



Original article

Maritime Terrorisms and Navigational Security in Sulu Sea[☆]

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Abstract

Piracy and maritime terrorisms are the eldest form of maritime criminal activities occurred across the globe and becoming enormous threats to navigational security. Since the past decades, major actors in maritime policy such as ocean governance and international security have discussed to include countermeasures in combating maritime terrorisms. However, maritime security remained as a critical agenda that have no definite solution. Recently, these ongoing terrorisms have threatened the sovereignty of many countries including Malaysia. Concerning about the issue, this paper aims to analyses the piracy and maritime terrorisms in Sulu Sea by identifying and assessing the effects of piracy and maritime terrorisms on the Malaysian navigational security in Sulu Sea. Therefore, an Analytical Hierarchy Process (AHP) and Evidential Reasoning (ER) approaches are used in this analysis. An AHP is use for prioritizing the effects of maritime terrorisms. Then, the ER approach was proposed to assess each maritime terrorism effect in a fuzzy context. In this paper, Sulu Sea has been highlights as the case study. This article presents an exhaustive review on the piracy and maritime terrorisms in Sulu Sea. The results of the numerical assessment have indicated that the crew casualty and injury are the most alarming risks in that area due to the piracy and maritime terrorisms, followed by the vessel security, port security, navigational delay, vessel route diversion, financial loss and cargo loss and damages. It is suggested that the involvement of government and maritime stakeholders in Malaysia are necessary for ensuring safe and secure navigation. This paper is expected to assist and guide enforcement agencies and other related entities to enhance the navigational security by conducting the proactive assessment in combating and reducing maritime terrorisms especially in Malaysian waters.

Keywords: Piracy, maritime terrorisms, navigational security, Sulu Sea, Analytical Hierarchy Process, Evidential Reasoning

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1. Introduction

The dependence of every nation on the maritime environment are indispensable. The nation has many interests in its surroundings, including trade, employment, transportation, food resources, recreation and strategic elements. International seaborne trade continuing to boost the momentum with volumes expanding by 4.0 per cent in 2017 (UNCTAD, 2018). This was the fastest growth in the last five years. In 2017, 10.7 billion tons of goods were loaded worldwide; 1.5 billion tons more than in 2012. Asia was by far the largest trading region. As a result, it is noteworthy to mention that seaborne trade plays a significant role in contributing to the global economy (Salleh *et al.*, 2014).

As can be seen, the growing importance of maritime trade has opened the eyes of many parties. However, there are ships carrying high-value cargoes have been targeted by several criminal groups involving marine such as piracy and maritime terrorisms. One of the main factors that lead to piracy and maritime terrorism are poverty (Young, 2004). This issue has blurred the line of legality in their actions. Poverty rates in some countries have caused a desire to gain wealth in a way that leads to maritime terrorism. It is caused by social acceptance, lack of legal consequence, chronic unemployment, and opportunity all play a role in supporting a criminal enterprise.

Recently, piracy and maritime terrorisms have threatened the sovereignty of many countries including Malaysia. These terrorisms are the eldest form of maritime criminal activities across the globe and becoming enormous threats to navigational security. Laqueur (1977) defined terrorism as an illegal use of force to achieve a political objective by targeting innocent people. Maritime security is one of the critical agendas of international relations that have no definite meaning. As stated by Bueger (2015), the major actors in maritime policy such as governance and international security have discussed since the past decade, started to include maritime security in their mandate to combat maritime terrorism. The sovereignty of the country created by the two countries itself, but lack of adequate cooperation has raised some concerns over the safety and security of navigation in waterways (Febriana, 2014).

Concerning about these issues, this paper carried out the analysis and assessment of the effects of piracy and

maritime terrorisms on Malaysian navigational security in Sulu Sea. When most research focused on providing countermeasures against the maritime crime involving piracy and maritime terrorism, yet only a few papers discussing the effect of piracy and maritime terrorism in field of navigational security are found. To make clearer, it is important to show the difference between security and safety. Security is the measures taken to protect against people who do harm intentionally, while safety are the measures taken to avoid accidents caused by misfortunes or negligence. So far, there are limited studies focusing on the effects of piracy and maritime terrorism on Malaysian security in the Sulu Sea. Besides that, there are also limited previous researches that using Analytical Hierarchy Process (AHP) and Evidential Reasoning (ER) as methods of their research. Hence, this paper produces the latest research of effective identification and effect assessment of piracy and maritime terrorism on the Malaysian navigational security in the Sulu Sea.

2.0 Literature Review

2.1 Sulu Sea

The Sulu Sea (Figure 1), a portion of the western North Pacific Ocean that bounded by north-eastern Borneo on the southwest, the southwestern islands of the Philippines, including Palawan, on the west and northwest, Busuanga and Mindoro on the north, Panay and Negros on the east, and Mindanao and the Sulu Archipelago on the southeast (Gorlinski, 2012). Comprised of two large seas, Sulu and Sulawesi separated by the Sulu Archipelago and several smaller seas that is the Sibuyan, Visayan and Camotes Seas in the northeast and the Bohol Sea further south between Bohol and Mindanao (DeVantier *et al.*, 2004).

As mention by Al-Faruq (2018), Sulu is a vast and complex region determined by competing for maritime boundaries (Indonesian, Malaysian and Filipino). This area is a very popular location with maritime violence and maritime threats that include piracy attacks, armed robbery, abductions, and ransom. Through this route, the crime scene involving the waters is widespread because of its proximity between Malaysia and the Philippines. All the events happening at this location related to maritime terrorism have led to a detrimental effect on maritime navigational security.



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Figure 1: The Sulu Region

Source: Eklöf (2004)

2.2 Maritime Terrorisms

Maritime terrorism is a term which does not have an international definition. Most of the time maritime terrorism is subject to national interpretations based on own history (Moreels, 2016). Chew (2005, p.74), defined maritime terrorism as “the deliberate creation and exploitation of fear through violence or the threat of violence in the pursuit of political change, in the maritime domain”. Wee (2012, p.33) defined maritime terrorism as “the undertaking of terrorist acts and activities within the maritime environment, using or against vessels or fixed platforms at sea or in port, or against any one of their passengers or personnel, against coastal facilities or settlements, including tourist resorts, port areas and port towns or cities”. Latest, Moreels (2016, p.4) defined maritime terrorism as “any act or activities of terrorism in the maritime environment, but what an act of terrorism concretely is not explained and is thus subject to free interpretation”. Some of the factors that contributing to the increase of piracy and maritime terrorism in the Sulu Sea are the lack of adequate cooperation over the security of navigation in this area (Febrica, 2014). According to Sinai (2004), there are four main terrorist groups with maritime capability, which are The Liberation Tigers of Tamil Eelam (LTTE), Al-Qaeda, Hezbollah and Abu Sayyaf Group (ASG).

It is not surprising that until now terrorists have neglected to exploit maritime targets. From the past, maritime terrorism did not correspond well to terrorists’ available opportunities, capabilities, or intentions due to

limited equipment. Even for those groups that have a geographic opportunity, there are several problems associated with carrying out waterborne strikes that have at least historically, worked to offset some of the tactical advantages of the maritime environment (Greenberg *et al.*, 2006). As nowadays, there is more sophisticated technology and existing facilities have opened more space and opportunities for maritime terrorism.

Several researches have been conducted in the subject of maritime terrorisms and piracy such as Sinai (2004), Eklöf (2005), Bateman (2010), Shortland and Vothknecht (2011), Leonard *et al.* (2012), Singh (2014), Liss (2014), Febrica (2014), Storey (2016), Ali and Apandi (2016), Pristrom *et al.* (2016) and Hasan and Hasan (2017). Sinai (2004) examined of a maritime terrorists’ capabilities, regional maritime “hot spots”, the potential maritime terrorist targets and the future maritime terrorist trends. Eklöf (2005) discussed the characters and reasons the surge in piracy and armed raids in the waters off the east coast of British North Borneo (Sabah) in the 1950s and early 1960s. Bateman (2010) reviewed the spectrum of threats in the Indo-Pacific region that might have some impact on the maritime security of Southeast Asia. Shortland and Vothknecht (2011) evaluated the effectiveness of the international naval mission in the Gulf of Aden from 2008 to 2010 in terms of counter-piracy and its counter-terrorism objectives.

Leonard *et al.* (2012) discussed the threats of maritime terrorisms and piracy to international shipping network. Singh (2014) discussed the needs for Malaysia to cooperate with ASEAN in counter-terrorism. Liss (2014) closely reviewed the current pirate attacks in Southeast Asia especially Malaysia, Singapore, Indonesia and the Philippines. Febrica (2014) examined the roles Indonesia and Philippines in securing the navigation in the waterways in order to combat maritime terrorism. Storey (2016) examined the nature of piracy and sea robbery in Southeast Asia and the effectiveness of state and regional authorities’ response. Pristrom *et al.* (2016) analysed maritime piracy and robbery related incidents in terms of the major influencing factors such as ship characteristics and geographical locations. Latest, Hasan and Hasan (2017) provided a brief review of the evolution of the concept of piracy and explores its different faces throughout human history. The previous research has dealt with maritime terrorisms and piracy in

broad context and few of them are focused on narrowed area. In this paper, the research attempts to discover from a new angle of study by assessing the effects of maritime terrorism and piracy on the Malaysian navigational security. The Sulu Sea is selected as the case study of this research.

2.3 The Effects of Piracy and Maritime Terrorism on Malaysian Navigational Security in the Sulu Sea

2.3.1 Vessel Security

The main impacts of maritime terrorism especially piracy and armed robbery is the vessel security itself. The main target of terrorist attack is the ship passing around. The efforts of the Malaysian and Philippine government agencies to secure the waters and borders of the Sulu Sea are crucial. On the Malaysia side, the establishment of maritime agencies is unlikely to help. According to Liss (2014), shooting on sight at any suspicious looking vessel is problematic in waters such as the Sulu Sea, because of the sheer number of small vessels plying these waters, including fishing boats, transport ships, taxi boats, and small passenger ferries. Many of the small boats carry firearms for defensive purposes, as these waters are known to be dangerous. Simply shooting at a suspicious vessel is therefore likely to put the lives of civilians at risk.

Most pirate attacks on merchant vessels in Southeast Asia between the 1990s and mid-2000s were simple "hit and run robberies," conducted at sea, on anchorage or in ports (Liss, 2014). Nowadays, most countries of the world operate fleets of merchant vessels (Chapsos and Kitchen, 2015). Indonesia's Foreign Minister, Retno Marsudi stated that more than 100,000 ships sailed through the Sulu Sea last year, carrying about 60 million tons of cargo and more than 18 million passengers (Al-Faruq, 2018). Globally, there are many types of vessels were attacks which are listed in Table 1 (ICC International Maritime Bureau, 2018). Table 1 shows that the number of attacks from the past seven years were still at alarming rate. The latest year in 2018, bulk carrier, tanker chemical product and container vessels are the main target for attacks with number of attacks of 59, 50 and 18 respectively. According to ICC International Maritime Bureau (2018), Malaysia as recorded as the second highest country with number of actual and attempted attacks from 2013-2018 with the number of 71 cases, after Indonesia (342 cases).

Table 1: Types of vessel attacks, January–December (2013–2018)

Type	2013	2014	2015	2016	2017	2018
Accommodation Barge	-	-	-	1	-	-
Bulk Carrier	53	55	86	52	38	59
Cable Ship	-	-	1	-	-	-
Cement Carrier	-	1	-	-	1	-
Container	30	20	30	10	23	18
Dhow	1	-	-	-	3	-
Dredger	-	-	-	1	-	-
Drilling Rig	-	-	-	-	-	1
FPSO/FSO	-	-	2	-	-	-
General Cargo	17	14	15	11	12	6
Heavy Lift Vessel	-	-	-	4	-	1
Heavy Load Carrier	-	1	-	1	-	-
Hopper Dredger	-	-	1	-	-	-
Landing Craft	1	-	-	-	-	1
Livestock Carrier	1	1	-	-	-	-
Offshore Processing Ship	-	1	-	-	-	-
Ore Carrier	-	-	1	1	-	1
Passenger	-	1	1	-	-	-
Pipe Layer Barge	-	-	1	-	-	-
Pipe Layer Crane Layer	-	-	1	-	-	-
Refrigerated Cargo	2	-	3	1	2	6
Research Ship	-	2	-	2	2	-
RORO	1	2	-	-	-	2
Supply Ship	5	3	2	4	8	5
Support Ship	-	1	-	1	2	2
Tanker Asphalt/Bitumen	3	4	-	1	1	1
Tanker Bunkering	-	2	1	-	1	-
Tanker Chem/Product	82	86	62	56	42	50
Tanker Crude	39	24	20	13	19	16

Oil						
Tanker LNG	-	1	-	1	3	2
Tanker LPG	9	13	4	10	11	6
Trawler/Fishing	2	3	2	1	1	12
Tug/Offshore Tug	18	7	10	14	11	11
Vehicle Carrier	-	2	1	2	-	1
Water Barge	-	1	-	-	-	-
Wood Chips Carrier	-	-	2	-	-	-
Yacht	-	-	1	-	-	-
Total at year end	264	245	246	191	180	201

Source: ICC International Maritime Bureau (2018)

2.3.2 Port Security

Port security refers to the defence, law and treaty enforcement, and counterterrorism activities that fall within the port and maritime domain. It includes the protection of the seaports themselves, the protection and inspection of the cargo moving through the ports, and maritime security (Frittelli, 2008). Approximately, there are 17 ports in the area of Sulu Sea which are Port of Sandakan, Port of Kudat, Port of Solo, Port of Holland, Port of Isabela Citu, Port of Zamboanga, Port of Santa Maria, Port of Brookes Point, Port of Puerto Princesa, Port of Please, Port of Danao Escalante, Port of Coron, Port of Caminawit (San Jose), Port of Culasi, Port of San Jose Buenavista, Port of Jordan and Port of Pulpandan.

Herbert-Burns *et al.* (2008) reported that in July 2005, the ASG and JI fighters performed the underwater training in Sandakan, Malaysia to attack maritime targets such as ports and a commercial vessel. In August 2005, military intelligence disclosed that ASG leaders and some foreign terrorist met in Patikul, Sulu Sea to plan an attack of some beach in Palawan. This prompted the Philippines government to strengthen the security of major ports and beaches in the country preventing any plan maritime terrorist attack to happen.

2.3.3 Navigational Delay

Interruptions in navigation due to terrorism can be shortages or delays of critical inputs (Czinkota *et al.*, 2004). Interruptions reduce the efficiency of supply chains and logistics (Czinkota *et al.*, 2005). ICC International Maritime Bureau (2017), reported that the Malaysian flagged Fishing Trawler BN-838/4/F was

attacked by armed persons while underway near Taganak Island, Philippines. On 18 January 2017, the Fishing Trawler, with three crews had sailed from Sandakan Jetty. On 19 January 2017, the Owners received information from the Malaysian Marine Police in Sandakan that the Fishing Trawler was found drifting off Taganak Island while information by Taganak Authorities indicated that the trawler was found without any crew on board. After that, the Fishing Trawler then towed to Taganak for investigation. From the case, it was found that the delay occurred in the Fishing Trawler navigation, which should sail around the waters for fishing purposes but was abducted by piracy. This has resulted the voyage of the ship cannot be continued. The ongoing investigation also took a long time to complete. Therefore, there is a navigational delay as well as a search operation to be carried out to find the lost crew on board the cruise. As a result, terrorisms and piracy not only affect the security of vessel but also causing absolute navigational delay to the vessel which finally resulting in financial losses to the shipping company.

2.3.4 Vessel Route Diversion

Diversion is the act of altering the destination port, navigation or final destination city, from what was originally booked after the cargoes have loaded, and the vessel has sailed (Bendall, 2010). There are many reasons why diversion occurred. One of the reasons is when the vessels were being attack by piracy or any kind of maritime terrorisms. Increasing activities by maritime terrorism such as piracy and armed robbery attack particularly in the Sulu Sea has been rising and make a shipping company to be concerned. The Sulu/Celebes area is the world's fastest-growing piracy hotspot with violent attacks on commercial vessels and their crew, also increasingly successful kidnap and ransom activity within the area. As reported by The International Maritime Bureau's piracy reporting centre in Kuala Lumpur warned of the rising threat of armed pirates in this area with a shipping company, starting to shy away. Shipping data in Thomson Reuters Eikon shows that several large vessels carrying iron ore from Australia to Northern Asia, which is using the route through the Sulu Sea, are now sailing east of Philippines, through the open Pacific Ocean. There are six shipping companies, diverting their vessels to avoid Sulu Sea. One of it is the U-Ming Marine Transport, Taiwan's largest dry-cargo

ship owner, which said 10 of its large Capsizes-class vessels had taken this detour since the end of 2016. Another company that uses the same way and make the same decision are Eastern Pacific Shipping, Diana Shipping, and Anglo-Eastern Ship Management.

2.3.5 Cargo Losses and Damages

When mentioning terrorist attacks, it would certainly involve cargo loss and damages. Cargo loss and damages not only involve merchandise but also involve valuables belonging to ransom victims who are on board involved with piracy attack especially. In some cases, cargos have been hijacked for ransom. This maritime criminal experienced that the government will trying the best to find a way to save the hostage by paying a ransom with a high amount of money. Most of the kidnapping victims during the year 2016 were Indonesian and Malaysian fisherman. On 18 November 2016, reported that gunmen attacked a Malaysian-flagged fishing trawler in the Celebes Sea off the coast of Sabah.

The gunmen abducted the captain and a crewmember and took an outboard engine and some of the crew's personal belongings before departing in an unmarked speedboat (Bureau of Counterterrorism, 2016). From the observation of the cases that occurred involving piracy and armed robbery attacks found that they used some weapons to ensure the maritime crime to be perform smoothly. According to the ICC International Maritime Bureau (2018), there are several types of armed used during attacks, from January to December for the year 2013 until 2018, which is shown in Table 2. Based on Table 2, most of the cases not stated the type of armed during attacks due to unawareness, but guns are frequently used in any attacks.

Table 2: Types of armed used during attacks, January–December (2013–2018)

Types of Arms	2013	2014	2015	2016	2017	2018
Guns	71	62	33	48	52	56
Knives	81	83	97	44	44	36
Not Stated	109	93	108	96	80	104
Other weapons	3	7	8	3	4	5
Total	264	245	246	191	180	201

Source: ICC International Maritime Bureau (2018)

2.3.6 Crew Casualty and Injury

In 2015, ASG conducted its first large-scale attack of amphibious forces landed by boat, torched the Philippine town of Ipil, robbed seven banks, and killed about a hundred people. ASG gained global notoriety in 2000 and 2001 when it kidnapped dozens of people, among them Filipinos, Malaysians, Chinese, Europeans, and Americans, in a series of raids on, especially vessels, resorts, and villages in and near the Sulu and Celebes Seas. Despite a large-scale government offensive backed by American forces, Philippine officials have confirmed ASG claims of responsibility for the 26 February 2004 sinking of Superferry 14 near Manila, in which 116 people were, killed (Bradford, 2005).

Apart from that, on 6 November 2016 there were incident occurred when the gunmen in a speedboat attacked a private yacht, abducting a 70-year-old German man from his yacht and killing his wife that reportedly tried to resist the attack. An ASG representative claimed the yacht was initially intercept while cruising near Tanjong Luuk Pisuk, Sabah. Local residents subsequently found the yacht drifting near Laparan Island in the Philippines with the remains of the deceased German woman. The ASG later posted a video of the German man requesting assistance in raising ransom money (Bureau of Counterterrorism, 2017). According to ICC International Maritime Bureau (2018), there are several types of violence to the crew, from January to December for the year 2013 until 2018, which are listed in Table 3:

Table 3: Types of violence to the crew, January–December (2013–2018)

Types of Violence	2013	2014	2015	2016	2017	2018
Assaulted	-	1	14	5	6	-
Hostage	304	442	271	151	91	141
Injured	21	13	14	8	6	8
Kidnap/Ransom	36	9	19	62	75	83
Killed	1	4	1	-	3	-
Missing	1	1	-	-	-	-
Threatened	10	9	14	10	10	9
Total	373	479	333	236	191	241

Source: ICC International Maritime Bureau (2018)

Table 3 shows the type of violence to the crew from January to December on year 2013 until 2018. It is

classified to seven types of violence that is assaulted, hostage, injured, kidnap or ransom, killed, missing and threatened. For the past year shows that total of kidnap or ransom is the highest number which is 83 cases in 2018 and the number of hostages is 141.

2.3.7 Financial Loss

Throughout the history, the oceans were always of vital economic importance. Both global shipping and fisheries have developed into multi-billion industries. The commercial value of the oceans has increasingly re-evaluated due to the economic potential of offshore resources, centrally fossil energy but also seabed mining, as well as the economic promises of coastal tourism (Bueger, 2014). Despite the long history of extensive social, political and economic exchanges between people in the area, the attacks and raids polarise the population, spread fear and harm local businesses (Liss, 2014).

Securing the sea-lane is important for the logistics and supply chains, as global trade is reliant on the waterways. The UNCTAD (2014) reported that the piracy costs

range from USD\$ 1 billion to 16 billion a year, including the industry cost for the payment of ransom and rerouting, ship protection measures, counter-piracy organisation, prosecution and imprisonment and government and civil society costs. Piracy also affected insurance premiums and coverage. The additional premiums were paid on cargo transiting piracy regions has increased by USD\$25 to \$100 per container (Bendekovic and Vuletic, 2013). In 2010, the Hull insurance has doubled and the cost of rerouting the ships to avoid the high-risk piracy area estimated US\$2.3 to US\$3 billion per year (UNCTAD, 2014).

According to Ali and Apanidi (2016), recent piracy activities in these remote sea-lanes interrupt the flow of cargo. If a ship is hijacked and held for any period of times, the shipping company and the charterer may have to deal with the loss of revenue and higher charter expenses, particularly the high-value cargoes such as crude oil, pharmaceuticals, luxury cars etc. To some extent, this cost inevitably transfers to end-user and potentially increase the price of goods in the market.

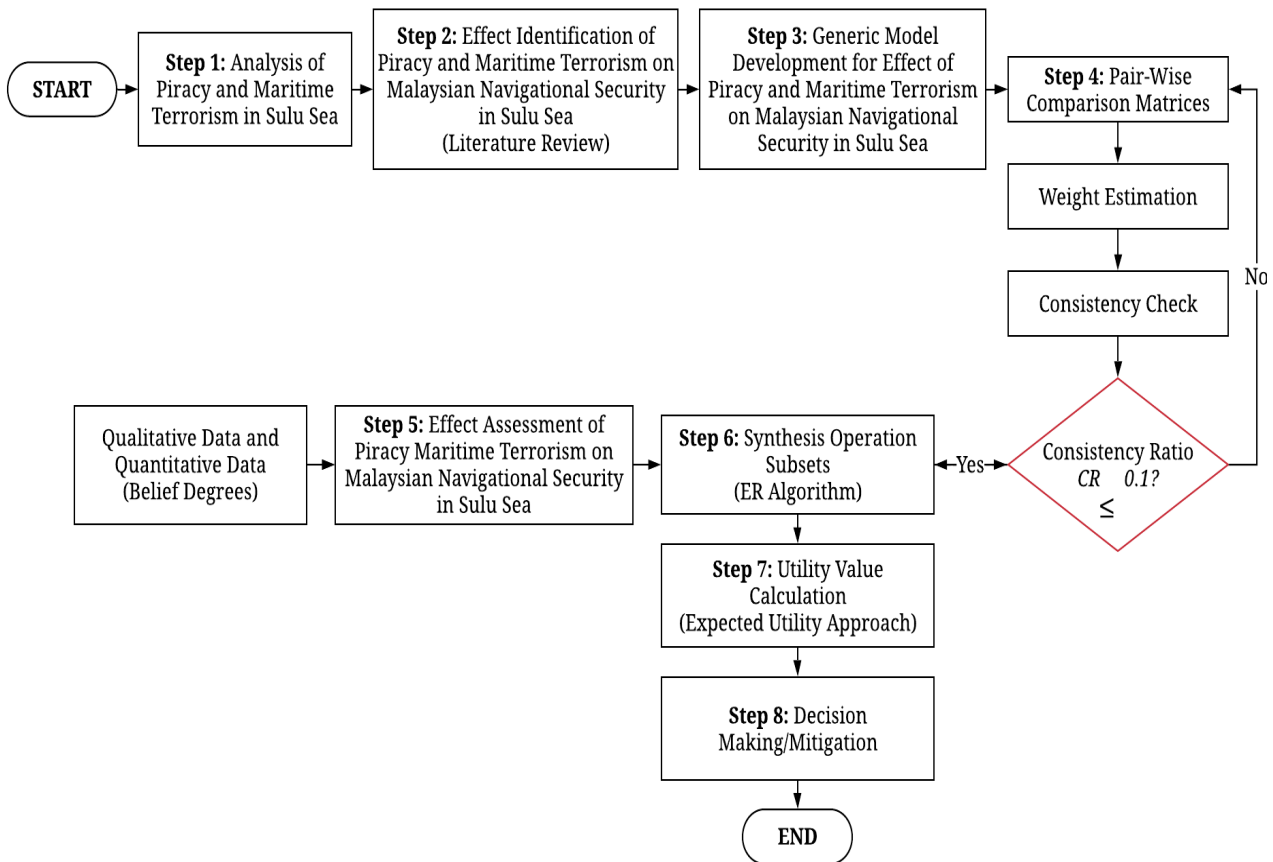


Figure 2: The Flowchart for Effect of Piracy and Maritime Terrorism on Malaysian Navigational Security in the Sulu Sea

3.0 Methodology

This paper carried out two multi-criteria on decision-making methods to access the effect of maritime terrorism on Malaysian navigational security in Sulu Sea. By using an AHP, pair wise comparisons will be conducted in order to compare the relative attributes in the same group. The weight will be established to each criterion based on local and global weights, determining the most significant criteria in the evaluation model. On the other hand, an ER method is a new developed multi-criteria decision-making tool which can be used to back up the insufficiency of AHP, besides dealing with uncertain information. In this paper, 10 experts have been approached to perform the pair-wise comparison for determining which effects is more critical. The selection of domain experts for their judgements were selected based on their position (i.e. managerial positions) and experiences (i.e. 10 years and above) in counter-terrorism and piracy expert. Questionnaires were provided to assist the experts during the interview session. Equal weight has been assigned to each expert in order to overcome difficulty in assigning weights for them and to avoid prejudgement. For developing the most significant effect of piracy and maritime terrorism on Malaysian navigational security in Sulu Sea, a flowchart of proposed methodology has been developed as illustrated in Figure 2 and describe how the steps of methodology framework in order to achieve the objectives.

3.1 Analysis of Maritime Terrorisms (Step 1)

The analysis of maritime terrorism in this paper provides the definition of maritime terrorism and the scope of the terrorism that include in the world. It is also an explanation to a merchant vessel, the main terrorist group that involves in the world of maritime terrorism which including Abu Sayyaf Group (ASG); the theory of piracy and armed robbery; hijacking/kidnapping; and the smuggling activity is being discussed in this section.

3.2 Identification the Effects of Maritime Terrorism on Malaysian Navigational Security (Step 2)

The process for identifying the effect is based on a literature review (i.e. Subsections 2.2-2.3) by listing each effect, and then classifying them into appropriate criteria. Every significant effect related to maritime shipping security is carefully reviews. The main criterion of these effects was dividing into two that are the threat to the security level, interruption on international shipping and

disruption and the threat to navigational operation.

3.3 Generic Model Development for the Effects of Piracy and Maritime Terrorism on Malaysian Navigational Security in the Sulu Sea (Step 3)

Generic model as shown in Figure 3 were based on the analysis of maritime terrorism in Step 1. Based on Figure 3, effect of the piracy and maritime terrorism on Malaysian navigational security is determine by seven factors that is vessel security, port security, navigational delay, vessel route diversion, cargo loss and damages, crew casualty and injury and financial loss.

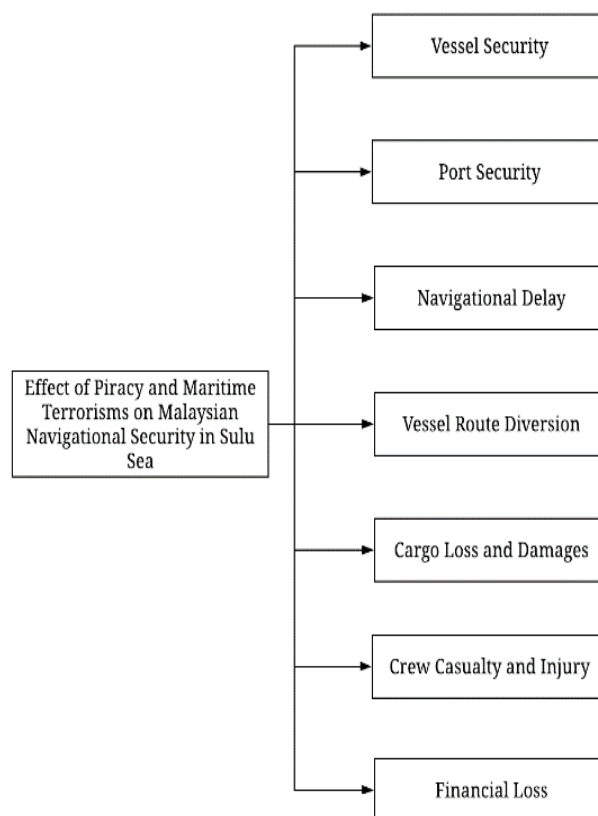


Figure 3: Generic Model Development for Effect of Piracy and Maritime Terrorism on Malaysian Navigational Security in the Sulu Sea

3.4 Establishment of Criteria Weights for Determining the Crucial Level of each Effect (Step 4)

In-depth interview prior to quantitative research is very important to identify if the research is worth exploring. Particularly, it is very useful when there is scarcity of publications on the topic (Asrilhant *et al.*, 2007). The mixed-methods strategy selected is sequential mixed-methods (Cresswell, 2009). This strategy involves the exploratory interview (before entering further

investigation (Stebbins, 2001). It is help in strengthen statement issued against seven effects that had been developed. Step 4 discussed or elaborate on how to assign each criterion based on a pair-wise comparison (i.e. AHP). A fundamental scale of absolute number is used in pair-wise comparisons in order to compare the alternatives or criteria. Further information about the AHP can be found in Saaty (1980; 1986), Andersen *et al.* (2008), Salleh *et al.* (2014), Singh *et al.*, (2016) and Salleh and Halim (2018).

3.5 Effect Assessment (Step 5)

The lack of data in the literature, imprecise information in past events, and high uncertainty about future events, a qualitative method can be employed in assessing the effects from more human perception (Salleh *et al.*, 2015). There are various methods of qualitative data collection and one of them is through domain expert judgments. Qualitative criteria can be presents by linguistic variables (i.e. linguistic terms and their corresponding belief degrees). According to Salleh *et al.* (2015) presented that, the number of remarkable coincidences between the channel capacity of several human cognitive and perceptual tasks. They also indicated the effective channel capacity between five equally weighted errorless choices. In this chapter, all factors are present by five linguistic terms, which are “very low”, “low”, “medium”, “high”, and “very high”. These assessment grades will synthesize after gathering the assessment from experts. This synthesis will be conduct using ER Algorithm. Qualitative data can be obtaining through pair wise comparison using Analytical Hierarchy Process (AHP) and Evidential Reasoning (ER) method. From this method involves in this research, it believes gaining the most appropriate factor in determining the effect that is closest to maritime terrorism to navigational security in Sulu Sea.

3.6 Synthesis Operation on Subset (Step 6)

The basis of a multi-attribute evaluation framework and the evidence combination of the D-S theory has led to the development of ER Algorithm (Yang and Xu, 2002; Salleh *et al.*, 2014). ER Algorithm is where an upper level is assessing through lower level attribute association and it helps to aggregate multi-attributes in a hierarchical structure (Salleh *et al.*, 2014). In this study, this effectiveness evaluation will be computerised by using Intelligent Decision System (IDS) only.

3.7 Utility Value Calculation and Decision-Making (Steps 7 and 8)

The results from each assessment will be presented by five linguistic terms (i.e. very low, low, medium, high and very high). This utility value is used to obtain a single value for decision makers to rank on the effects and further make a comparison between effects. Once the result has been obtained it could be used for a decision-making for looking for the best alternative(s) for addressing this maritime terrorism problem. Additionally, the most significant effect obtained from this result can used as a reference for various agencies, especially government and shipping companies, to be more sensitive to issues involving maritime terrorism, which should have a negative impact.

4.0 Result and Discussion

Based on the AHP calculation, the most significant factors have been weighted and ranked. Table 4 presents the weight value for the effect of piracy and maritime terrorism on Malaysian navigational security in the Sulu Sea. The prioritization process shows the concern level of these effects of piracy and maritime terrorism on navigational security in Sulu Sea. The most concerned effect is crew casualty and injury (0.3229), followed by vessel security (0.2490), port security (0.0998), navigational delay (0.0994), vessel route diversion (0.0917), financial loss (0.0746), and cargo loss and damages (0.0626).

The results obtained in Table 4 are persistent with the report on the previous incident in Sulu Sea from 2008 until 2018, where the most critical issue is crew casualty and injury. The crew is at risk of being held until the ransom is given to the kidnapper. In some cases, crew of vessels are killed by maritime terrorist. It is desirable to take priority over crew safety when involving such incidents in the area. When looking at the importance, vessel security issue in relation to vessel passing through Sulu Sea within Malaysia context would be very pertinent for Malaysian Enforcement Agencies to safe guard this waterway. So that, the trade waterways would be secured. As referred to previous incident in Sulu Sea, a term of petty theft is the activities of piracy and maritime terrorism which try to steal crew’s belonging that able to be taken or called “shopping”. The action of this group is not extreme as armed robbery, but the more

experience they carry out this activity, it will lead to armed robbery. When they feel that they are no longer able to carry out small theft activities over a relatively long period, they will seek out friends beforehand to use their existing expertise and experience to carry armed robbery against the ship. This group focuses on goods such as the proportion of vessels in the market and the activity of these activities is during the festive season and during the downturn.

Table 4: Result of Weight Values and Consistency Ratios for all Main Factor Effect of Piracy and Maritime Terrorism on Malaysian Navigational Security in The Sulu Sea

Effect Factors	Weight of the Main Factor	Rank
Crew Casualty and Injury	0.3229	1
Vessel Security	0.2490	2
Port Security	0.0998	3
Navigational Delay	0.0994	4
Vessel Route Diversion	0.0917	5
Financial Loss	0.0746	6
Cargo Loss and Damages	0.0626	7
Consistency Ratio: 0.0078		

From the exploratory interview with Maritime Government Related Agencies, the geographical location of Sulu Sea where bordered between the Philippines, Malaysia, and Indonesia. Despite having a coordinated patrol, it is still porous border. Patrolling at night-time and day-time are different. Currently, they do not know how terrorist or pirates monitor the enforcement agencies in terms of daily, weekly, monthly and yearly. They know the pattern, especially the time between the two countries when certain patrolling hours are been managed, definitely, there are know this pattern. This situation needs a serious concern, because when talking about this pattern it might relates to port security and vessel security, as the group will know when, where and how the agencies monitoring the vessel in the water.

After the effects of maritime terrorism have been prioritised by using the AHP, each of these effects is assessed to understand the impact level if it is occurred. The assessment values of each effect are then synthesised with the weight obtained (Table 4) by using the IDS. As

a result, Table 5 shows the assessment values for effect level under belief degrees. These results were aggregated by 10 experts to assess each effect. While utility values show the single synthesised value for each assessed effect. By considering 0 as “negligible”, 0.25 as “mild”, 0.5 as “moderate”, 0.75 as “severe” and 1 as “catastrophe”, cargo loss and damages have been assessed as the highest impact to the stakeholders in Sulu Sea area, compared other effects with the assessment value of 0.5182. Second highest impact is found to be crew casualty and injury (0.4845), followed by the vessel security (0.4789), vessel route diversion (0.4561), navigational delay (0.4561), financial loss (0.4139). Port security had been assessed as the least impact (0.2008) since navigational security is more profound on vessel movement. These values are further illustrated in Figure 4.

Table 5: The belief degrees of the criteria

Effects	Negligible	Mild	Moderate	Severe	Catastrophe	Utility Value
Vessel Security	0.1509	0.0789	0.5061	0.2348	0.0293	0.4789
Port Security	0.4532	0.3198	0.1979	0.0290	0	0.2008
Navigational Delay	0.1464	0.1186	0.6094	0.0876	0.0379	0.4380
Vessel Route Diversion	0.0756	0.2161	0.5836	0.0578	0.0669	0.4561
Cargo Loss and Damages	0.2090	0.1180	0.2745	0.1881	0.2104	0.5182
Crew Casualty and Injury	0.0927	0.2825	0.3236	0.1965	0.1047	0.4845
Financial Loss	0.2311	0.1859	0.3510	0.1605	0.0715	0.4139

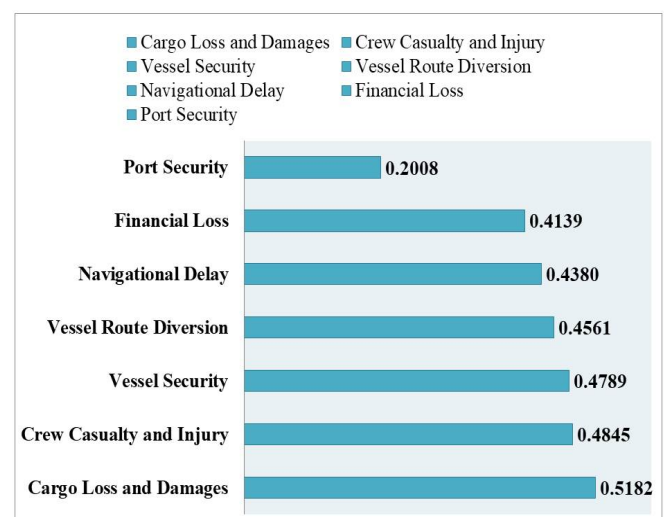


Figure 4: Evaluation outcomes for each criterion

The result has shown that cargo loss and damages are the most critical effects of maritime terrorism in Sulu Sea. This surprising result has contradicted with the previous research where crew casualty and injury are the most critical effects in few literatures. Globally, there are an estimated value of \$6.6 to \$6.9 billion loss due to piracy though commercial fraud, loss of cargo or delay (Nguyen and Le (2019)). This figure supports that cargo loss and damages are also the significant impact of maritime terrorism in Sulu Sea.

5.0 Conclusion and Recommendation

Within this paper, the analysis of the previous years' statistics has shown that the piracy and maritime terrorism activities were continuously occur from year to year involving different types of violence, vessels and arms used on the activities. As a result, this paper looks on different angle of study by analysing the effects of piracy and maritime terrorism on Malaysian navigational security in Sulu Sea by using several mathematical methods (i.e. AHP and ER) and decision support framework. For the assessment process, firstly, various effects of piracy and maritime terrorism on navigational security were identified. Secondly, generic model is developed in a hierarchal structure. Thirdly, AHP method have been used to rank the concern level of every effect. Fourthly, effect assessment and finally, an ER algorithm are used to synthesis experts' judgements by using IDS software. From the seven identified effects, crew casualty and injury are the highest concerned by stakeholders followed by the vessel security, port security, navigational delay, vessel route diversion, financial loss and cargo loss and damages.

This exploration has raised few suggestions to limit the impact of piracy and maritime terrorism on Malaysian navigational security in Sulu Sea. Firstly, Malaysian government should prepare a security measures to ensure the navigational security in Sulu Sea. Besides that, government should strengthen the cooperation with ASEAN members in counter-terrorisms. It is important for Malaysia to cooperate with ASEAN in handling this threat. Although it has been years since ESSCOM's establishment, issues such as kidnappings of Malaysian citizens in Sabah by ASG groups tend to be repeating. Since it is a transnational issue, it is best for Malaysia to

cooperate with ASEAN in resolving these threats. Cooperation with ASEAN will provide additional strength for Malaysia in resolving this issue. The consequences of globalization have largely forced countries to work towards their common goal on security issues such as counter-terrorism, human trafficking, or drug smuggling. Moreover, advancement in communication and transportation technologies has made it impossible to control state's borders from outside threats. Apart from that, for ensuring the navigational security in Sulu Sea, government should enhance and strengthen the coordination between relevant agencies. The involvement and cooperation between various agencies such as the Malaysian Armed Forces, Royal Malaysian Police and Malaysian Maritime Enforcement Agency are necessary. In a conclusion, each party needs to work hand in hand in addressing these piracy and terrorisms issues.

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