uses GIS from secondary data to obtain information on which area is vulnerable and hazardous and there is an insufficient study in Kelantan that uses primary data to create a GIS map that gives overall pictures of the community itself. This can be made by using primary data from the social sciences method and GIS.

This kind of study has been made in some parts of Malaysia such as a study by Majid et al., (2019), that focuses on the study of GIS-based Livelihood Vulnerability Index mapping of the socioeconomic of the Pekan community. This study has incorporated both GIS and the socio-economy of the community in the study. Further, it will increase the knowledge on community livelihood, and it can be used as an indicator for the governments or other agencies to help the communities and mitigate the flood.

Besides that, further research can be made in terms of community vulnerability. The lack of study regarding vulnerability is apparent where the study about vulnerability in Kelantan only focuses on physical flood vulnerability (buildings). There is a lack of study regarding the livelihood vulnerability or socio-economic vulnerability among the community in Kelantan affected by the flood. Study that includes vulnerability will help not only the researcher but also other agencies in understanding flood vulnerability among the communities that were affected by the flood. Other than that, a study regarding vulnerability will help improve the livelihood of the community.

As described, there is a lot of studies have been made regarding the flood in Malaysia including a study about the flood in Kelantan. Even though there has been a lot of studies have been made, the approach of the study is different according to the aim, purpose, and methodology of the study. The different study gives different input and outcomes, and the continuation of the study is needed to ensure an increase in knowledge. Flood study that has been made in Kelantan include the impacts of flood, community experience on the flood, the factor of the flood, community resilience, flood vulnerability, disaster management, and hazard mapping. Even though there is a lot of studies regarding flood in Kelantan, there is still a lack of study and information regarding the vulnerability of the community that is affected by the flood.

## Conclusion

There is a lot of studies have been made regarding the flood in Kelantan and each one of study has contributed a lot to understanding the flood and the community that has been affected by the flood. From the review that has been made from the past research, the themes of floods study in Kelantan can be split into three is the factor of the flood, impact of flood, and flood resilience or mitigation.

Even though there is a lot of studies have been made regarding the floods in Kelantan, there is still a lot of room for improvement that can be made. For instance, study regarding the vulnerability of the community that is affected by the flood since there is less study that has been made about vulnerability. In conclusion, past studies that have been made regarding the floods in Kelantan have contributed to understanding the event of a flood in Kelantan.

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