UMT PRESS

Journal of Maritime Logistics
Journal Homepage: https://journal.umt.edu.my/index.php/jml
e-ISSN: 2805-5195
DOI: http://doi.org/10.46754/jml.2024.12.003

ADAPTING IMPACTS OF MONSOON FLOOD TOWARDS PORT-HINTERLAND BUSINESS ACTIVITIES VIA APPLICATION OF DESCRIPTIVE AND EXPLORATORY FACTOR ANALYSIS: A CASE STUDY FOR KEMAMAN SUPPLY BASE, TERENGGANU, MALAYSIA

HARITH FAIZAL*, JAGAN JEEVAN AND LOKE KENG BIN

Faculty of Maritime Studies, Universiti Malaysia Terengganu, 21300 Kuala Nerus, Terengganu, Malaysia.

**Corresponding author: harithfaizalfadzilah@yahoo.com*

ARTICLE INFO

Article History:
Received: 28 June 2024
Accepted: 17 November 2024
Published: 30 December 2024

Keywords:
Kemaman Supply Base,
port-hinterland,
monsoon flood,
descriptive analysis,
Exploratory Factor Analysis.

ABSTRACT

Kemaman Supply Base (KSB) is one of the port facilities in Malaysia that has been specifically designed to provide logistics support to the upstream oil and gas activities in the Peninsular Malaysia water. Known as the largest petroleum supply base in Peninsular Malaysia, the roles of KSB are truly essential to ensure daily oil and gas activities at offshore platforms and rigs can be executed. However, despite its significance, the operation of KSB often be interrupted by the occurrence of Northeast Monsoon floods which regularly hit the state of Terengganu and the district of Kemaman from November to March, disrupting the state's economic activities. This includes KSB port-hinterland operations and connectivity. With the application of the descriptive and Exploratory Factor Analysis (EFA) technique, this research has identified common impacts of the flood on the KSB port-hinterland activities, proposed appropriate strategies that the affected companies can consider to mitigate flood impacts and summarised a set of actions that should be prioritised in managing the disaster.

Introduction

Kemaman Supply Base (KSB)

Port of Kemaman is a port facility in Peninsular Malaysia's East Coast region, located in Telok Kalong, Kemaman, Terengganu (Lembaga Pelabuhan Kemaman, 2020). The port has five main terminals: East Wharf, Kemaman Supply Base (KSB), LPG Export Terminal, Liquid Chemical Berth, and West Wharf. Among all the terminals, KSB is the main terminal specifically designed to provide logistics support to upstream oil and gas activities on offshore water in the Peninsular Malaysia region. The supply base is managed by Pangkalan Bekalan Kemaman Sdn. Bhd. (PBKSB), subsidiaries of EPIC, which has 360 m of jetty length with a maximum draught of 8 metres.

KSB, which was established in 1982, initially covered 30 hectares of land areas when it first opened. Since then, it has expanded as the largest petroleum supply base in Peninsular Malaysia, covering 200 hectares in total, with an additional 60 hectares of land reserved for future expansion. The main users and clients of KSB consist of major oil and gas operators in Peninsular Malaysia, and more than 200 support service companies have their presence and facilities inside KSB. Notably, they offer various types of oilfield trade specialities, making KSB a truly integrated supply base for the upstream oil and gas sector.

Hinterland Connectivity of Kemaman Supply Base with the Regional Area

As its name suggests, KSB is located in Kemaman, Terengganu, Malaysia, and the district is bordered by the district of Dungun to the north and the state of Pahang to the south and west. The district of Kemaman is well known as a maritime and oil and gas hub that deals with shipping activities, offshore platform operations, petrochemical production, natural gas processing, and crude oil refinery. The role of Kemaman as the main hub for the oil and gas sector started with the first oil discovery in Peninsular Malaysia in 1969, in the offshore province called Malay Basin, the most prolific oil and gas basin in Malaysia. Remarkably, it has over 2,100 wells and contributes up to 40% of the country's total hydrocarbon resources (PricewaterhouseCoopers, 2015; Madon, 2021).

Since then, especially after the enactment of the Petroleum Development Act 1974 and the establishment of the national oil company, Petroliam Nasional Berhad (PETRONAS), oil and gas activities in Peninsular Malaysia started to progressively grow and expand. As a result, other than the substantial integrated petrochemical complex in Kertih, the progression has led towards multiple setups of other industrial areas within the neighbourhood regions such as Kemaman Port, Telok Kalong Industrial Estate, Kemaman Bitumen Company, Gebeng Industrial Petrochemical Complex, and others.

Flood Disaster in Kemaman District

Almost every year, the state and people of Terengganu have to deal with flood disasters, which cause miserable situations in people's lives and business activities. The Northeast Monsoon, which takes place from November until March, often causes large floods to the east coast state of Peninsular Malaysia as well as to the states of Sabah and Sarawak. The occurrence of floods is also part of the repercussions of global climate change phenomena. Since 1800, human activities have been the main driver of climate change, primarily due to the burning of fossil fuels like coal, oil, and gas. For Malaysia, the impact of climate change also became a concern where between 1970 and 2013, Peninsular Malaysia, Sabah, and Sarawak recorded an increment of surface mean temperature at 0.14°C to 0.25°C per decade (World Bank Group, 2021). In addition, based on rainfall trending on the east coast of Peninsular Malaysia between 1970 and 2010, it has been observed a significant increase in annual rainfall and an increased number of days classified as heavy rainfall (days with rainfall > 20 mm), making the country prone to greater risk towards flood disaster.

The flood tragedy at Kemaman in the year 2013 has been perceived to be the worst hit flood ever in the past 90 years, with the water height being recorded at 4.0 m in certain villages (JPSNT, 2014). From December 2013 to January 2014, three flood waves hit the state of Terengganu, where the first wave was the worst, resulting in 36,308 citizens needing evacuation. During that time, Kemaman recorded the highest number of evacuees at relief centres, with a total number of 24,334 evacuees during the first wave of flood which amounted to 67% of total evacuees in the state of Terengganu. The tragedy has resulted in Kemaman virtually becoming an isolated island after being cut off from all access. During that period, the district also experienced a loss of communication network and disconnectivity of power lines, leading to food shortages and basic necessities (Zakaria *et al*., 2018).

In 2014, from November 2014 to January 2015, Terengganu was hit by three flood waves again, with the second wave being observed as the most catastrophic, with a total of 62,281 victims (JPSNT, 2015). In particular, Kemaman has recorded the highest number of victims, with a total of 32,281 victims, representing 52% of the total victims within the state. Meanwhile, in December 2015, the flood impact on Terengganu and Kemaman was much better where the number of evacuees was at 2,556 and 1,631 victims, respectively (JPS, 2016), and a slight increment of flood victims was observed at Kemaman during flood season from November 2016 to January 2017 with the total evacuees was 2,281 victims. However, the flood's victims within the entire state of Terengganu surged tremendously, with a total of 28,638 victims (JPSNT, 2017). At the same time, the flood situation at Terengganu in December 2017 saw 9,157 victims evacuated, of which 257 were from Kemaman (Baharin, 2017; JPSNT, 2019).

Flood season in Kemaman and Terengganu from November 2018 to December 2018 recorded numbers of 522 and 2,501 victims, respectively (JPSNT, 2019), and the toll during the subsequent flood season from November to December 2019 in Kemaman decreased to 199 victims only. Somehow, for the overall state of Terengganu, the numbers have surged to 11,384 victims (JPSNT, 2021). After six years, flood disasters from November 2020 to January 2021 returned to catastrophic occurrences similar to those in 2014, where the numbers of evacuees were counted at 26,400 victims. This represents 71% out of 37,041 state victims (JPSNT, 2021). The situation has re-occurred during flood season from November 2021 to January 2022 and December 2022 to February 2023, where the state recorded 30,659 and 62,783 victims, respectively. In both seasons, Kemaman district has recorded the highest numbers of evacuees, with a total of 11,500 and 15,020, representing 37.5% and 23.9% of total evacuees within the state of Terengganu, respectively (JPSNT, 2023).

Based on 10 years of data from the year 2013 until 2022, it can be concluded that flood phenomena in Kemaman during the Northeast Monsoon period are highly inevitable. The whole state of Terengganu and other states in the country have also encountered the situation. Notably, the severity of destruction might vary and differ during each monsoon season where from 2013 until 2023, the most devastating seasons in Kemaman were in 2013, 2014, and 2020, which indicated the numbers of evacuees were more than 20,000 victims. Consequently, the disaster of the flood left the victims in trauma and brought them a hard burden due to unbearable damages and loss of property. In addition, it has threatened people's wellness and life. Meanwhile, from the context of port-hinterland connectivity, the occurrence and tragedy of flood will cause definite disruption to the entire chains and business processes involved.

In view of this issue, this research has been conducted purposefully to identify the impacts of flooding the business activity in the hinterland areas of KSB, provide valuable recommendations to minimise the disruptions and summarise a set of actions that should be prioritised in managing the disaster. Thus, the issue is worth discussing further as the flood consequences in the hinterland area of KSB will ultimately cause logistics disturbance to the supply base itself and the further knock-on effect on the upstream oil and gas activity at Peninsular Malaysia.

Literature Review

Potential Flood Impacts to the Companies' Business

Lu. *et al*. (2023) have summarised a few types of business disruptions that will be experienced during floods: Delays in logistics delivery, elevated risk of road accidents, and damage of goods on top of these impacts. Moreover, Rentschler *et al*. (2021) mentioned that floods lead to human resources and workforce issues in an organisation which disrupt the overall productivity of an organisation.

Logistics delay in a hinterland operation is one of the major issues encountered during flood situations, as road closures and damages will lead to disconnectivity of supply chain and logistics access. A study by Koks *et al.* (2019) revealed that around 27% of all global road and railway assets are exposed to at least one natural hazard, and around 7.5% are exposed to a 1/100-year flood event. Global Expected Annual Damages (EAD) due to direct damage on road and railway assets range from US$3.1 to 22 billion, where 73% is caused by surface and river flooding. While in Europe, it has been highlighted that 30% to 50% of road deterioration was due to weather-induced factors, with repair costs estimated at 10 billion Euro per year (Nemry &

Demirel, 2012). Notably, a similar situation has been observed in Malaysia, where the flood has caused road networking to become inaccessible and directly affected the desired performance of logistics services. From 2021 to 2023, losses in public assets and infrastructure facilities including road networking, amounted to RM2.61 billion (DOSM, 2022-2024). Moreover, in the context of business losses, according to business transformation consultancy TMX Global, the firm has stated that the disruption in the supply chain will cost Malaysia RM8.7 billion in losses, where one of the contributing factors is due to the climate change issue (NST Business, 2023). Recap from a scenario that occurred in December 2021 in the Klang area: The occurrence of heavy rainfall and flash floods has caused severe operation disruption at Port Klang's terminals, namely Northport, Westports, and Southport (Malay Mail, 2021). Accordingly, the situation has restricted the haulier and truck operator from performing their logistics duties to serve the port.

Flood tragedy will also cause an elevated risk of good's vehicle incidents. Panakkal *et al*. (2023) mentioned that up to 40% to 63% of flood-related deaths are linked to roadway-related incidents in developing countries. Notably, between 1995 and 2005 in the United States, weather-related incidents caused nearly 7,400 deaths and 673,000 injuries (Jackson & Sharif, 2014). Furthermore, the influence of weather-related factors on road accidents such as rainfall, fog, wet or flooded pavement, wind speed, temperature, and humidity, to name a few, would affect driving and road conditions due to changes in visibility, pavement friction, lane obstruction, and lane submersion, amongst others (Shahid & Minhans, 2016). In addition, Cai *et al*. (2013) asserted that the combination of safety aspects consisting of roadway, vehicle, traffic control, and driver behaviour during rainy weather conditions could increase the potential of traffic incidents as well.

Every type of natural disaster will result in economic losses and it is almost certain that the losses would be incredibly huge and cost the individual and country badly. World Economic Forum (WEF) has listed the 10 costliest climate disasters for the year 2022, where four flooding occurrences in China, Australia, Pakistan, and South Africa have been ranked 3^{rd}, 5^{th}, $6^{th,}$ and 10^{th}, respectively, in the list with total accumulated losses at US$28.4 billion (WEF, 2023). In Malaysia, between 2022 and 2023, it has been reported that the country has suffered value losses of RM622.4 million and RM755.4 million. The year 2021 would be the costliest flood event impacting the country, with substantial losses of RM6.1 billion (DOSM, 2022-2024). Notably, half of the 2021 flood losses were contributed by Selangor, with a loss value of RM3.1 billion. During that time, Selangor was the most affected state in the country as the state encountered unprecedented floods caused by unusual torrential rainfall and high tide phenomena. Combining the flood-losses value from the year 2021 until 2023, the country has suffered total value losses of RM7.48 billion which consist of losses of public assets and infrastructures (RM2.61 billion), living quarters (RM1.93 billion), agriculture (RM366 million), business premises (RM603.5 million), vehicles (RM1.4 billion), and manufacturing sector (RM1.09 billion). In addition, the statement from the Ministry of Finance (MOF) mentioned that the 2021/2022 flood disaster had caused an estimated RM4 billion to RM8 billion reduction in the whole country's economic sector's production value (MOF, 2022).

In many occurrences of a flood, it has been revealed and highlighted on the issue of physical and psychological impairment among the flood victims and a business organisation. This issue could affect the human resources aspect of organisations. Golitaleb *et al*. (2022) mentioned that floods could lead to unpleasant short, medium, and long-term consequences on the victims' welfare, relationships, and physical and mental health. Note that Post-Traumatic Stress Disorder (PTSD) is one of the most common mental health disorders to the victims. In addition, the flood could also impact the victim's physical and psychological health with the occurrence of injuries, infectious disease outbreaks, malnutrition, new or worsening chronic diseases, anxiety, depression, distress, and others (Zhong *et al*., 2018). Meanwhile, in the context of the business impact, a flood disaster will cause the workers to be late or absent from work and indirectly will cause productivity loss in the organisation (Rentschler *et al*., 2021).

Strategies that can be Taken by Companies to Mitigate Flood Impacts on Their Business

Floods are among the most destructive natural disasters that could endanger people's lives, damage properties, and disrupt business and economic activity in the localised region. It is almost impossible for any business type to be totally safe from flood effects when a disaster hits their business territory. Moreover, businesses still need to deal with and face the disaster when it occurs. Hence, upfront mitigation and preparation should be in place to reduce and minimise the impacts on their operation further.

A flood disaster management plan is one of the crucial measures an organisation needs to deal with floods effectively. It involves the upfront preparation and planning that require particular attention before the disaster occurs to ensure that the severity of destruction to the property can be further minimised under a common and comprehensive approach to flood management. In particular, four phases are involved: The prevention/mitigation phase, the preparedness phase, the response phase, and the recovery phase (Mohamad Yusoff *et al*., 2018). Notably, the first and second phases are preparation before a disaster occurs, the third phase is the actions required when a disaster occurs, and the last phase is the activities conducted after the disaster which consists of disaster relief, rehabilitation, and reconstruction. At the national level, the country's flood management is governed under Directive No. 20 which falls under the National Disaster Management Agency (NADMA).

Despite the existence of a flood management council at a national level, it is highly recommended that a business own a specific flood disaster management plan within the company's boundaries to protect and safeguard the company's interest and the well-being of staff which was affected. This is aligned with the World Bank Group and Bank Negara Malaysia (2024) recommendation which proposed that businesses adopt a range of coping strategies to mitigate their vulnerabilities towards floods and strengthen their resilience. It is performed by planning and investing in precautionary measures, emergency responses, and recovery efforts that this effort will minimise business risks and strengthen their resilience.

In addition, CHUBB, one of the world's leading insurance providers has proposed a company have a Flood Emergency Response Plan, in order to respond to the flood threat where the company's Emergency Response Team (ERT) can be leveraged for this purpose (CHUBB, 2022). Furthermore, as part of a flood disaster management effort, it is highly recommended that a business has flood insurance coverage. It has been reported that people's awareness of the significance of flood insurance is significantly low, as only 25% out of 5 million homeowners who live in flood-prone areas have their houses insured. At the same time, only 5% of vehicles in Malaysia have flood insurance protection (Malaysia Reinsurance Berhad, 2021).

Communication is critical in flood management as it helps raise awareness, provide early warning, coordinate efforts, educate the public, and aid recovery efforts. Note that effective communication would save lives, reduce damage, and help communities recover more quickly from a flood (UTHM News, 2023). In addition, El Khaled and Mcheick (2019) emphasised that failure of communications systems may cause catastrophic consequences to human life and economic activities in natural disasters. Thus, National Oceanic and Atmospheric Administration (NOAA) has proposed certain tools in flood communication programmes including face-to-face engagement, usage of printed materials and virtual resources, leveraging social media use, and mapping and geospatial tools (MacKinnon *et al*., 2018). Moreover, Mohamad Yusoff *et al*. (2018) have suggested a few useful communication technologies that can be utilised during flood management including mobile phone Short Message Service (SMS), web-based support systems, and Geographic Information Systems (GIS). For the application of technologies to the good's vehicle, an enhanced Flood Warning System (FWS) has been developed by Sung, *et al*. (2023) using long-range communication or Long Range (LoRa) technology. It is a wireless system that has been used for long-distance and low-power communication and this network is effective in connecting millions of devices including controllers and sensors.

The developed FWS is suited for vehicle use, alerting drivers while sending warnings to end users. The FWS will enable vehicles to connect within a particular radius to broadcast flood information via LoRa communication technology. When the water level rises over a certain point, the system sends a warning to drivers indicated through a mobile application. Notably, drivers can take an alternative route, reducing the likelihood of damage when driving into or near a flooded area.

On top of the LoRa technology, the readily used technology of the In-Vehicle Monitoring System (IVMS) which is fitted to good vehicles and equipped with geofencing features can also be leveraged. An IVMS normally employed to monitor driver activities and behaviours, it can provide additional benefit through its geofencing function by prohibiting vehicle entry from restricted areas. For instance, in a geofencing experiment performed by Hakim *et al.* (2023), when an object with a cellular device approaches or enters the geofenced area, the object will automatically receive a notification that it is approaching or in a disaster-prone area. Instead of solely relying on enhanced vehicle technologies which might be costly, especially for small and medium-scale corporations, the utmost priority shall be focused on the safety behaviour of the driver.

As per the Ministry of Transport, 80% of road accidents happen due to poor driving attitudes (Adnan, 2023). Due to this, it is crucial for a driver to possess a good driving ethic. On top of that, many reputable agencies and organisations have recommended that road users adopt defensive driving behaviour to enhance safety precautions while on the road. For instance, Carsome (2022) has mentioned that a defensive driver does not just concentrate on their driving. However, they will also anticipate what other drivers are doing and coupled with awareness of their surroundings, the chances of getting into an accident will be significantly reduced. In a similar quote from Shell (2024), the international oil firm stated that awareness is a key to defensive driving, where a defensive driver will keep alert of potential hazards and other road users' actions. This enables them to take proactive action to avoid incidents. During the rainy and flooding season, a defensive driver will adapt his driving behaviour to the road and weather conditions.

Glago (2020) emphasised that unplanned development projects and inadequate and poor management of drainage systems are among the factors that will cause floods. A similar thought has been addressed by Mustafa and Jasmi (2022) who asserted that the contributory factor of the flood was also caused by human negligence and not solely due to mother nature. In addition, DID (2017) advised water outlets such as drains and sewage outlets to be examined and any obstructions to be cleared to ensure that the flood water will not spill over. This is fundamental and must be performed during pre-flood preparation. Furthermore, other measures for office and business premises flood prevention include conducting a thorough inspection to identify flood areas and installing physical preventive mechanisms if necessary. This includes application of ideal landscaping techniques such as constructing the bioswales, artificial pond, permeable paving and other appropriate means as has been proposed by Palazzo and Wang (2022) to enhance flood resilience especially in urban areas. Additionally, to avoid encroachment and vandalism on the stormwater drainage system which can be considered as a critical area of a business premise, surveillance mechanisms such as periodic patrol and inspection by relevant personnel, provision of perimeter fencing, and leverage use of CCTV and drones can also be considered (BOSCH, 2024).

Additionally, inculcating people's awareness on the subject of sustainability can be one of the leading actions that can reduce and mitigate the causes of floods and it is deemed a crucial measure that needs to be taken. Michael *et al*. (2020) have highlighted a lack of attention towards sustainability in higher education institutions and suggested it be embedded in the university academic course. Meanwhile, Ibrahim & Saria Tasnim (2023) has mentioned the significance of instilling an awareness of environmental sustainability for the purpose of flood control. On top of the lesson on sustainable awareness, Shah (2015) mentioned the importance of education in minimising the effects of any disaster. He has proposed that flood awareness programmes such as short-term disaster management courses or scientific talks be delivered to people in a community.

Undeniably, any kind of natural disaster, including flood events will greatly incur losses to the affected victims which require the administrative government to render and provide them with physical and monetary support. The United States of America (USA) in the year 2017 has distributed over US$130 billion to provide recovery assistance to their citizens who were hit by Hurricanes Harvey, Irma, and Maria (Lee, 2021) and Malaysia in the year 2021 has spent RM1.4 billion in flood relief assistance programme (BHOnline, 2022). Apart from the government's obligatory role in providing relief assistance to the flood victim, many entities and agencies have proposed a business organisation to propose similar aid and support to their workers affected by the flood. For instance, the government has requested private organisations to provide their workers with flood emergency leave without cutting their salary and annual leave entitlement (Ramayah, 2021). Meanwhile, the Malaysian Employers Federation (MEF) similarly has urged all private-sector employers to provide whatever assistance is required for their affected employees (Sinar Harian, 2021). Additionally, emotional and mental support is critically essential as flood victims are prone to get traumatised. In a situation where the victim exhibits extreme anxiety symptoms such as screaming and prolonged or uncontrollable crying, immediate help should be provided to them by trained counsellors, clinical psychologists, or psychiatrists (Malay Mail, 2021).

In the context of business continuity, an organisation most likely has to deal with a temporary workforce shortage if any of its employees are affected by floods. Spencer and Urquhart (2021) proposed that workers be allowed to work from home if they encounter weather difficulties for commuting purposes. At the same time, Rentschler *et al*. (2021) have mentioned the need for staff overtime during the time of disruption to cover the flood absentees. Moreover, Luciano (2022) has proposed a few strategies to deal with the understaff situation which include rearrangement of project calendar, prioritising core client needs, and sourcing for quick intervention by making some process improvements. Other than that, to address logistics disruption during floods, TruxCargo (2024) has stressed the importance of having a Business Continuity Plan (BCP) in place to minimise downtime and losses while maintaining the business reputation and customer trust. Among the proposed measures under the continuity plan are establishing alternative transportation routes, diversifying the number of suppliers to avoid single dependency, and developing stock-buffering strategies to maintain the optimal inventory level.

Research Conceptual Framework

The following illustration displays the conceptual framework (Figure 1) for this research:

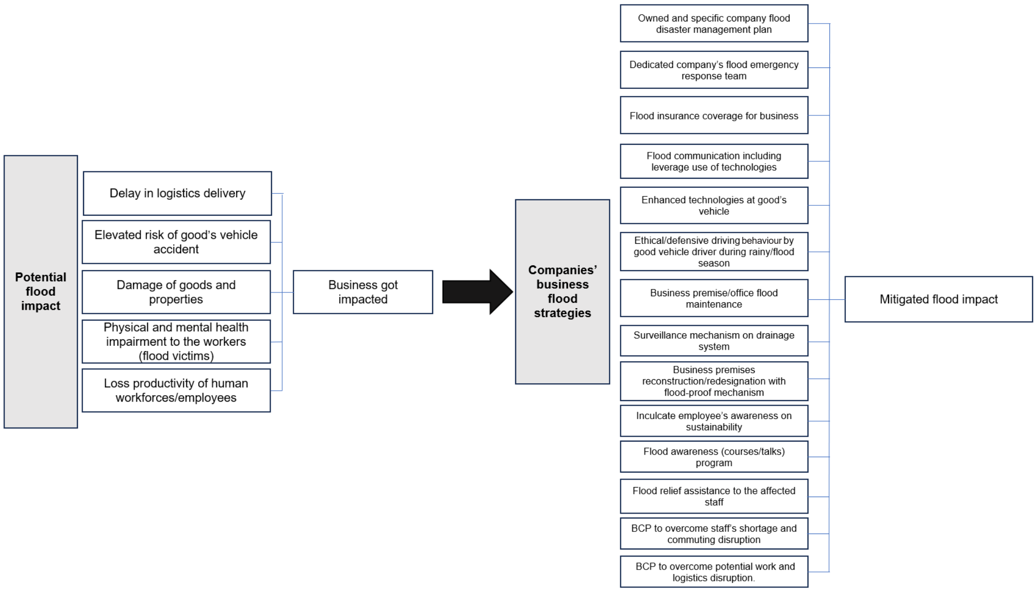


Figure 1: Research conceptual framework

Research Methodology

Research Design

This research employs a quantitative method that applies the descriptive and Exploratory Factor Analysis (EFA) research technique. The application of descriptive analysis involves converting raw data into a form that is easy to understand and interpret such as using tables, charts, and graphs (Fisher & Marshall, 2009). Furthermore, the EFA research technique is a multivariate statistical method based on the concept that unobserved or latent variables underlie the variation of scores on observed or measured variables (Watkins, 2018). In particular, the primary purpose of EFA is to identify the underlying factors that explain the patterns of correlations within a set of observed variables and determine the number of latent constructs (factors) and the strength of the relationship between each factor and the observed variables. The following diagram illustrates the general flow of conducting this research (Figure 2).

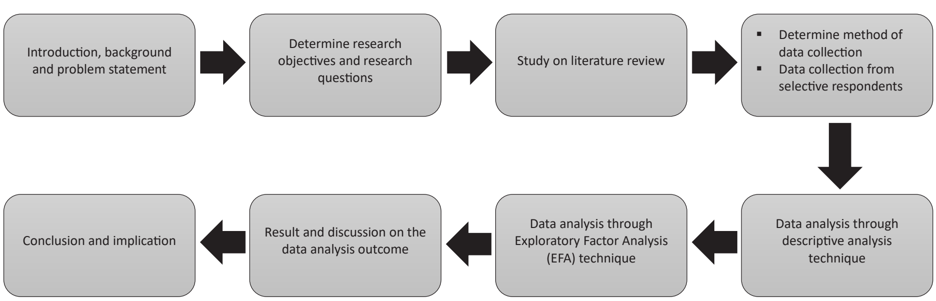


Figure 2: Research process

Data Collection Method

Under this study, secondary data was obtained and gathered from various resources such as journals, articles, books, the Internet, and previous research. In contrast, primary data was collected from responses received through a set of five Likert scale questionnaires.

The questionnaire has been divided into three sections. It has 25 questions which consist of a section of details of respondents, potential flood impact on the companies' business, and strategies that companies can take to mitigate flood impacts on their business. Notably, the target respondents are those who are working directly with KSB, working with companies inside KSB premises, and working with the companies that have business operations or connectivity with the supply base itself at the East Coast region, particularly at Kuantan, Kemaman, Dungun, Marang, and Kuala Terengganu.

This study applied a sampling procedure known as non-probability (purposive or judgmental) sampling. In particular, this procedure will allow the researchers to identify and select individuals or groups that are especially knowledgeable about or experienced with a phenomenon of interest (Palinkas *et al*., 2015).

Data Analysis Method

Descriptive Analysis

Using the software IBM Statistical Package for Social Sciences (SPSS) version 27.0, the survey result derived from the respondent's feedback was descriptively analysed purposefully to describe and summarise the data set. The range of respondents' agreement can be referred in Table 1, replicated and customised from Alkharusi (2022) which has set Likert scale intervals to interpret the composite scores using the average or mean. As a rule of thumb, the higher the mean value, the higher the agreement of the examined items. For the items with similar scores, the smaller standard deviation is considered more significant.

Table 1: Five point Likert scales intervals and composite scores

Likert Scale	Descriptions	Mean Range
5	Highly agree	4.21-5.00
4	Agree	3.41-4.20
3	Neutral	2.61-3.40
2	Disagree	1.81-2.60
1	Highly disagree	1.00-1.80

Exploratory Factor Analysis

The IBM SPSS version 27.0 software has been utilised to perform EFA in this research, where the initial stage is a data collection process meant to gather observations on multiple variables. Any data with missing values will be excluded and in the next stage, internal reliability will be measured using the conventional Cronbach's Alpha method. Subsequently, the following step requires a data suitability assessment process prior to the execution of EFA by conducting the Kaiser-Meyer-Olkin (KMO) Test and Bartlett's Test of Sphericity. The process then continued with the execution of the factor extraction process with the application of Principal Component Analysis (PCA) extraction and Varimax (orthogonal) rotation method and the number of extracted factors eigenvalues should be more than 1.0. Consequently, the table of total variance explained and scree plot graph will appear where the component with an eigenvalue of more than 1.0 will be extracted. Subsequently, through a table of the Rotated Component Matrix, factor loading for each extracted item will be identified, and only items with a factor loading above 0.6 will be retained. Finally, the component will be relabelled to suit its respective retained items, and reliability testing will be performed.

Results and Discussion

Descriptive Analysis Results and Discussion

Table 2 summarises the demographic information of respondents who participated in the survey.

Table 2: Demographic information of respondents

Demographic Variables	Categories	Frequency	Percentages (%)
Education level	SPM	10	7.6
	STPM/Diploma	39	29.5
	Degree	67	50.8
	Master	16	12.1
	Total	**132**	**100.0**
Work Locations	Kemaman	118	89.4
	Kuala Terengganu	8	6.1
	Kuantan	6	4.5
	Total	**132**	**100.0**
Area of Work/Business	Construction/Manufacturing/ fabrication/Other engineering services	6	4.5
	Education, training institution, and consultancy	1	0.8
	Fishing & agriculture	1	0.8
	Food & beverages	4	3.0
	Government agencies	1	0.8
	Healthcare	1	0.8
	Offshore platforms/Onshore process plant/Oil and gas producer regional HQ office	33	25.0
	Port & shipping/logistics/ Warehousing	84	63.6
	Sales/retail/services	1	0.8
	Total	**132**	**100**
Working experiences	1-5 years	9	6.8
	6-10 years	30	22.7
	11-20 years	61	46.2
	21 years and above	32	24.2
	Total	**132**	**100**

Company's business/ work relation with KSB	Company located inside KSB premise	33	25
	Company located outside KSB premise but having business activity at KSB	87	65.9
	Working directly with KSB	12	9.1
	Total	**132**	**100**
Position in the organisation	Clerk/general and semi-skilled worker	13	9.8
	Higher management level	11	8.3
	Low/mid management level	50	37.9
	Supervisory/executive level	58	43.9
	Total	**132**	**100**

Table 3 provides the outcome of descriptive analysis which consists of parameters of mean and standard deviation for each examined item. Overall, all the items in Sections B and C received a good acceptance from the respondents as all items were above the mean of 4.0. Under Section B, the item "delay in logistics delivery" has been observed as the highest agreed item with a mean score of 4.42. Meanwhile, the item "elevated risk of good's vehicle" scored the lowest mean score at 4.18. Moreover, under Section C, item "BCP to overcome staff's shortage and commuting disruption" is the most agreed item with a mean score of 4.39, while item "reconstructing and redesigning office/business premises with flood-proof mechanism" is the item with the lowest rating with mean scores 4.05. In addition, the internal consistency of the scale used is portrayed as the Cronbach's Alpha value for Section B and Section C were computed at 0.843 and 0.921, respectively, meeting the minimum value of 0.7 as suggested by Somu *et al*. (2023).

Table 3: Descriptive analysis outcome of potential flood impacts on the companies' businesses and proposed mitigation strategies

Section B: Potential Flood Impacts to the Companies' Business (Cronbach's Alpha: 0.843)					**Section C: Strategies that can be taken by Companies to Mitigate Flood Impacts on the Business (Cronbach's Alpha: 0.921)**				
Ranking Priority	**Items**	**Mean**	**Std. Deviation**	**Item**	**Ranking Priority**	**Items**	**Mean**	**Std. Deviation**	**Item**
1	Delay in logistics delivery	4.42	0.568	B1	1	BCP to overcome staff shortage and commuting disruption	4.39	0.615	C13
2	Damage to goods and properties	4.35	0.605	B3	2	Flood relief assistance to the workers (flood victims)	4.36	0.583	C12

3	Physical and mental health impairment to the workers (flood victims)	4.28	0.609	B4	3	BCP to overcome potential work and logistics disruption.	4.36	0.596	C14
4	Loss of productivity of human workforce/ employees	4.25	0.635	B5	4	Business flood insurance coverage	4.33	0.662	C3
5	Elevated risk of good's vehicle accident	4.18	0.708	B2	5	Flood communication, including leverage use of technologies	4.27	0.567	C4
					6	Business premise/ office flood maintenance	4.20	0.670	C7
					7	Flood awareness (courses/talks) programme	4.19	0.644	C11
					8	Inculcate employee's awareness on sustainability	4.17	0.682	C10
					9	Owned and specific company flood disaster management plan	4.16	0.708	C1
					10	Enhanced technologies at good's vehicles	4.15	0.659	C5
					11	Ethical and defensive driving behaviour by good's vehicle drivers during rainy/flood season	4.13	0.756	C6
					12	Dedicated company's flood emergency response team	4.11	0.713	C2

	13	Surveillance mechanism to avoid encroachment and vandalism on stormwater drainage system	4.06	0.674	C8
	14	Reconstructing and redesigning office/business premises with a flood-proof mechanism	4.05	0.785	C9

Exploratory Factor Analysis (EFA) Results and Discussion

Number of Samples

The research has successfully collected data from 132 selected respondents without any missing value in any of the response items. Hence, meeting one of the EFA criteria which requires the minimum sample to be 100 respondents (Somu *et al*., 2023).

Data Suitability Assessment Prior Performing Exploratory Factor Analysis (EFA)

Determining the value of the Bartlett's Test of Sphericity and KMO index (Table 4) is a required process prior to performing EFA. It is purposeful to assess the data suitability where the value of Bartlett's Test of Sphericity should be significant with $p < 0.05$, while the KMO index should be greater than 0.6 (Baistaman *et al*., 2022; Somu *et al*., 2023). In this research, the *p*-value is at 0.000 and the KMO index has been computed at 0.877, indicating that the data is feasible for further stages in EFA processes.

Table 4: KMO and Bartlett's Test

Kaiser-Meyer-Olkin measure of sampling adequacy		0.877
Bartlett's Test of Sphericity	Approx. chi-square	1489.143
	df	171
	Sig.	0.000

Factor Extraction Method

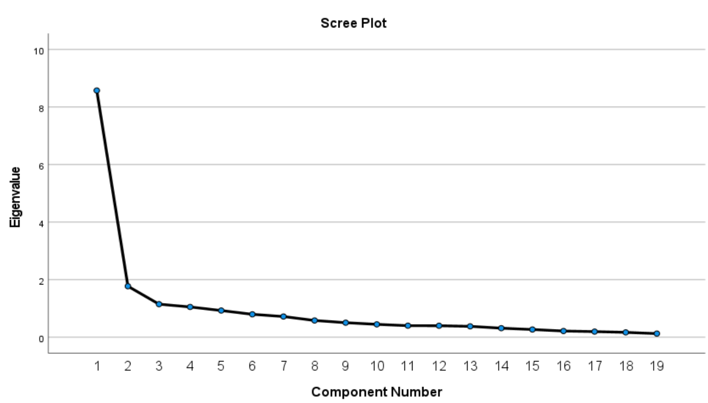
Using EFA, the PCA with Varimax rotation, also known as the orthogonal rotation method has been applied for factor extraction. Other than the Varimax method, the Promax or oblique rotation method is another rotation method where both methods have the capability to generate a similar amount of variance. For this study, the Varimax (orthogonal) rotation method has been selected as it is preferred when implementing EFA (Somu *et al*., 2023). Furthermore, the number of extracted factors with an eigenvalue of more than 1.0 was set and four components were generated. All those components having eigenvalues greater than 1.0 ranged between 1.052 to 8.575, and the total percentages of variance explained for all four components yields is 66.051%, exceeding the minimum percentage of 60%, as suggested by Baistaman *et al*. (2022). The outcome of total variance explained (Table 5) has also been portrayed by a graph of a Scree Plot, a line graph of eigenvalues displayed in Figure 3 of eigenvalues explained by each component.

Table 5: Total variance explained

Components	Initial Eigenvalues			Extraction Sums of Squared Loadings		
	Total	Percentage of Variance (%)	Cumulative Percentages (%)	Total	Percentage of Variance (%)	Cumulative Percentage (%)
1	8.575	45.133	45.133	8.575	45.133	45.133
2	1.773	9.331	54.463	1.773	9.331	54.463
3	1.149	6.048	60.511	1.149	6.048	60.511
4	1.052	5.539	66.051	1.052	5.539	66.051
5	0.928	4.883	70.934			
6	0.797	4.192	75.126			
7	0.720	3.788	78.914			
8	0.582	3.064	81.978			
9	0.506	2.661	84.639			
10	0.448	2.359	86.998			
11	0.401	2.113	89.111			
12	0.399	2.103	91.214			
13	0.379	1.994	93.207			
14	0.315	1.657	94.865			
15	0.268	1.412	96.277			
16	0.216	1.137	97.414			
17	0.196	1.030	98.444			
18	0.169	0.891	99.335			
19	0.126	0.665	100.000			

Extraction method: Principal Component Analysis (PCA).

Figure 3: Scree plot graph



Rotated Component Matrix

According to Baistaman *et al*. (2022), only items that generate factor loading 0.6 and above will be retained for further analysis. For this purpose, a refined Rotated Component Matrix, which has already delisted the items that have factor loading below 0.6 has been displayed in Table 6. In this stage, those four components have been renamed or relabelled into a new construct suited to their retained items. In particular, those components have been renamed as business assets protection and educational programmes for workers, flood disaster impact to port-hinterland business activity and connectivity, flood's BCP and workers' welfare, and flood disaster management plan and response team. Finally, Cronbach's Alpha has been computed for each new-labelled construct purposefully to measure its internal consistency reliability where the value should be more than 0.7 (Baistaman *et al*., 2022). As a result, the outcome of Cronbach's Alpha for every four components is above 0.7, ranging between 0.786 and 0.894, indirectly indicating its reliability.

Table 6: Rotated Component Matrix

		Components				
Construct	**Items**	**1**	**2**	**3**	**4**	**Cronbach's Alpha**
Business assets protection and educational programme for workers	Surveillance mechanism to avoid encroachment and vandalism on stormwater drainage system	0.809				0.894
	Inculcate employee's awareness on sustainability matters	0.746				
	Business premise/office flood maintenance	0.716				
	Reconstructing and redesigning office/business premises with a flood-proof mechanism	0.709				
	Flood awareness (courses/ talks) programme	0.697				
	Enhanced technologies at good's vehicles	0.601				
Flood disaster impact port-hinterland business activity and connectivity	Loss of productivity of human workforce/employees		0.772			0.843
	Elevated risk of good's vehicle accident		0.738			
	Damage to goods and properties		0.728			
	Physical and mental health impairment to the workers (flood victims)		0.683			
	Delay in logistics delivery		0.641			

Flood's business continuity plan and worker's welfare	BCP to overcome potential work and logistics disruption.	0.754		0.797
	BCP to overcome staff shortage and commuting disruption.	0.666		
	Flood relief assistance to the workers (flood victims)	0.619		
Flood disaster management plan and response team	Dedicated company's flood emergency response team		0.835	0.786
	Owned and specific company flood disaster management plan		0.798	

Extraction method: Principal Component Analysis (PCA).

Rotation method: Varimax with Kaiser Normalisation.

a. Rotation converged in seven iterations.

Conclusions and Implications

Generally, via the application of descriptive and EFA methods, this research has achieved its objectives. That is, the identification of potential flood impacts on the companies' business, the proposal of appropriate strategies that can be considered to mitigate the flood impacts, and lastly, the summarisation set of actions that should be prioritised in managing flood disaster. With a focus on the monsoon flood scenario which frequently hits the East Coast state of Peninsular Malaysia, particularly in the district of Kemaman, Terengganu, it has been acknowledged that the disastrous situation of flood will impact KSB port-hinterland operation in various aspects. The tragedy of a monsoon flood has been recognised as causing delays in logistics delivery, damage to goods and properties, physical and mental health impairments for workers affected by the flood, loss of productivity among employees, and an increased risk of vehicle accidents involving goods. These aligned with Lu *et al*. (2023) and Rentschler *et al*. (2021), who have addressed the same in their research.

Moreover, based on the descriptive analysis outcome, all the proposed mitigation strategies towards floods were generally agreed upon by the respondents. In contrast, five out of 14 proposed strategies were indicated as highly agreed upon. Those five "highly agreed" items are inclusive of recommendations for a company to have BCP in place to overcome staff shortage and commuting disruption as well as BCP to overcome potential work and logistics disruption, recommendation for a company to provide flood relief assistance to the workers who become flood victims. It also consists of recommendations for flood insurance coverage for the business, and lastly, the recommendations for effective flood communication programmes and tools by leveraging the use of technologies.

Referring to the EFA outcome, the performed EFA procedures successfully produced four components under respective construct or underlying variables. Suit with the items that fall under each component, the constructs for each component have been relabelled as business assets protection and educational programme for workers (Component 1), flood disaster impact to port-hinterland business activity and connectivity (Component 2), flood's BCP and worker's welfare (Component 3), and lastly flood disaster management plan and response team which falls under Component 4. Components 1, 3, and 4 have been perceived as strategic measures that companies can consider to mitigate flood impacts on their business, while Component 2 addresses the business consequences of floods.

Implications of the Study

This research has investigated the impact of the flood on the port-hinterland business activities and connectivity as well as the mitigation plan to reduce its impact on the business. The flood situation surrounding KSB has been regarded as a case study. Therefore, by adopting all the recommendations highlighted in this research, a business organisation, particularly those dealing with KSB port-hinterland activities, would be able to acknowledge the impact of the flood on their business operation and take necessary control measures. Furthermore, this research can be one of beneficial references to other port-hinterland industry players, as well as the impact of floods is mostly the same in any port and logistics sector regardless of the places or areas. In addition, by focusing on the common factors that have been addressed in each EFA component, it is believed those factors can be formulated by organisations, ranging from small to big scale to have a systematic plan in managing flood disasters that potentially can hit their businesses.

Limitation of Study and Direction for Future Research

In completing the research, the researcher faced difficulty sourcing the actual value of losses that industrial players had suffered due to the flood. Notably, most of the value of the flood losses revealed in this research such as monetary losses, numbers of victims, flood relief, and recovery costs obtained from government official agencies such as the Department of Statistics Malaysia (DOSM), Department of Irrigation and Drainage (DID), and newspaper articles. However, no similar report has been produced by large and established private firms in Malaysia such as port operators, oil and gas companies, and shipping firms which analyse the flood impacts specifically on their business operations.

For future research, the researcher aims to collaborate with interested private firms to specifically investigate and analyse actual business losses experienced by them. Accordingly, significant loss figures such as average loss of productive manhours, total amount of loss of business properties, average hours of delay in road and ship delivery, extended period of vessel turn-around time at port, average production losses at offshore platforms, and other relevant and significant figures can be further analysed and examined.

Acknowledgement

The authors would like to thank all reviewers for their comments and suggestions for improving this manuscript.

Conflict of Interest Statement

The authors declare that they have no conflict of interest.

References

Adnan, A. S. (2023, March 2). Lebih 80 peratus faktor utama kemalangan maut berpunca sikap manusia. *Berita Harian*. https://www.bharian.com.my/berita/nasional/2023/03/1071217/lebih-80-peratus-faktor-utama-kemalangan-maut-berpunca-sikap-manusia

Alkharusi, H. (2022). A descriptive analysis and interpretation of data from Likert scales in educational and psychological research. *Indian Journal of Psychology and Education*, *12*(2), 13-16.

Baharin, H. B. (2017, December 9). Banjir Kemaman pulih sepenuhnya. *Berita Harian*. https://www.bharian.com.my/berita/wilayah/2017/12/361318/banjir-kemaman-pulih-sepenuhnya

Baistaman, J., Nawi, F. A. M., Mustapha, W. M. W., & Mamat, M. (2022). Exploratory factor analysis of financial literacy in the Malaysian context. *Proceedings 2022*, *82*(1), 24. https://doi.org/10.3390/proceedings2022082024

BHOnline. (2022, January 20). Ucapan Perdana Menteri berhubung bencana banjir penghujung 2021 di Dewan Rakyat. *Berita Harian*. https://api.bharian.com.my/berita/nasional/2022/01/913575/ucapan-perdana-menteri-berhubung-bencana-banjir-penghujung-2021-di

BOSCH (2024, April 10). *Intelligent Perimeter Security for Critical Sites. Bosch Security and Safety Systems I North America*. https://www.boschsecurity.com/us/en/news/trends-and-technologies/intelligent-perimeter-security/

Cai, X., Lu, J. J., Xing, Y., Jiang, C., & Lu, W. (2013). Analyzing driving risks of roadway traffic under adverse weather conditions: In case of rain day. *Procedia - Social and Behavioral Sciences*, *96*, 2563-2571. https://doi.org/10.1016/j.sbspro.2013.08.287

Carsome. (2022, March 16). *7 defensive driving tips that may just save your life*. https://www.carsome.my/news/item/defensive-driving-tips

CHUBB. (2022). *5 steps to develop and activate a flood emergency response plan*. https://www.chubb.com/my-en/articles/business/5-steps-to-develop-activate-a-flood-emergency-response-plan.html

Department of Irrigation and Drainage (DID). (2017). *Flood preparedness guidelines.* https://www.water.gov.my/index.php/pages/view/581

Department of Statistics Malaysia (DOSM). (2022-2024). *Laporan khas impak banjir di Malaysia 2021-2023*.

El Khaled, Z., & Mcheick, H. (2019). Case studies of communications systems during harsh environments: A review of approaches, weaknesses, and limitations to improve quality of service. *International Journal of Distributed Sensor Networks*, *15*(2). https://doi.org/10.1177/1550147719829960

Fisher, M. J., & Marshall, A. P. (2009). Understanding descriptive statistics. *Australian Critical Care*, *22*(2), 93-97. https://doi.org/10.1016/j.aucc.2008.11.003

Glago, F. J. (2020). Flood disaster hazards; causes, impacts and managements: A-state-of-the-art review. In Farsangi, E. N. (Ed.), *Natural hazards – Impacts, adjustments and resilience*. IntechOpen.

Golitaleb, M., Mazaheri, E., Bonyadi, M., & Sahebi, A. (2022). Prevalence of post-traumatic stress disorder after flood: A systematic review and meta-analysis. *Frontiers in Psychiatry*, *13*. https://doi.org/10.3389/fpsyt.2022.890671

Hakim, N. I., Renaldi, F., & Hadiana, A. I. (2023). Disaster management mitigation using geofencing concepts in West Bandung Regency, Indonesia. *3rd Asia Pacific International Conference on Industrial Engineering and Operations Management*. https://doi.org/10.46254/ap03.20220203

Ibrahim, M., & Saria Tasnim. (2023). Strengthening Sustainable Development Goals – SDG 9 Concerning Flooding in Malaysia. *Accounting and Finance Research*, *12*(4), 117-117. https://doi.org/10.5430/afr.v12n4p117

Jabatan Pengairan dan Saliran (JPS). (2016). *Ringkasan laporan banjir tahunan bagi tahun 2015/2016*.

Jabatan Pengairan dan Saliran Negeri Terengganu (JPSNT). (2014-2024). *Laporan banjir*. https://jpsweb.terengganu.gov.my/index.php/ms/arkib/penerbitan/laporan-banjir

Jackson, T. L., & Sharif, H. O. (2014). Rainfall impacts on traffic safety: Rain-related fatal crashes in Texas. *Geomatics, Natural Hazards and Risk*, *7*(2), 843-860. https://doi.org/10.1080/19475705.2014.984246

Koks, E. E., Rozenberg, J., Zorn, C., Tariverdi, M., Vousdoukas, M., Fraser, S. A., Hall, J. W., & Hallegatte, S. (2019). A global multi-hazard risk analysis of road and railway infrastructure assets. *Nature Communications*, *10*(1). https://doi.org/10.1038/s41467-019-10442-3

Lee, J. (2021). The economic aftermath of Hurricanes Harvey and Irma: The role of federal aid. *International Journal of Disaster Risk Reduction*, *61*, Article 102301. https://doi.org/10.1016/j.ijdrr.2021.102301

Lembaga Pelabuhan Kemaman (LPKmn) (2020). *Laporan tahunan Lembaga Pelabuhan Kemaman 2020*.

Lu, X., Ka, F., Hing Kai Chan, & Chen, W.-Q. (2023). Investigation of transport logistics disruptions from urban floods: A case study of the Chinese coastal megacity - Guangzhou, China. *Lecture Notes in Production Engineering*, 637-647. https://doi.org/10.1007/978-3-031-18641-7_59

Luciano M. M. (2022, May 17). *3 strategies for managing an understaffed team*. Harvard Business Review. https://hbr.org/2022/05/3-strategies-for-managing-an-understaffed-team

MacKinnon, J., Heldsinger, N., & Peddle, S. (2018). *A community guide to effective flood risk communication: Promoting personal preparedness*. University of Waterloo.

Madon, M. (2021). Five decades of petroleum exploration and discovery in the Malay Basin (1968-2018) and remaining potential. *Bulletin of the Geological Society of Malaysia*, *72*, 63-88. https://doi.org/10.7186/bgsm72202106

Majlis Keselamatan Negara. (2024, February 28). *Pentingnya etika di jalan raya untuk menyelamatkan nyawa*. https://www.mkn.gov.my/web/ms/2024/02/28/pentingnya-etika-di-jalan-raya-untuk-menyelamatkan-nyawa/

Malay Mail. (2021, December 29.). Experts: Flood victims could be traumatised, in urgent need of mental, emotional support. *Malay Mail*. https://www.malaymail.com/news/malaysia/2021/12/29/experts-flood-victims-could-be-traumatised-in-urgent-need-of-mental-emotion/2031745

Malay Mail. (2021, December 18). Port Klang authority: Operations in Port Klang affected by floods. *Malay Mail*. https://www.malaymail.com/news/malaysia/2021/12/18/port-klang-authority-operations-in-port-klang-affected-by-floods/2029408

Malaysia Reinsurance Berhad. (2021). *Malaysian insurance highlights 2021*. https://www.malaysian-re.com.my/api/uploads/MIH_22_final_a6da7cf755.pdf

Michael F. L., Sumilan, H., A. Bandar N.F., Hamidi H., Jonathan V. & Md Nor N.N. (2020). Sustainable development concept awareness among student in higher education: A preliminary study. *Journal of Sustainability Science and Management*, *15*(7), 113-122. https://jssm.umt.edu.my/wp-content/uploads/sites/51/2020/10/11-V15V7.pdf

Ministry of Finance Malaysia (MOF). (2022, January 20). *Floods reduce economic sector production by RM4 bln – RM8 bln – MoF*. Ministry of Finance Malaysia. https://www.mof.gov.my/portal/en/news/press-citations/floods-reduce-economic-sector-production-by-rm4-bln-rm8-bln-mof

Mohamad Yusoff, I., Ramli, A., Mhd Alkasirah, N. A., & Mohd Nasir, N. (2018). Exploring the managing of flood disaster: A Malaysian perspective. *Malaysian Journal of Society and Space*, *14*(3), 24-36. https://doi.org/10.17576/geo-2018-1403-03

Mustafa, N. F., & Jasmi, K. A. (2022). Analisis akhbar tentang banjir di Malaysia. *Seminar Falsafah Sains dan Ketamadunan (SFST)*, *4*(2), 329-334.

Nemry, F., & Demirel, H. (2012). *Impacts of climate change in Europe: A focus on road and rail transport infrastructures*. Publications Office of the European Union.

NST Business. (2023, February 21). Supply chain woes are costing Malaysia's economy RM8.7bil a year. *New Straits Times*. https://www.nst.com.my/business/2023/02/882096/supply-chain-woes-are-costing-malaysias-economyrm87bil-year

Palinkas, L., Horwitz, S., Green, C., Wisdom, J., Duan, N., & Hoagwood, K. (2015). Purposeful sampling for qualitative data collection and analysis in mixed method implementation research. *Administration and Policy in Mental Health and Mental Health Services Research*, *42*(5), 533-544. https://doi.org/10.1007/s10488-013-0528-y

Panakkal, P., Wyderka, A. M., Padgett, J. E., & Bedient, P. B. (2023). Safer this way: Identifying flooded roads for facilitating mobility during floods. *Journal of Hydrology*, *625*, Article 130100. https://doi.org/10.1016/j.jhydrol.2023.130100

Palazzo, E., & Wang, S. (2022). Landscape Design for Flood Adaptation from 20 Years of Constructed Ecologies in China. *Sustainability*, *14*(8), Article 4511. https://doi.org/10.3390/su14084511

PricewaterhouseCoopers. (2015). *Oil and gas in Malaysia: Exploring growth in a dynamic marketplace*. PwC. https://www.pwc.com/my/en/publications/2015-oil-n-gas-in-msia-overview.html

Ramayah, U. (2021, December 19). Kakitangan awam terjejas banjir diberi cuti kecemasan, majikan swasta digalak ikut serta – PM. *Astro Awani*. https://www.astroawani.com/berita-malaysia/kakitangan-awam-terjejas-banjir-diberi-cuti-kecemasan-majikan-swasta-digalak-ikut-serta-pm-337241

Rentschler, M., Erik, J., Jisun, K. E., Fabian, T. S., Robbe, D. V., Anne, S., Elisabeth, E. A., & Stephane, H. (2021). *Floods and their impacts on firms: Evidence from Tanzania*. Policy Research working paper, no. WPS 9774. World Bank Group. http://documents.worldbank.org/curated/en/481961631557620454/Floods-and-Their-Impacts-on-Firms-Evidence-from-Tanzania

Shah, A. A. (2015). Understanding and managing flood hazards in Malaysia. *The Borneo Post*. http://www.theborneopost.com/2015/11/03/understanding-and-managing-flood-hazards-in-malaysia/

Shahid, S., & Minhans, A. (2016). Climate change and road safety: A review to assess impacts in Malaysia. *Jurnal Teknologi*, *78*(4). https://doi.org/10.11113/jt.v78.7991

Shell. (2024) *The importance of defensive driving*. https://www.shell.com/business-customers/shell-fleet-solutions/health-security-safety-and-the-environment/the-importance-of-defensive-driving.html

Sinar Harian. (2021, December 21). Floods: MEF urge all private sector employers to provide whatever assistance needed for affected employees. *Sinar Harian*. https://www.sinarharian.com.my/article/179114/mef-urge-all-private-sector-employers-to-provide-whatever-assistance-needed-for-affected-employees#google_vignette

Somu, R., Jeevan, J., & Mohd Salleh, N. H. (2023). *The role of seaport system in regional development an exploratory analysis in east coast of Peninsular Malaysia*. Penerbit UMT.

Spencer, N., & Urquhart, M.-A. (2021). Extreme climate and absence from work: Evidence from Jamaica. *International Journal of Disaster Risk Science*, *12*, 232-239. https://doi.org/10.1007/s13753-020-00327-1

Sung, F. C., Abdul Razak, S. F., Yogarayan, S., Abdullah, M. F. A., Kamis, N. H., & Azman, A. (2023). Conceptualising flood warning system for connected vehicles. *Indonesian Journal of Electrical Engineering and Computer Science*, *31*(3), 1684-1684. https://doi.org/10.11591/ijeecs.v31.i3.pp1684-1695

TruxCargo. (2024, January 17). *Disaster preparedness: Ensuring business continuity in logistics*. https://www.linkedin.com/pulse/disaster-preparedness-ensuring-business-continuity-logistics-8tkqe#:~:text=Business%20continuity%20in%20supply%20chain%20is%20a%20critical

UTHM News. (2023, March 22). *Communication crisis: Do we provide enough information in mitigating the flood issue?* https://news.uthm.edu.my/en/2023/03/communication-crisis-do-we-provide-enough-information-in-mitigating-the-flood-issue/#:~:text=In%20conclusion%2C%20communication%20is%20critical%20in%20the%20mitigation

Watkins, M. W. (2018). Exploratory factor analysis: A guide to best practice. *Journal of Black Psychology*, *44*(3), 219-246. https://doi.org/10.1177/0095798418771807

World Bank Group and Bank Negara Malaysia. (2024). *Managing Flood Risks: Leveraging Finance for Business Resilience in Malaysia*. https://www.worldbank.org/en/country/malaysia/publication/flood-risk-management-leveraging-finance-for-business-resilience-in-malaysia

World Bank Group. (2021). *Climate risk country profile: Malaysia*. https://climateknowledgeportal.worldbank.org/sites/default/files/2021-08/15868-WB_Malaysia%20Country%20Profile-WEB.pdf

World Economic Forum (WEF). (2023, January 5). *10 costliest climate disasters of 2022*. https://www.weforum.org/agenda/2023/01/10-costliest-climate-disasters-of-2022/

Yap, J. B. H., Lee, K. P. H., Skitmore, M., Lew, Y. L., Lee, W. P., & Lester, D. (2022). Predictors to increase safety technology adoption in construction: An exploratory factor analysis for Malaysia. *Journal of Civil Engineering and Management*, *29*(2), 157-170. https://doi.org/10.3846/jcem.2022.18053

Zakaria, N. H., Ahmad, M. N., Mohd Noor, M. S. A., & Ahmad, M. (2018). Knowledge integration among flood disaster management team: Lessons from the Kemaman district. *Journal of Information and Communication Technology*, *17*(3), 393-408. https://doi.org/10.32890/jict2018.17.3.8258

Zhong, S., Yang, L., Toloo, S., Wang, Z., Tong, S., Sun, X., Crompton, D., FitzGerald, G., & Huang, C. (2018). The long-term physical and psychological health impacts of flooding: A systematic mapping. *Science of the Total Environment*, *626*, 165-194. https://doi.org/10.1016/j.scitotenv.2018.01.041