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Sea Lane Security of Oil and Liquefied Natural Gas in the East Asia Summit Region

Edited by

Shigeru Kimura

Tetsuo Morikawa

Siddharth Singh

Economic Research Institute for ASEAN and East Asia

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This report was prepared by the Working Group for the 'Sea ane Security of Oil and LNG in the EAS Region' under the Energy Research Institute Network (ERIN) research project of the Economic Research Institute for ASEAN and East Asia (ERIA). Members of the Working Group, who represent the participating East Asia Summit countries, discussed and agreed to utilise certain data and methodologies proposed. These data and methodologies may differ from those normally and/or officially used in each country, and therefore, the calculated results presented here should not be viewed as official national analyses of the participating countries.

Preface

The Energy Research Institute Network (ERIN) is a group of energy research institutes in the East Asia Summit (EAS) region. It was set up in September 2014 to discuss regional energy issues including the significant increase of energy demand due to stable economic growth. According to the ERIA report *Energy Outlook 2015*, oil and gas, especially liquefied natural gas (LNG) will continue to be an important fuel in 2040, and the supply of oil and LNG will depend on regions such as the Middle East and Africa. In this regard, ERIN chose the sea lane security of oil and LNG for Asia as one of its energy research projects in 2015.

This study consists of three parts: (a) forecasting future oil and LNG trade to assess congestion of choke points such as the Malacca and Singapore Straits, (b) analysis of sea lane risks such as piracy and congestion and extracting countermeasures, (c) country views on sea lane security. For this, ERIA requested The Institute of Energy Economics, Japan (IEEJ) and The Energy and Resources Institute (TERI) to conduct (a) and (b) respectively and formulate a working group to consist of several EAS countries for an overview of IEEJ's and TERI's research results and preparation of country views on sea lane security.

This report was prepared by the working group of sea lane security of oil and LNG for Asia, which consists of IEEJ, TERI, and members from China, Indonesia, Malaysia, and Thailand. Consequently, the working group meetings were held twice, one in February for kick off and the other in May to finalise the research results. The report also includes discussion results of the two working group meetings.

The report clearly mentions the following key messages to mitigate sea lane risks of oil and LNG transportation, (a) the development of alternative routes to avoid choke points, (b) joint regional patrols to prevent maritime piracy, and (c) measures to minimise the environmental impacts of oil spills.

Mr Shigeru Kimura

Dr Tetsuo Morikawa

Mr Siddharth Singh

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Special thanks go to Ms Maria Priscila del Rosario, chief editor and publication director of ERIA, and her team of editors and publishing staff for helping edit the report and prepare it for publication.

The Authors

List of Project Members

Mr Shigeru Kimura (Organiser): Special Advisor to Executive Director on Energy Affairs, Economic Research Institute for ASEAN and East Asia (ERIA)

Dr Tetsuo Morikawa (Leader): Manager, Oil Group, Fossil Fuels & Electric Power Industry Unit, The Institute of Energy Economics, Japan (IEEJ)

Mr Siddharth Singh (Leader): Area Convenor, Centre for Research on Energy Security, The Energy and Resources Institute

Dr Han Phoumin (Organiser): Energy Economist, Energy Unit, Research Department, Economic Research Institute for ASEAN and East Asia (ERIA)

Mr Rafiqan Ghani: Fleet Operations & Technical Services, PETRONAS LNG Sdn. Bhd.

Mr Anandajit Goswami: Fellow, Modelling and Scenario Building, The Energy and Resources Institute

Dr Siri Jirapongphan: Executive Director, Petroleum Institute of Thailand

Dr I Gusti Suarnaya Sidemen: Deputy Director for Technical and Environmental Regulation and Compliance, Ministry of Energy and Mineral Resources

Dr Shao-Yuan Wu: National Institute for South China Sea Studies

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List of Abbreviations

ASCOPE	ASEAN Council on Petroleum
ASEAN	Association of Southeast Asian Nations
EAS	East Asia Summit
EIA	Energy Information Administration
ERIA	Economic Research Institute for ASEAN and East Asia
ERIN	Energy Research Institute Network
HRA	high-risk area
ICC	International Chamber of Commerce
IEA	International Energy Agency
IEEJ	The Institute of Energy Economics, Japan
IMB	International Maritime Bureau
IPCC	Intergovernmental Panel on Climate Change
ISC	Information Sharing Centre
LNG	liquefied natural gas
LPG	liquefied petroleum gas
Mmscfd	million standard cubic feet per day
Mmscmd	million standard cubic metre per day
MT	million tonnes
OECD	Organisation for Economic Co-operation and Development
ReCAAP	Regional Cooperation Agreement on Combating Piracy and Armed Robbery against Ships in Asia
SLOC	sea lines of communication
TERI	The Energy and Resources Institute
UNCLOS	United Nations Convention on the Law of the Sea
US	United States
WRA	war-risk area

Executive Summary

With robust demand and modest supply growth in the region, the East Asia Summit (EAS) area is expected to rely more on imported oil and natural gas in the future. Lacking international pipeline infrastructure, the majority of the oil and natural gas is imported by sea transport to the EAS region. Therefore, sea lane security of oil and liquefied natural gas (LNG) is of vital importance for energy security of supply to the region.

IEEJ estimates that oil and LNG imports into Asia Pacific will increase by 76 percent and 120 percent towards 2040 and reach 34 million barrels per day and 394 million tonnes (MT), respectively. Despite diversified supply sources of oil and LNG, the Hormuz and Malacca/Singapore Straits will remain by far the busiest choke points for the EAS region even in 2040.

There are various risks to sea lane security that impact the trade of oil and LNG. The key background elements that determine sea lane risks are congestion, geography, geopolitics, climate change, poverty, and law and order. These background elements in turn can trigger events that increase costs and delays in international energy trade. Such trigger events include piracy, terrorism, regional conflicts, accidents and extreme weather events. Trigger events in turn impact energy security of the EAS region in the form of supply disruptions, price volatility of the traded goods, financial risks to the industry including increased insurance premium, and the physical risk to human life.

Such background elements and trigger events have different dynamics in different parts of the world. For instance, while piracy has declined globally, instances of piracy have been on the rise in the Malacca and Singapore Straits. On the other hand, in the Strait of Hormuz and the Western Indian Ocean, regional conflict and militancy is the key risk to energy trade. Further, extreme weather events are expected to increase over time due to climate change, which could pose greater risks of congestion and accidents in Southeast Asia and the Panama Canal in particular.

In order to mitigate risks, various measures and strategies will need to be adopted. These include the adoption of electronic identification tags to monitor vessels, regional agreements to foster joint patrolling of waters, regulation of private security agencies, the implementation of an integrated accident risk management approach to prepare joint contingency plans in case of emergencies, and the development of alternate sea routes.

With increasing dependency on imported oil and LNG, participant countries in this study recognise the importance and risks of sea lane security. The Ministry of Energy and Mineral Resources of Indonesia regards accident, piracy, terrorism, and extreme weather as major threats for sea lane security, and recommends improving mutual trust among stakeholders, promoting cooperation on capacity building among stakeholders, and improving coordinated response to any attacks or casualties. Thai initiatives include an Oil Fund Scheme and Mandatory Reserve Requirement, and the ‘Kara Canal Project’ that bypasses

Malacca, interconnected gas infrastructure of the Association of Southeast Asian Nations (ASEAN) countries, and various multilateral measures like the traffic separation scheme (TSS), automatic identification system (AIS), and the Regional Cooperation Agreement on Combating Piracy and Armed Robbery against Ships in Asia (ReCAAP). Pointing out the discrepancy in perception of sea lane security of Malacca/Singapore Straits among littoral countries, the National Institute for South China Sea Studies encourages international organisations and institutions to play a positive and effective role in upgrading confidence building and capacity building of littoral states as well as prompting the maritime navigation order under the United Nations Convention on the Law of the Sea (UNCLOS), the Declaration on the Conduct of Parties in the South China Sea, and the Code of Conduct in the South China Sea.

Chapter 1

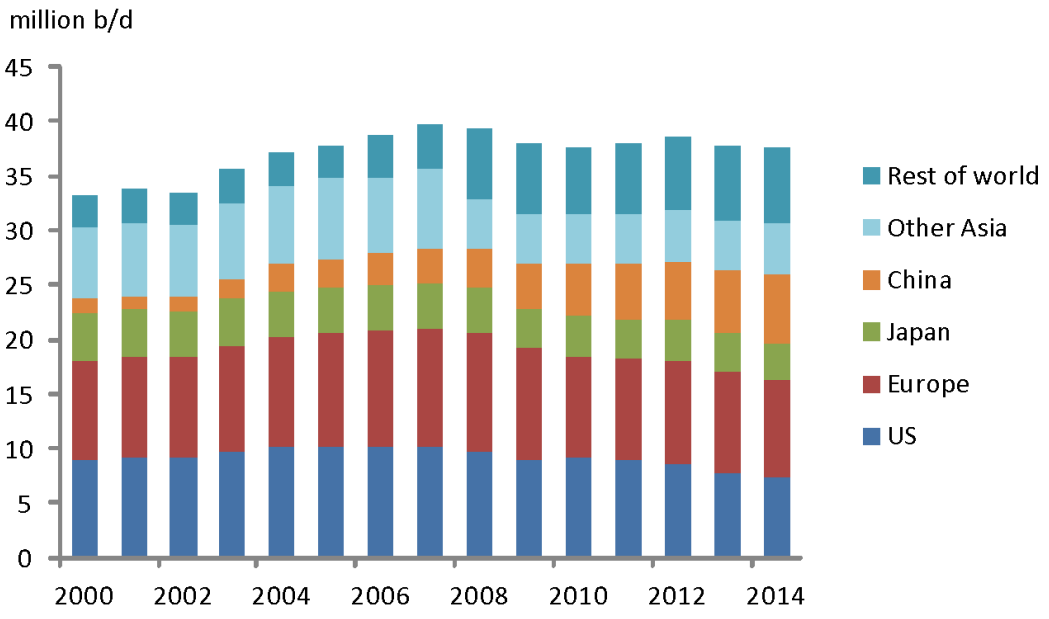
Oil and LNG Imports and Trade Flow Outlook

1. Oil

1.1. Trade

World crude oil trade has increased from 2000 to 2007 by 6.6 million barrels per day (mb/d) backed by strong demand growth in China and the United States (US). The trade volume, however, has declined since then because of the economic downturn caused by the Lehman shock. After 2010, the trade volume was further impacted by US shale oil production growth and rapid fall of US crude oil imports. Persistent economic stagnation in Europe and Japan put additional downwards pressure to their oil demand, and thus reduced their import. On the other hand, imports of China and 'Other Asia' have grown steadily backed by rapid demand increase (Figure 1-1).

Figure 1-1. Crude Oil Imports, by Region (2000–2014)

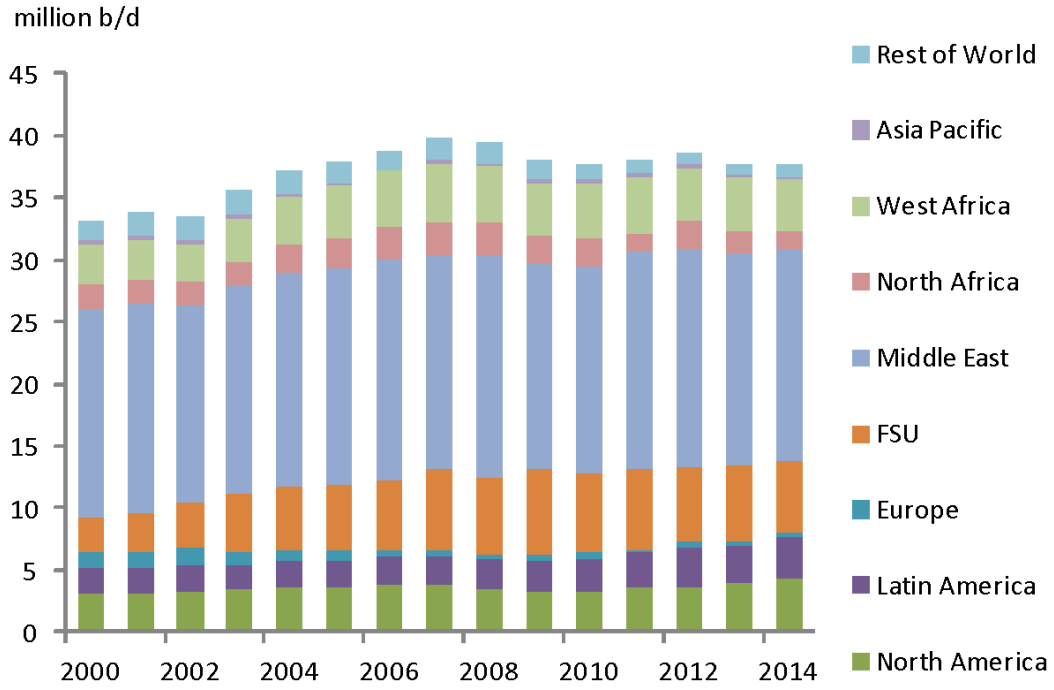


b/d = barrel per day, US = United States.
Source: BP (2015).

As for exports, the Middle East has almost maintained their export volume since 2000 (Figure 1-2). Former Soviet Union (FSU), now Russia, has increased its exports particularly to

the Asian market though Africa and Latin America have failed to maintain their export volume. This is, because in some African countries such as Libya and Nigeria, civil strife or political instability has hindered steady production and exports. As for Latin America, the US used to be the biggest market for their crude oil exports, but tough competition from Canadian crude oil and increased shale oil production in the US significantly narrowed export windows for their crude oil.

Figure 1-2. Crude oil exports by Region (2000–2014)



FSU = Former Soviet Union.
Source: BP (2015).

It is highly likely that oil demand in Asia will continue to grow (Table 1-1). China has led the demand growth in the region since the mid-2000s, and it will remain so with imports of 12 mb/d in 2040, by far the largest in the world. South Asia, importing 9 mb/d and the Association of Southeast Asian Nations (ASEAN), importing 7 mb/d, will also emerge as other demand giants towards 2040. Oil production in Asia- Pacific will either decline or maintain at best, the region will continue to be the major oil importer in the world. Thus, the share of Asia-Pacific in world crude oil imports will increase from 48 percent in 2014 to 71 percent in 2040.

Meanwhile, Asia-Pacific shares only 2 percent of the world crude oil export in 2014, and the share will further decrease towards 2040 due to decline of production in the region (Table 1-2). Europe will be even more negative; the export of which will be negligible in 2030 onwards. The US and Canada are expected to increase their export, thanks to their shale revolution to a certain extent. FSU and Africa will expand their exports gradually too. North

America, FSU, and Africa will contribute to diversify export sources of Asian importers; however, the Middle East will clearly remain by far the largest export region in the foreseeable future with 25mb/d export in 2040, sharing 52 percent of the world total.

Table 1-1. Crude Oil Import Outlook (2014–2040)

Thousand b/d

	2014	2020	2030	2040
China	6,186	8,519	11,040	12,200
Japan	3,237	3,183	2,991	2,620
Taiwan	822	834	836	834
Korea	2,469	2,481	2,483	2,408
ASEAN	1,987	3,920	5,026	6,525
South Asia	3,900	5,880	8,494	8,911
Oceania	566	556	516	360
Asia Pacific total	19,167	25,373	31,386	33,858
US	7,388	6,628	6,422	5,300
Canada	564	161	80	40
Latin America	925	988	1,090	1,106
Americas total	8,877	7,777	7,592	6,446
Europe	10,307	8,228	6,792	6,250
FSU	584	210	106	negligible
Africa	656	701	773	796
Middle East	492	526	580	588
Total	40,083	42,813	47,228	47,938

ASEAN = Association of Southeast Asian Nations; FSU = Former Soviet Union; US = United States.
Source: IEEJ.

Table 1-2. Crude Oil Export Outlook, by Region (2014–2040)

Thousand b/d

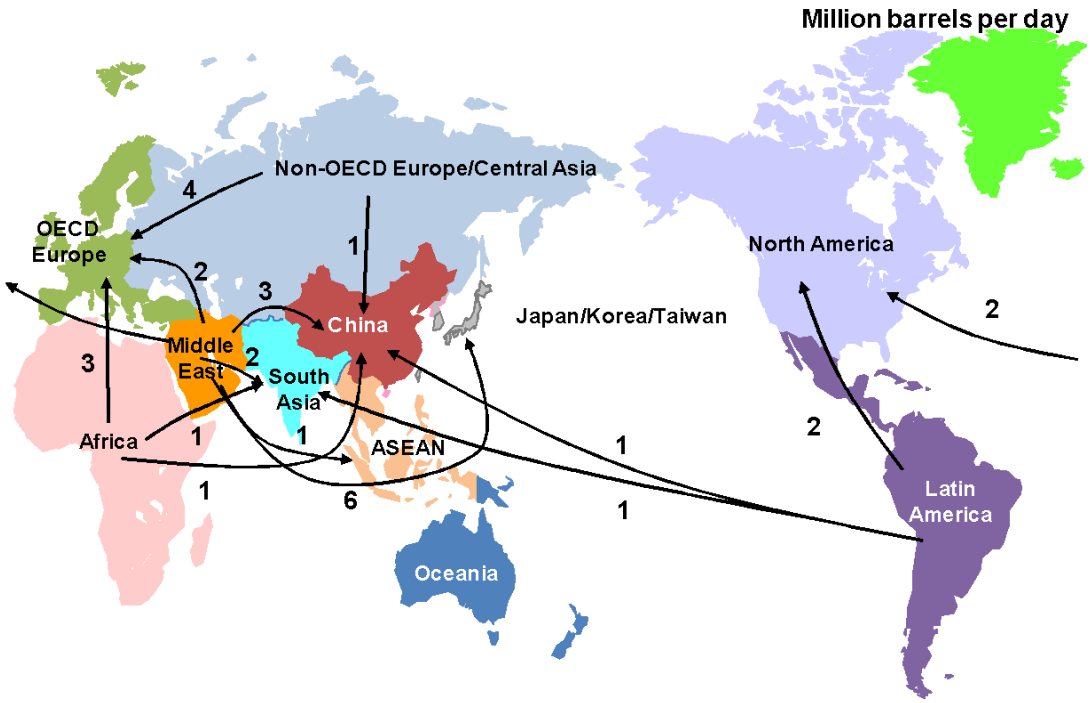
	2014	2020	2030	2040
ASEAN	848	441	230	120
Australia	161	302	420	472
Other Asia Pacific	212	198	175	112
Asia Pacific total	1,221	942	825	704
US	345	209	424	591
Canada	2,266	2,844	3,452	3,707
Latin America	5,001	4,166	3,889	3,509
Americas total	7,612	7,219	7,764	7,807
Europe	1,885	158	negligible	negligible
FSU	6,798	6,876	7,254	7,847
Africa	5,774	5,832	6,390	6,454
Middle East	16,793	21,786	24,995	25,127
Total	40,083	42,813	47,228	47,938

ASEAN = Association of Southeast Asian Nations; FSU = Former Soviet Union; US = United States.
Source: IEEJ.

1.1.2. Trade flow and shipping frequency through major choke points

Being by far the largest export region, the Middle East is currently the origin of the major crude oil flow (Figure 1-3). It exported 12 mb/d to Asia, 2 mb/d to Europe, and 2 mb/d to North America in 2014. This is followed by the flows from non-Organisation for Economic Co-operation and Development (OECD) Europe/Central Asia, mostly Russia to Europe (4mb/d), Africa to Europe (3mb/d), and Latin America to North America (2mb/d).

Figure 1-3. Major Interregional Oil Flows (2014)



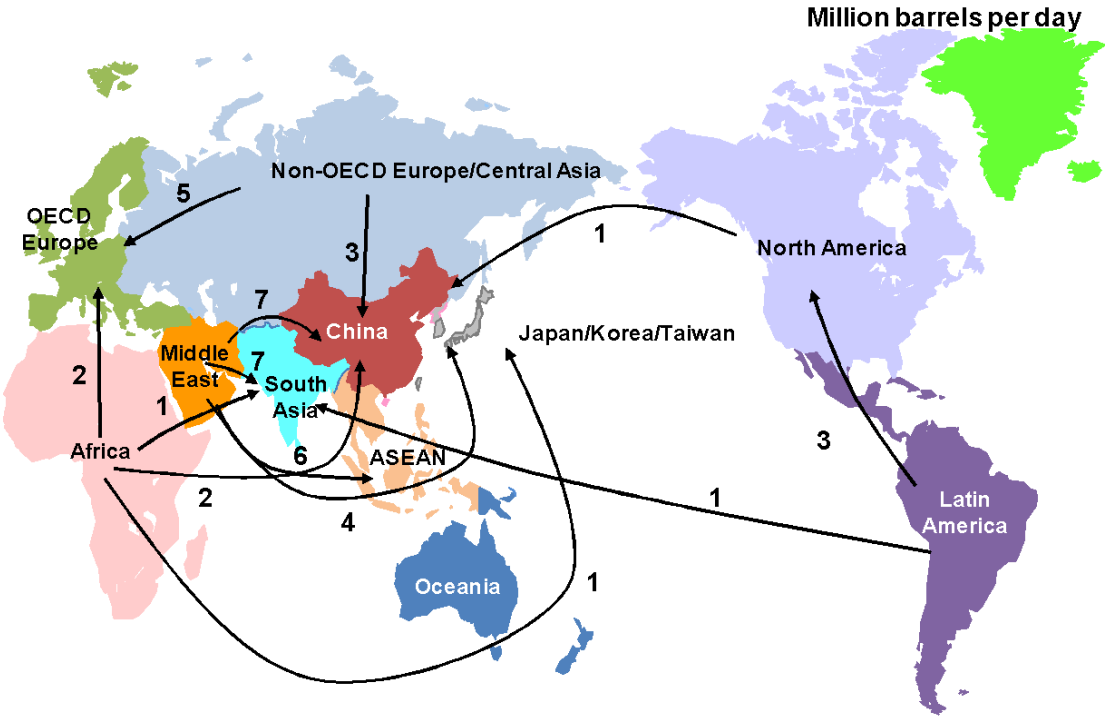
ASEAN = Association of Southeast Asian Nations; OECD = Organisation for Economic Co-operation and Development.
Source: IEEJ.

There is no doubt that, among various choke points in the world, the Hormuz and Malacca/Singapore Straits will be the two most important passages for oil trade for Asia. In the last several years in the 2010s, dependence on Middle Eastern crude oil has eased because of a larger volume of crude imports from non-Middle Eastern sources such as Russia, Africa, and Latin America. Figure 1-4 represents the growing oil demand in Asia that will be largely met by the Middle East because of its development cost competitiveness and geographical proximity, although the growth rate will slow down after 2030 due to demand growth in the Middle East. This means the dependence on the two important choke points will inevitably increase.

It should be noted that this oil flow outlook only concerns crude oil rather than oil products. Should oil products and liquefied petroleum gas (LPG) be included, the total oil flow (i.e.

crude, oil products, LPG) will be even more substantial in the future, especially in the Hormuz and Malacca/Singapore Straits.

Figure 1-4. Major Interregional Crude Oil Flows (2040)



ASEAN = Association of Southeast Asian Nations; OECD = Organisation for Economic Co-operation and Development.
Source: IEEJ.

Table 1-3 represents the outlook of crude oil shipping through major choke points for the East Asia Summit (EAS) region. While those choke points will be busier towards 2040, the question is whether they will be able to handle increasing traffic. Physical limitation of shipping passage does not seem to be an issue for the Hormuz Strait that is deep and wide enough, also for the Panama Canal and Bering Strait that a limited number of oil tankers are expected to go through. For the Malacca/Singapore Straits, on the other hand, physical limitation might be the case in the future, although there are conflicting views among maritime experts as to whether Malacca/Singapore will overflow with vessels. There are no clear criteria as to how many vessels (or tonnage) can pass through the straits. Even if the straits can manage an increasing number of vessels, considering the possibility of accidents and oil spills, it is sensible to develop alternative routes such as Sunda and Lombok in

Indonesia. Diverting a cargo ship from Malacca/Singapore straits to Sunda and Lombok will add 36 and 72 hours, or $48,000–$72,000 of transportation cost, respectively[1].

Table 1-3. Outlook of Crude Oil Shipping through Major Choke Points for EAS Region

Choke point		2014		2030		2040	
		Thousand b/d	number of tanker passages	Thousand b/d	number of tanker passages	Thousand b/d	number of tanker passages
Hormuz	Asia bound	12,419	7,815	23,414	14,735	23,994	15,100
	Atlantic bound	4,443	2,796	1,573	990	negligible	negligible
	Total	16,862	10,611	24,987	15,725	23,994	15,100
Malacca/ Singapore		12,272	7,723	18,456	11,615	19,404	12,211
Panama*		91	133	127	93 (47)	140	103 (51)
Bering		0	0	negligible	negligible	negligible	negligible

Notes: 1. Average tanker size for Hormuz and Malacca/Singapore is assumed at 1.1 million barrels (mb) (based on the research by the Nippon Foundation and the Institution for Transport Policy Studies. For the Panama Canal, it is assumed that Panamax (0.5mb) and Suezmax (1mb, indicated in brackets in the table) will be utilised.
2. Number of tanker passages assumes round trips.
EAS = East Asia Summit.
Source: IEEJ.

1.2. Liquefied Natural Gas

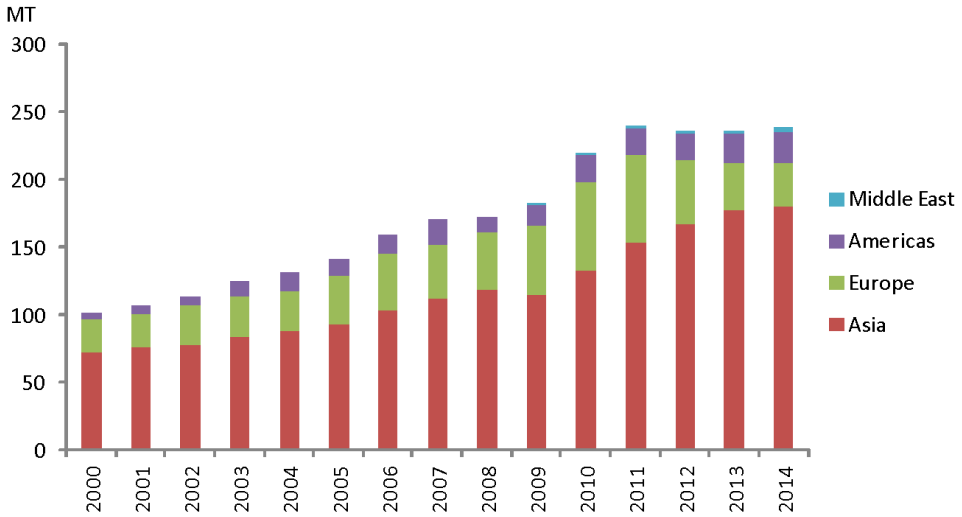
1.2.1. Trade

LNG imports grew by 5.6 percent per annum from 118 million tonnes (MT) from 2000 to 239 MT in 2014. Asia, mainly Japan, Korea, China, Taiwan, and India, is the largest importing region, that is followed by Europe and Americas. In 2014, 29 countries, including 8 EAS countries, imported LNG[2] (Figure 1-5).

The largest export region of LNG is the Middle East (Qatar, United Arab Emirates, Oman, and Yemen), which exported 96 MT in 2014. That is followed by Asia, Africa, and Oceania. Nineteen countries, including six EAS countries[3], exported LNG in 2014 (Figure 1-6).

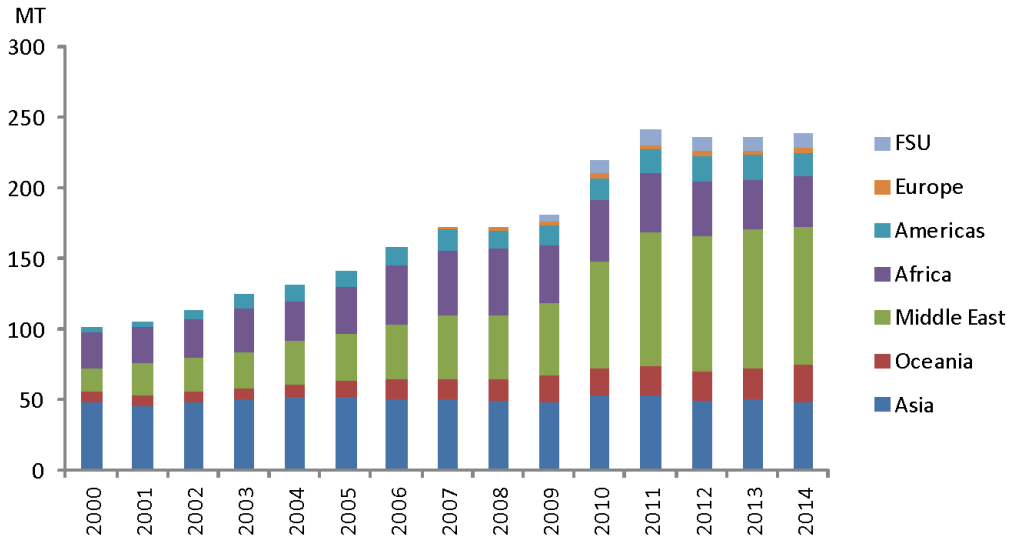
[1] Very large crude carrier (VLCC) shipping from the Persian Gulf to Northeast Asia and charter rate of $24,000/day are assumed here.
[2] China, India, Japan, Korea, Malaysia, Singapore, Thailand, and the US.
[3] Australia, Brunei, the US, Indonesia, Malaysia, and Russia.

Figure 1-5. LNG Imports, by Region (2000–2014)



LNG = liquefied natural gas; MT = million tonne.
Source: GIIGNL (2015).

Figure 1-6. LNG Exports, by Region (2000–2014)



FSU = Former Soviet Union; LNG = liquefied natural gas; MT = million tonne.
Source: GIIGNL (2015).

Table 1-4 represents LNG import outlook towards 2040. With robust natural gas demand and inadequate supply growth, international trade of natural gas, especially in the form of LNG, is likely to increase rapidly towards 2040. According to the IEEJ, LNG demand in Asia will expand from 179 MT in 2014 to as much as 394 MT in 2040.

However, the forecast situations may vary from country to country. Japan, the largest LNG importer in the world, will greatly decrease its imports mainly due to the restart of its nuclear power plants, renewable expansion, and energy efficiency. Korea is expected to follow a similar path with its expansion of nuclear and coal-fired power generation. Despite the uncertainty in terms of the extent of energy efficiency, gas-fired power generation in the power mix, and pipeline gas imports, China will be the largest LNG importing country in the world in 2040. Compared with Northeast Asia, other regions will remain minor importers. Nevertheless, with 62 MT, India will be the third largest LNG importer in the world in 2040. LNG imports in Southeast Asian countries will quickly reach 70 MT in 2040. While Europe will import significantly more in the future, the import growth potential in Oceania, North America, and South America is limited towards 2040.

Table 1-4. LNG Import Outlook

Million Tonnes

Region	Country	2014	2020	2030	2040
Asia Pacific	Japan	89	75	85	86
	Korea	38	36	44	45
	China	19	47	82	99
	Thailand	1	8	19	25
	Singapore	2	8	11	14
	Malaysia	2	5	6	8
	Indonesia	0	5	9	12
	Vietnam	0	1	3	6
	Phillipines	0	1	4	5
	India	15	23	50	62
	New Zealand	0	0	1	1
	Taiwan	13	15	21	23
	Pakistan	0	2	2	4
	Sri Lanka	0	0	1	1
	Bangladesh	0	0	2	2
	Sub total	179	227	339	394
Middle East	Persian Gulf	4	7	13	21
	Non Persian Gulf	0.1	3	4	5
	Sub total	4	10	17	26
Europe	Baltic	0.1	4	5	9
	Altantic	13	31	32	33
	Medditeranean	19	44	46	46
	Sub total	32	78	83	88
Americas	North America	10	10	11	12
	South America	12	12	15	17
	Sub total	23	22	26	29
Africa	North Africa	0	0	2	3
	Sub Sahara Africa	0	1	5	7
	Sub total	0	1	7	10
Total		238	338	472	547

Source: IEEJ.

Table 1-5 represents the LNG export outlook towards 2040. The biggest change in terms of LNG export towards 2040 is the emergence of North America as a significant export region. Thanks to the shale revolution, the region, especially the US, is rapidly developing export capacity. Exporting the first cargo from the Gulf of Mexico in 2016, the US export will reach as much as 95 MT in 2040. Oceania, mainly Australia, is expanding capacity too. Together with Papua New Guinea, the region will export as much as the US in 2040. The Middle East, on the other hand, will export less in 2020 mainly due to feed gas shortage as well as losing market share. However, the LNG demand growth will call for Middle East supplies in 2030 onwards, and the Middle East will pick up its export quickly.

Table 1-5. LNG Export Outlook

Million Tonnes

	2014	2020	2030	2040
ASEAN	48	45	43	39
Oceania	27	67	85	98
US	0.3	31	66	95
Canada	0	0	24	32
S&C America	17	14	13	11
Americas total	17	45	103	138
Europe	4	3	2	1
FSU	11	15	31	55
Africa	36	45	56	87
Middle East	96	89	109	129
Total	239	309	429	547

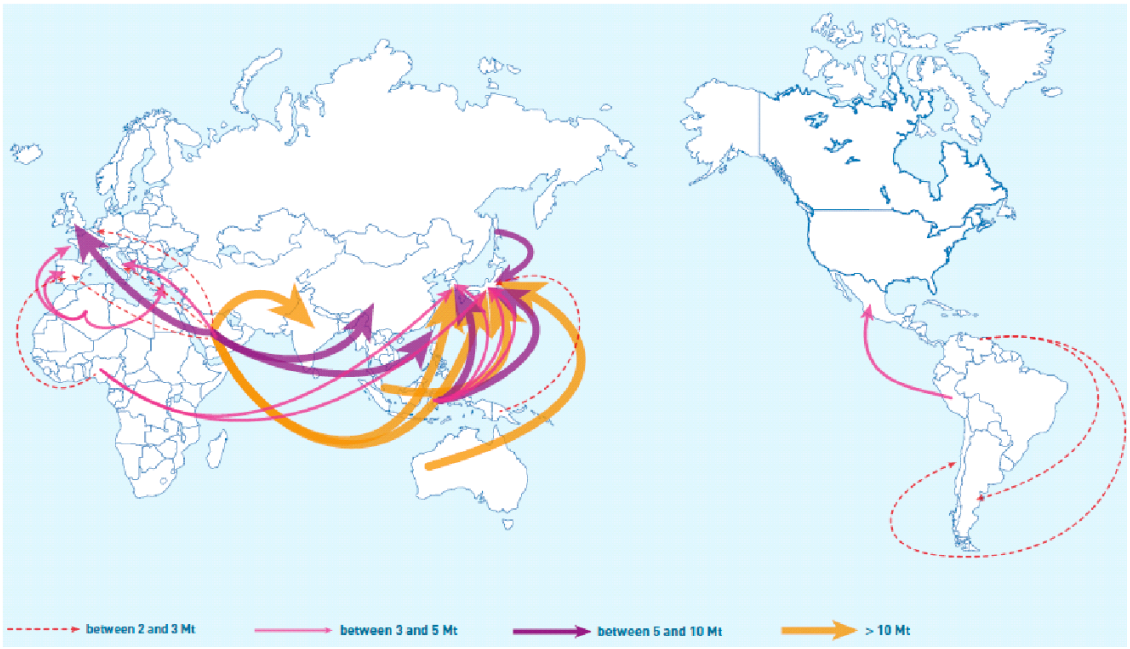
ASEAN = Association of Southeast Asian Nations; FSU = Former Soviet Union; S&C America = South and Central America; US = United States.
Source: IEEJ.

1.2.2. Trade flow and shipping frequency through major choke points

Figure 1-7 indicates major LNG flows in 2014. Flows are from the Middle East to Asia (74 MT), Southeast Asia to Northeast Asia (48 MT), Oceania to Asia (27 MT), the Middle East to Europe (18 MT), and Africa to Europe (15 MT). With excessive supply to Europe, 6MT was reloaded at European LNG terminals and re-exported to Asia and Latin America.

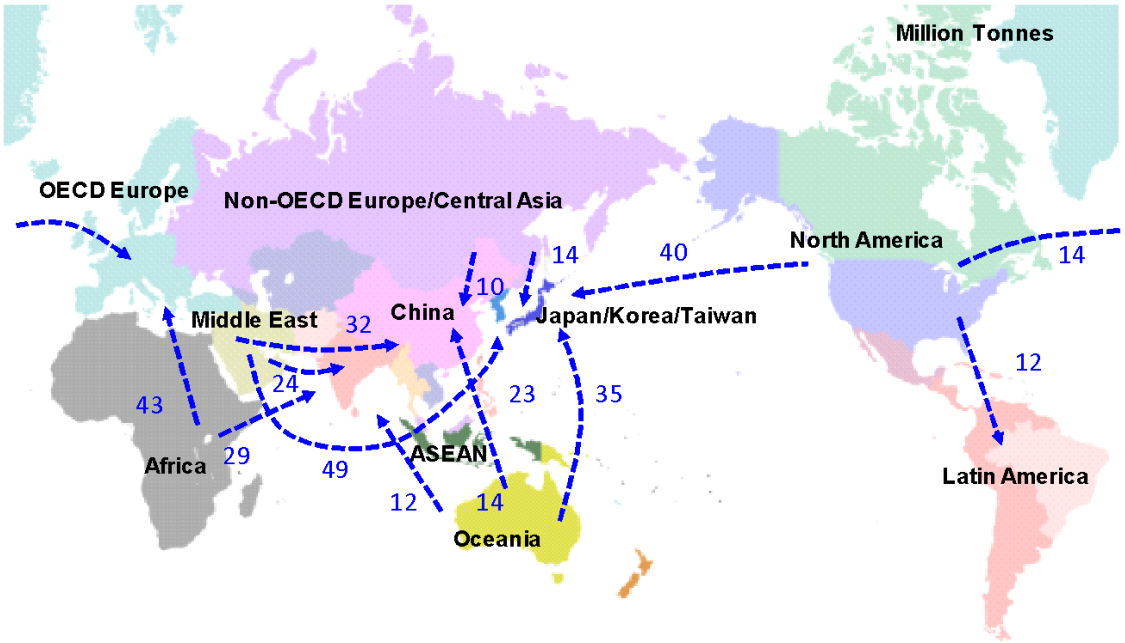
Figure 1-8 outlooks major LNG flows in 2040. Major choke points like Hormuz and Malacca/Singapore straits will remain important especially for Asian countries, although LNG flows will be more diversified. Panama and Bering will emerge as new choke points since the US will be the third largest LNG exporter by 2020 and the giant Yamal LNG in Arctic will start operation by 2020. For Atlantic market, Hormuz, Bab al-Mandab, and Suez will remain critical especially for the cargoes from Middle East. With commercialisation of East African LNG in Mozambique and possibly Tanzania and regasification terminals in Sub Sahara Africa might make Cape of Good Hope and Mozambique Channel significant choke points, too.

Figure 1-7. Major LNG Flows (2014)



Source: GIIGNL (2015).

Figure 1-8. Major LNG Flows (2040)



ASEAN = Association of Southeast Asian Nations; LNG = liquefied natural gas; OECD = Organisation for Economic Co-operation and Development.
Source: IEEJ.

Taking future flow changes into account, the Hormuz Strait, Malacca/Singapore Straits, the Panama Canal, and the Bering Strait are the most important choke points for LNG supplies to Asian countries.

Table 1-6 represents the outlook of LNG shipping through major choke points for the EAS region. With robust demand growth, major choke points will clearly be busier with more LNG tankers. Hormuz and Malacca/Singapore Straits will remain the busiest of all. With existing exporters, Qatar and the United Arab Emirates, it is assumed that Iran will start exporting LNG in the 2020s. Panama and Bering traffic will pick up quickly, but not to the extent of the Hormuz and Malacca/Singapore Straits. The latter will not only accommodate east bound tankers mainly from the Middle East and Africa to meet the demand mainly in Northeast Asia but also some west bound tankers mainly from Australia to Malaysian and Singaporean regasification terminals.

Therefore, as mentioned in Section 1.2, diverting away from Malacca/Singapore could be a reality in the future. Should that be the case, there would be additional shipping hours and the cost would be $56,000–$84,000[4].

Table 1-6. Outlook of LNG Shipping through Major Choke Points for the EAS Region

Choke point		2014		2030		2040	
		MT	number of tanker passages	MT	number of tanker passages	MT	number of tanker passages
Hormuz	Asia bound	61	1,537	62	1,580	72	1,820
	Atlantic bound	20	503	24	608	28	700
	Total	81	2,040	96	2,431	111	2,801
Malacca/ Singapore	East bound	94	2,388	67	1,693	102	2,589
	West bound	0.5	13	9	215	11	278
	Total	95	2,401	75	1,908	113	2,867
Panama		0	0	18	450	63	1,597
Bering		0	0	3	76	10	242

Note: 1. Tanker size is assumed to be 170,000 cubic meter (79,000 tonnes)
2. Number of tanker passages assumes round trips.
Source: IEEJ.

[4] Tanker rate of $28,000 is assumed here.

Chapter 2

Risk Analysis on Sea Lane Security of Oil and LNG

2.1. Introduction to Sea Lane Security

While 'energy security' is a malleable concept, international institutions such as the International Energy Agency (IEA) and governments of various countries agree to its core tenets, which are the importance of secure, adequate, affordable and reliable supply of energy (Singh, 2012). A fundamental aspect of energy security is the management of risk, particularly, the risk of interruptions, unavailability of energy, and price volatility. The Society for Risk Analysis defines risk as the potential for the realisation of unwanted, adverse consequences to human life, health, property or the environment.

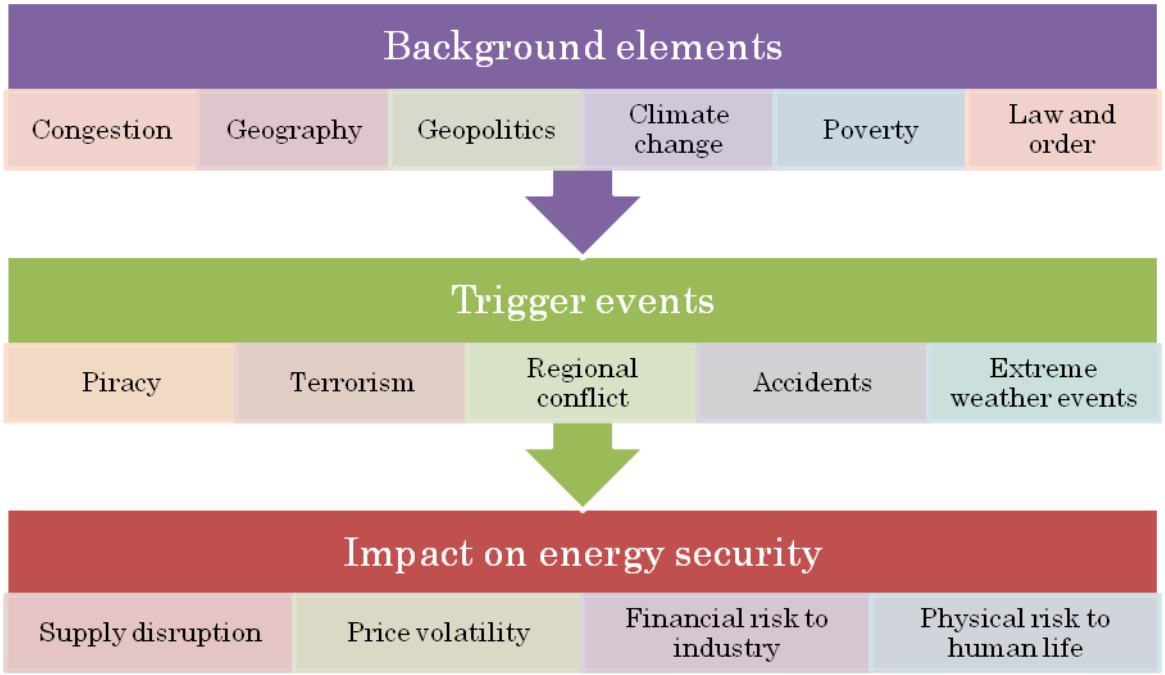
In the case of the global hydrocarbons economy, there emanate serious risks in the supply of petroleum and natural gas. Traded internationally are 42.5 percent of all crude oil produced and 24.8 percent of all petroleum products exported, much of it by sea (BP, 2015). Importing nations – particularly those in Asia – should be cognisant of and provide security in sea lanes where possible, to mitigate risks to affordable and reliable energy supply. Those sea lanes that are key maritime passageways that facilitate heavy shipping traffic volumes and host the transport of strategic goods such as crude oil are called sea lines of communication (SLOC).

The global community agrees that SLOCs must be kept open at all times, even during war and conflict. However, militaries often posture and plan for blockades and any other risks that may disrupt movement in these SLOCs.

In Asia's larger context, the most important sea lanes pass through the choke points of the Straits of Malacca, Singapore, Lombok, and Makassar in Southeast Asia and the Strait of Hormuz and the Persian Gulf. Further, other chokepoints that will become relevant to Asia in the future include the Panama Canal and Bering Strait. Currently, over 14,000 ships navigate the Panama Canal each year, which is likely to grow once canal expansion works are completed (Mitchell, 2011). Trade around the Cape of Good Hope is also relevant to Asia; however, it is not considered a 'chokepoint'.

As represented in Figure 2-1, the key risks to sea lane security are piracy, terrorism, regional conflict, accidents and extreme weather events. In various ways, the background elements of congestion, geography, geopolitics, climate change, poverty and law and order influence these risks, as will be discussed in the following sections.

Figure 2-1. Background Elements of Risks to Sea Lanes, Trigger Events, and Impact on Energy Security



Source: Author.

These risks impact energy security not only by creating supply disruptions and spikes in energy prices, they also can lead to risks to human life, particularly that of energy industry workers, and can impose financial costs to the energy industry, *inter alia*, in the form of higher insurance payments.

The next section explores risks impacting sea lane security and provides geography-specific dynamics of each risk.

2.2. Risks Associated with Sea Lanes

In this report, sea lane risks will be explored theme-wise. The risks under consideration are piracy, terrorism and regional conflict, congestion and accidents, and extreme weather events.

2.2.1. Piracy

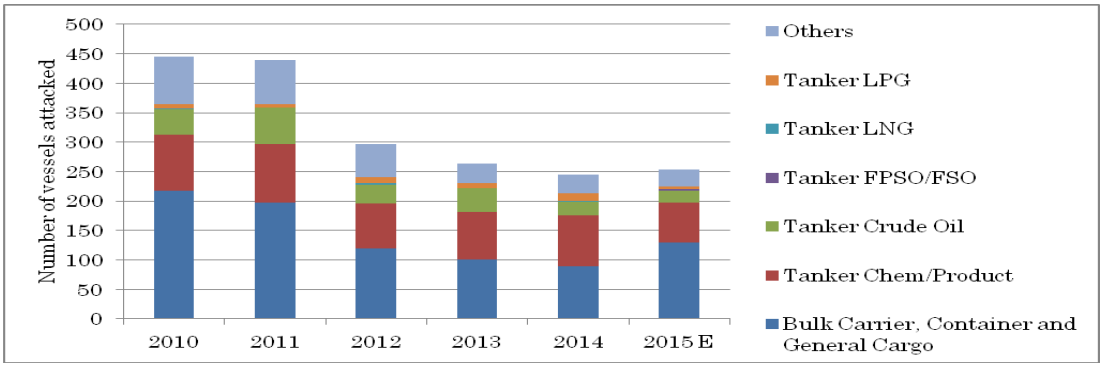
As defined by the United Nations Convention on the Law of the Sea (UNCLOS), piracy consists of, inter alia, 'illegal acts of violence or detention, or any act of depredation, committed for private ends by the crew or the passengers of a private ship'. Further, the International Maritime Organisation (IMO) defines 'armed robbery against ships', which are acts including 'violence or detention or any act of depredation, or threat thereof, other than an act of piracy, committed for private ends and directed against a ship or against persons or

property on board such a ship, within a State's internal waters, archipelagic waters and territorial sea.'

In recent history, piracy and armed robbery has played a role in disrupting the free movement of vessels, causing delays, financial losses, and even loss of life. Data[5] from the International Maritime Bureau (IMB) of the International Chamber of Commerce (ICC) reveals that globally, acts of piracy and robbery at sea have declined over the past 5 years.

However, importantly, vessels transporting energy products and facilitating energy operations continue to form a prime target of pirates and robbers alike. As shown in Figure 2-2, while total attacks on vessels have been declining, vessels transporting liquefied petroleum gas (LPG), liquefied natural gas (LNG), crude oil, chemicals and products, and floating production storage and offloading (FPSO) tankers continue to be a significant share of targets. In 2014, 51 percent of targets were such ships associated with hydrocarbon trade and allied services.

Figure 2-2. Number of Vessels Attacked, by Vessel Type

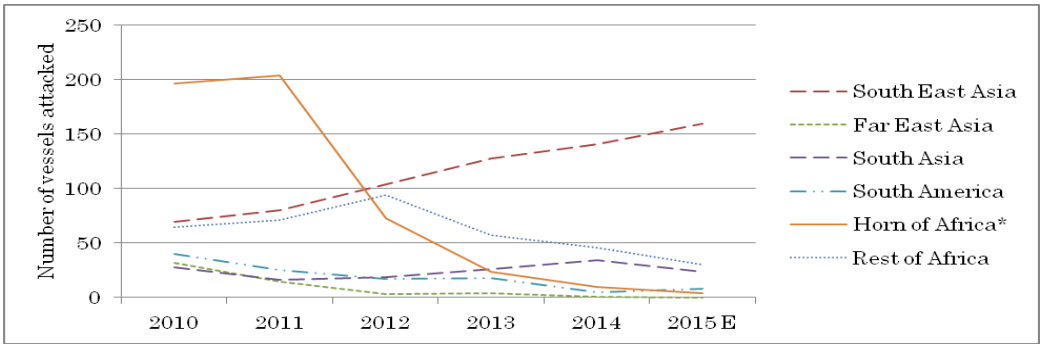


Note: 2015 data has been estimated using actual January–September 2015 data.
FPSO = floating production storage and offloading; LNG = liquefied natural gas; LPG = liquefied petroleum gas.
Source: Author calculations using IMB (2015).

The decline in piracy, however, is not universal. Piracy incidents in Southeast Asia and South Asia are either rising or continuing unabated (Figure 2-3). The declining trend in attacks on vessels has been led by greater maritime security off the Horn of Africa, which in this data set includes the Gulf of Aden, the Arabian Sea, and all countries on Africa's eastern coast between Egypt and Mozambique.

[5] IMB uses the UNCLOS and IMO definitions of piracy and armed robbery.

Figure 2-3. Number of Vessels Attacked, by Region



Note: 1) 2015 data has been estimated using actual January–September data of 2015. 2) *Horn of Africa here includes Gulf of Aden, Arabian Sea and all countries on Africa's eastern coast, from Egypt to Mozambique.
Source: Author calculations using (IMB, 2015), (IMB, 2015).

Many of the victim ships are managed or controlled by Asian and European countries. Table 2-1 lists the top 15 countries impacted by piracy and robbery in 2014. (Note that this does not reveal the direction of trade, only the ownership of vessels).

Table 2-1. Countries Where Victim Ships Controlled/Managed January–December 2014

Country	No. of Ships	Country	No. of Ships
Singapore	63	Denmark	8
Greece	30	Netherlands	8
Germany	15	Italy	7
Hong Kong	13	Japan	7
India	13	Norway	7
United Kingdom	13	Thailand	6
Malaysia	11	China	5
Denmark	8	South Korea	4

Source: IMB (2015).

Of the 245 ships attacked in 2014, 14 percent of them were either hijacked or fired on. In all, 442 crew members were held hostage. Between 2010 and 2014, 27 crew members were killed, 141 were injured and 108 kidnapped or held for ransom.

Oceans Beyond Piracy (OBP) (a project under the One Earth Future Foundation) in its 'State of Maritime Piracy' Report (OBP, 2015) uses a broader definition of piracy and compiles data from a host of sources including the counter piracy naval operations, datasets from IMB, International Maritime Organization, United States Maritime Liaison Office Weekly, National Geospatial-Intelligence Agency, Regional Cooperation Agreement on Combating Piracy and Armed Robbery against Ships in Asia (ReCAAP), OceanusLive, other private sources, and reporting from the media. It estimates that in all, 3654 crew members were attacked

(successful and unsuccessful incidents) in Southeast Asia, 320 in Western Indian Ocean, and 1035 in the Gulf of Guinea in 2014. Importantly, OBP estimates that piracy led to economic losses of $2.3 billion in the Western Indian Ocean and $983 million in the Gulf of Guinea[6].

While socio-economic causes and piracy trends differ from region to region, weaknesses in legal frameworks have had a role to play in the lack of resolute and effective action globally. Definitional issues as well as the lack of ratification of the Montego Bay Convention (1982) and the Rome Convention (1988) both contribute to the legal shortcomings. The Montego Bay Convention defines piracy by including only those acts carried out on the high seas and only those that have a 'personal motivation' (as opposed to a political one). Importantly, if there was a chase that began on the high seas, it is supposed to end when the target vessel enters the territorial water of one state, unless the agency has authorisation to conduct the chase. Pirates have liberally exploited this loophole. While the Rome Convention later expanded the definition, however, limitations have remained, for instance in the form of inadequate description of violence and the exclusion of mutinies as acts of piracy. These issues have been discussed in depth in (IRASEC, 2008).

Definitional inconsistences and inadequacies have impacted data collection and therefore analysis. Language barriers and changing reporting requirements by various agencies too have led to the exclusion of certain acts of piracy in the datasets. Nonetheless, the dynamics of piracy in Southeast Asia and the Western Indian Ocean are discussed below.

2.2.1.1. Southeast Asia

Piracy in Southeast Asia has been a perennial problem, enabled by both the region's unique geography and socio-economic and political problems. IMB data reveals that piracy has been rising since 2008, after a sharp fall starting 2000. Prior to that piracy had steadily increased in the 1990s, and had spiked after 1997.

Oceans Beyond Piracy (2015) reports that in 2014, 3654 crew members were attacked and 800 of them were subjected to or threatened with violence. A total of 289 were held hostage and 5 were killed. Of all the crew members exposed to piracy in this region, nearly 30 percent were from Philippines, 28 percent from India, and 11 percent from India[7].

The area of interest in Southeast Asia is nearly as large as the high-risk area (HRA) in the Indian Ocean (as described in section 2.2.1.2), however, piracy in the HRA takes place in international waters, unlike Southeast Asia, where piracy incidents take place in territorial and archipelagic waters, and the exclusive economic zones (EEZ) of the countries in the region. The region's unique geography – scattered with small islands, narrow waterways, small islets, riverine access and narrow straits – provides a conducive environment for pirates to operate in robbery at sea within the EEZ.

[6] Economic losses in Southeast Asia were not calculated.

[7] So far, there has been no analysis of the economic costs of piracy in Southeast Asia that could be comparable to the analysis carried out in the case of Somalian piracy.

Data from the Information Sharing Centre (ISC) of the ReCAAP (2015) reveal that in 2015, 93 incidents occurred in the Straits of Malacca and Singapore, 10 in the South China Sea, 2 each off the coasts of Philippines and Malaysia, and 1 incident off Indonesia. These incidents constituted 60 percent of the nearly 200 incidents in Southeast Asia, the rest of which occurred while vessels were at ports and anchorages. Indonesia and Viet Nam were major spots of in-port incidents. Most cases, however, are instances of petty theft rather than high profile hijackings that characterised piracy in the Western Indian Ocean.

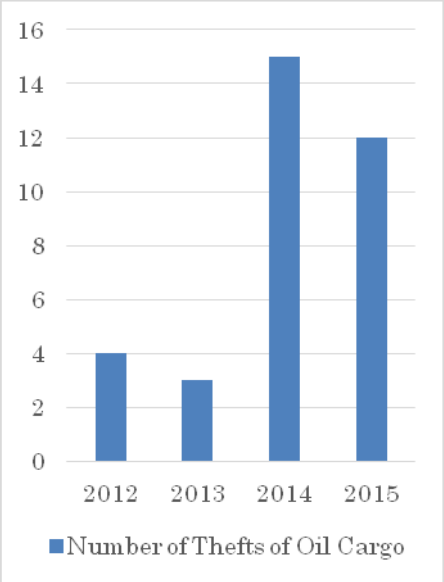
Figure 2-4. Trade Routes in Southeast Asia

Source: Author.

In 2015, there were 12 incidents involving hijackings of vessels carrying oil cargoes. Six of these were in the South China Sea, four in the Malacca Strait, and one each in Indonesia and Malaysia. Figure 2-4 displays a map with the major trade routes in Southeast Asia.

Overall, thefts of oil cargo in the region have increased since 2013 (Figure 2-5). Examples of incidents include MT Jaoquim whose load of light crude oil (LCO) was 'stolen' in August 2014 (Jakarta Post, 2015), and in July 2015, MT Orkim Harmony carrying 6000 MT of gasoline valued at $7.5 million was attacked by pirates (the pirates were eventually arrested) (Nikkei, 2015) (Jakarta Post, 2015). In many cases, the modus operandi has been to siphon the oil cargo sell in the underground markets, to destroy the communication and navigation equipment, and to thieve the personal belongings of the crew. However, violence was not reported in most cases (ReCAAP, 2015).

Figure 2-5. Number of Thefts of Oil Cargo in Southeast Asia



Source: ReCAAP (2015).

An analysis of the causes of the rise in piracy starting in the 1990s and then the decline starting in the 2000s provides a good template to understand the dynamics of the problem in this region. Security practitioners and commentators in the region interviewed by Storey (2008) reasoned that the socio-economic distress on the islands of Sumatra and Riau linked to the Asian financial crisis as the primary cause of increased piracy attacks starting in the 1990s. The crisis began in Thailand in 1997 and soon after spread to Indonesia, leading to a spike in unemployment from 4.7 percent to 21 percent in 1998 in one year. In the same year, defence spending fell by 17 percent, which ultimately led to only 30 percent of the Indonesian navy's vessels being operational.

Elsewhere, the Sulu Archipelago in the Philippines had become a hub of illegal maritime activities including smuggling, trafficking, and piracy in the 1990s. Other regions in Southeast Asia also became mired in poor socio-economic conditions, poor governance, weak political control and the lack of state capacity. There were even instances of corrupt government officials passing on information of vessel movements to pirate gangs in advance.

As pirate attacks increased in the 1990s, Southeast Asian states increased engagement with each other to control this problem. Initial efforts, however, did not have the desired effect as they were 'poorly implemented, largely ineffective, and became moribund during the Asian financial crisis', according to Storey (2008). In the 2000s, new efforts were launched, including the Regional Maritime Security Initiative (RMSI) and the ReCAAP. However, due to concerns over sovereignty and competing priorities of member states, these efforts led to controversy. In the fallout of such controversy, Malaysia, Singapore, and Indonesia began conducting coordinated patrols in the waters in 2004. This was followed by an initiative called Eyes in the Sky in 2005, which involved maritime patrol aircraft conducting two sorties every week over the Malacca and Singapore Straits. Together, these patrols were known as

the Malacca Strait patrols. Cooperation between countries was facilitated by ASEAN, even as it practiced a policy of 'non-intervention' in the domestic affairs of member nations.

Further, Singapore required all vessels in its territorial waters to carry identification transponders, and the Singapore Navy deployed armed security teams. The Government of Malaysia also deployed armed guards to conduct search and security operations. Separately, Indonesia also conducted comprehensive exercises using warships, helicopters, aircraft, and special forces. Importantly, action was also taken on land. These efforts paid off, with piracy falling to a decade low in 2008.

However, piracy in the region could not be maintained to these levels for long, with the numbers spiking thereon. Even as the efforts succeeded initially, there were a few weaknesses. Firstly, the Malaysia Strait patrols were coordinated patrols, not joint patrols. That is, every country was responsible for patrolling its own waters, rather than the navies jointly patrolling the entire region. This would particularly be a problem when it came to 'hot pursuit' into the territorial waters of a different country. Secondly, the patrol aircrafts were not equipped with night vision equipment and the patrols were too few to cover the entire region. There was also a fear of 'patrol fatigue', whereby participating countries would lower their guard over time, and a lack of coordinated patrols particularly in the tri-border area (Storey, 2008). Further, some countries in the region, such as Indonesia, had multiple agencies in charge of security at sea, which impacted coordinated action (ARC, 2007).

The use of private security guards in this region has been starkly different from the western Indian Ocean owing in part due to the attitudes of governments, as vessel movements in this region is often in territorial waters. Indonesia has spoken out against the use of armed private guards on ships because, inter alia, there is an absence of international regulation in this domain (Jakarta Post, 2012). On the other hand, while Singapore does not ban the use of private guards on ships, it does not consider it an alternative to the employment of best management practices. It considers the use of private security as the last resort, after a thorough risk assessment by private operators (Dutton, 2013). Several private security companies, however, have been operating in the region, the oldest of which started operations in 1946.

The resurgence of piracy in the Southeast Asian region has been made possible owing to the high volume of traffic in the region (120,000 vessels annually through the Strait of Malacca alone) and the strengthening of pirate gangs. Further, poverty, which is a background condition that enables piracy, remains in place. Illegal fishing by foreign vessels in the territorial waters of the littoral states too has played an enabling role in the lawlessness at sea and economic distress of local communities (Roughneen, 2015). Importantly, the underground market for light fuel oil (marine gas oil) continues to be highly profitable in this region (Baird Maritime, 2014).

While international cooperation has focused on securing SLOCs, piracy and armed robbery in territorial waters lack similar cooperation as operations have been traditionally rather than jointly coordinated.

To counter the resurgence of piracy in the Southeast Asian region, the littoral states have begun stepping up security exercises. For instance, the navies of ASEAN member countries joined forces to hold joint operations in 2015 in the Malacca Strait (Jakarta Post, 2015). Malaysia and Indonesia particularly have taken robust action by targeting organised pirate gangs through their rapid response teams (Reuters, 2015). The arrest and prosecution of two gangs – the MT Sun Birdie gang and the MT Orkim Harmony hijackers in 2015 – were a key achievement. Indonesia and Australia have also formed a regional partnership to combat piracy, which includes capacity building through the 'Jakarta Centre for Law Enforcement Cooperation' (TME, 2015). Additionally, action against illegal fishing has been undertaken, including the destruction of illegal and foreign fishing vessels (Roughneen, 2015). However, the IMB warned against complacency as piracy remains high in frequency (IMB, 2015).

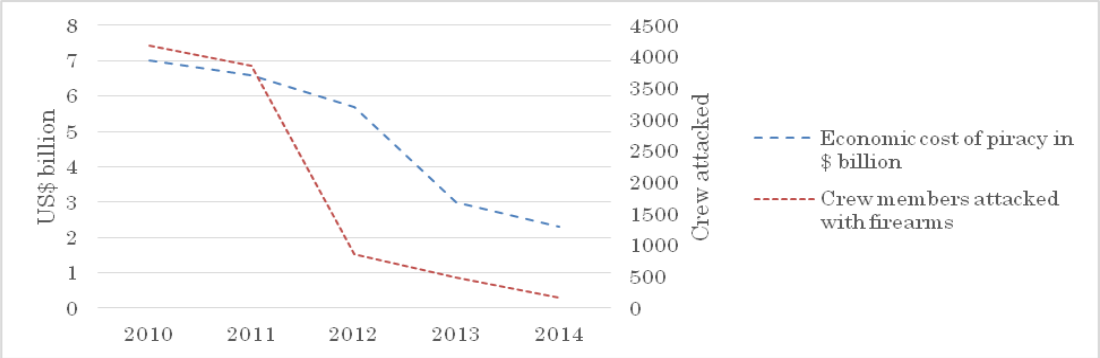
2.2.1.2. Western Indian Ocean

While the Western Indian Ocean itself is not on the path of the oil and LNG vessels that are headed towards Asian countries, it is worth considering the region in this analysis of Asia's energy security. This is because, firstly, at the height of piracy off Somalia's coasts in 2009–2010, there were attacks deep into the Arabian Sea, which did come in the path of trade from the Middle East to Asia. This is relevant because even though piracy in the Western Indian Ocean has now been curbed, the background conditions are still in place (discussed below), due to which the risk of piracy re-emerging remains. Secondly, an HRA has been announced by market associations in this region (discussed below, Figure 2-7), which has raised insurance premium for vessels passing this region. This has an impact on trade between the Middle East and Asia.

IMB data indicate that piracy in the Western Indian Ocean region originates primarily from Somalia. Piracy in this region has gained infamous proportions over the past several years due to high profile hijackings, large payoffs to pirates and counter piracy activities by the world navies. Over the last few years, however, IMB and other reports show a decline in piracy in this region. For instance, 139 attacks were reported to IMB off the coast of Somalia and 53 in the Gulf of Aden in 2010. This number dropped to three and four in 2014, respectively. Overall in the entire Western Indian Ocean region, Oceans Beyond Piracy recorded 18 attacks. However, there were no hijacks of commercial vehicles.

Further, the economic losses of $2.3 billion estimated by Oceans Beyond Piracy includes costs imposed due to the employment of armed guards, security equipment, increased speed of travel, rerouting (both through the Cape of Good Hope and within the Indian Ocean region), insurance costs, military operations, ransoms and associated payments, prosecutions and imprisonment and counter-piracy operations. These economic costs have fallen over the years with a fall in the number of vehicles attacked (Figure 2-6). The figure also shows that attacks on crew members have fallen since 2010.

Figure 2-6 Economic Costs and Number of Crew Members Attacked in the Western Indian Ocean Region



Source: OBP (2015).

However, this should not lead to the conclusion that piracy in this region will remain under control in the future, as the background conditions that have enabled piracy continue to exist. The background conditions are threefold: firstly, the socio-economic conditions in Somalia; secondly, the lack of state capacity and division between states; and thirdly, the presence of illegal fishing off the coast of the country.

Life expectancy in Somalia stood at 55.4 years in 2015. The Human Development Index report points out that underdevelopment and poverty in the country has led to a feeling of 'exclusion' and 'frustration' among the youth. Multidimensional poverty in Somalia affects 60 percent of the urban and 95 percent of the rural population. Unemployment estimates are at 47.8 percent of the population over 25 years of age (UNDP, 2015). Per capita income in Somalia was $600 (PPP) in 2014, ranking it 197 out of 198 countries (CIA, 2014).

Somalia's poor socio-economic indicators continue to remain depressed in part owing to the lack of a stable government. In fact, the country has not had a permanent centralised government since 1991, when the military regime of President Said Barre was overthrown. Although it has had a federal government based in Mogadishu since 2012, it is weak and is in conflict with the regional governments of Puntland in the northeast and Somaliland in the northwest.

The regional governments of Puntland (which was declared an autonomous state in 1998), and Somaliland (which declared independence in 1991) operate with varying degrees of independence and effectiveness (Seyle, 2015). Somaliland particularly is nearly fully autonomous and has sought recognition as an independent state, but the state is weak and several areas in the region are dominated by non-state militias. Further, these two regional governments too are at loggerheads, with risks of military conflict between the two (Balthasar, 2014).

Such conflict in the region has ensured that the capability and coordination needed to fight maritime crime such as piracy and illegal fishing has remained wanting. In fact, Somali piracy itself may have its roots in illegal, unreported and unregulated (IUU) fishing in the region, as

claimed by several quarters including Hassan Sheikh Mohamud, the President of Somalia (Mohamud, 2015). The argument is that in the absence of state capacity to provide security, Somali fishermen independently took up arms to protect their waters in the face of IUU fishing that had its origins in various countries. After success against foreign IUU fishing vessels, these armed Somali fishermen shifted their focus towards cargo ships and oil tankers, giving rise to piracy as we know it.

Piracy in this region reached its peak in 2011, when around 50 pirate bands operated comprising 2,000–3,000 pirates from six known bases in Somalia. By this year, Somali pirates had spread from just off the coast of the Horn of Africa to deep into the Arabian Sea and other distant waters. Pirate earnings stood at $238 million, with the average ransom at $5.4 million in 2010, up from $150,000 in 2005. Crude oil tankers particularly became vulnerable to attacks. Major instances of hijackings include Korea's MV Samho Dream in 2010, carrying 2 million barrels (mbls) of oil, which was released upon a payment of $9.5 million. An even larger payout took place in the case of Greece's MV Irene SL in 2011, which was also carrying 2 mbls of crude oil. The ransom amount for this vessel was $13.5 million.

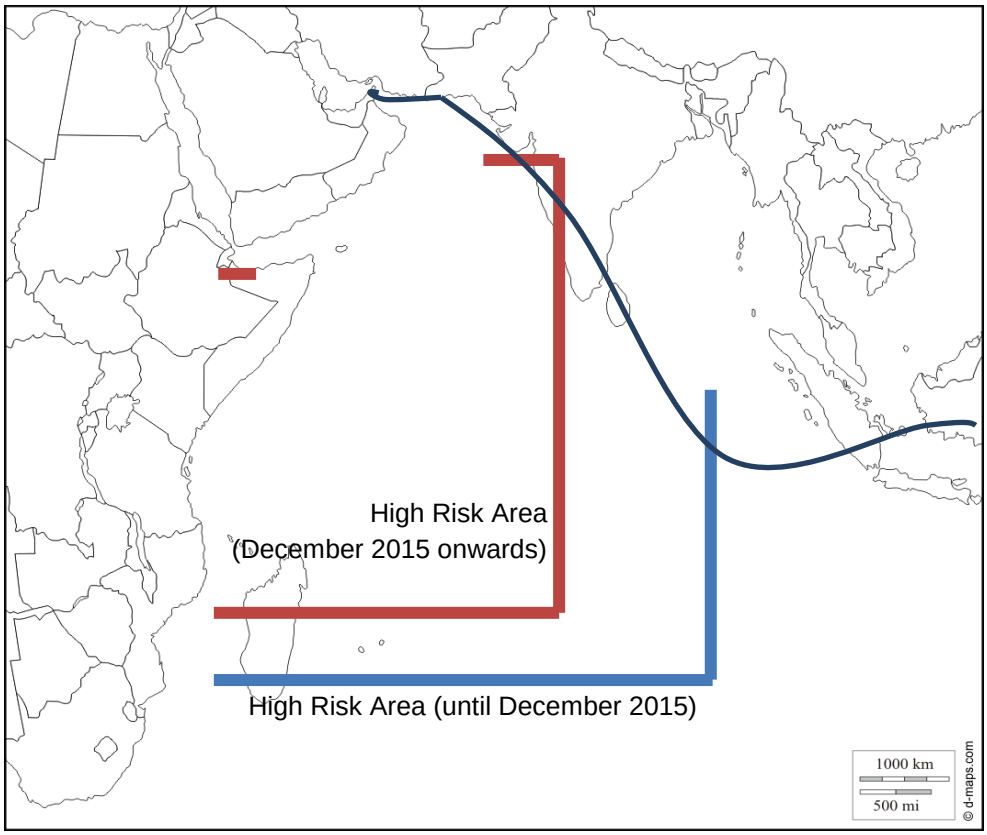
To deal with piracy, the shipping industry along with the United Kingdom Marine Trade Operations, European Union (EU) NAVFOR, and other organisations formulated the Best Management Practices for Protection against Somalia Based Piracy (BMP). The BMP (the latest version being BMP4) includes tactics such as speeding up in pirate-infested zones, better coordination and vigilance, use of water cannons[8] to prevent the boarding of pirates, among others (BMP4, 2011). The United Kingdom Marine Trade Operations and the EU Chair of the Contact Group of Piracy off the Coast of Somalia also announced a high-risk area (HRA), which is an area that has a high risk of piracy and therefore BMP4 must be put into force (PIB, 2015). Further, the Joint War Committee of London–based Lloyd's Market Association has delineated a war-risk area (WRA) to include regions with risks of piracy, terrorism, and war (Figure 2-7) (OBP, 2015).

Over the years, piracy in the HRA/WRA has fallen not only due to the deployment of the BMP, but also due to coordinated naval action by several countries. Major operations and naval missions include Operation Atlanta, an EU deployment (EU NAVFOR), which was originally put in place to protect United Nations World Food Programme vessels to Somalia; a North Atlantic Treaty Organization (NATO) deployment; and the Combined Task Force 151, which is a US-led mission consisting of 25 countries. Apart from this, countries including India, Japan, China, Russia, Saudi Arabia and Iran have conducted maritime security operations in the area. The missions include visit, board, search and seizure operations, and escorting high value and vulnerable ships in the region (CSIS, 2011). For instance, the Government of India revealed that it had deployed 52 naval ships in the HRA, which escorted over 3,100 merchant ships carrying over 23,000 Indian crew safely (PIB, 2015).

[8] As per international law, civilian vessels are not permitted to carry guns on board.

Apart from the BMP and naval activity, piracy in this region has seen a proliferation of private security companies that offer, inter alia, armed escorts and on-board presence of guards to merchant ships in the HRA. The number of registered maritime private security companies has risen from 56 in 2010 to over 400 in 2014. This has proven to be expensive to merchants, as armed escorts can cost up to $50,000 for a three-day transit through the Gulf of Aden (CSIS, 2011). Further, in 2013, 35–40 percent of the over 65,900 merchant vessels that transited through the HRA had private armed guards on board.

Figure 2-7. High-Risk Area in the Western Indian Ocean



Source: OBP (2015).

While some merchants may find private security necessary, there is a risk of untrained and overzealous guards killing pirates and even innocent civilians indiscriminately. Some accounts suggest that this may already be happening (Dutton, 2013). There also is an element of uncertainty for private security companies when they enter the territorial waters of other countries, as is illustrated by the sentencing of 35 private security guards by an Indian court for illegally entering Indian waters carrying weapons aboard a US-based anti-piracy vessel in 2016 (Strait Times, 2016).

Yet another private security measure has been the establishment of floating armouries, which are vessels that provide services for PSCs including the embarkation and disembarkation of PSC personnel, and storage of arms and equipment. About 30 floating armouries were in operation in the Red Sea and the Gulf of Aden in 2014, with an average of 1,000 firearms and other ammunition on board (GIG, 2015).

Of course, not all the efforts against piracy have been at sea: action against pirate bases on land have had a large impact. The Puntland Maritime Police Force particularly helped dismantle pirate bases on Puntland's coast. However, this force has come into criticism for its murky private financing, lack of regulation and links of its members with local militias (Mazzetti and Schmitt, 2012).

Owing to the multi-fold effort against piracy, i.e. the implementation of the BMP, coordinated naval operations, on ground action, and private security guards, Somali piracy in the Western Indian Ocean was brought to check after it hit a peak in 2010. However, such action has come at an economic cost due to several factors including increased speeds (as suggested by the BMP), military costs, and the amounts paid to private security agencies. None the less, the root causes that led to piracy in the first place – i.e. poverty and the lack of opportunity in Somalia, and illegal fishing off the coasts of the country – have not yet been addressed.

Somali President Mohamud (2015) points out that foreign bottom trawlers have fished 'recklessly and acted with impunity, dragging heavy nets, razing the bottom of our seafloor and damaging an astounding 120,000 square kilometres of important marine habitat'. In spite of the Somali Fisheries Law that outlaws bottom trawling in its 200 nautical miles EEZ, there is evidence that foreign fishing vessels have returned to its waters. Secure Fisheries, a programme of the One Earth Future Foundation, reveals that foreign IUU fishing extracts three times more fish than Somalis from Somalia's EEZ, the value of which is nearly five times more. Between 1981 and 2013, foreign IUU fishing has increased 20 times, with a majority of such vessels from Iran, Yemen, Spain, Egypt, and France. In fact, even as Somali piracy was brought into check after 2010, IUU continues to remain high (Secure Fisheries, 2015). Reports from 2015 point at protests in Somalia against foreign fishing trawlers, with locals being quoted as saying they would resume piracy if they could not earn. Puntland's President Abdiweli Ali Gaas also stated that the 'highway robbery' of foreign fishing trawlers 'may rekindle piracy' (BBC, 2015).

2.2.2. Terrorism and regional conflict

While piracy and terrorism are linked in various ways, unlike terrorism, the dynamics of piracy largely work in a maritime environment, which make solutions in the maritime space possible. The BMP and private security are examples of solutions in this space, even though the solutions of the 'root cause' in the form of poverty of coastal communities remain an on-shore issue. The dynamics of terrorism, however, are almost entirely based on shore, with maritime trade being only one potential theatre of conflict.

Intelligence reports point to risks of attacks on oil and LNG tankers (discussed below) that could have an impact on the economy of any region. Such an attack would be technically very challenging to execute, and there have been no precedents. However, a 'Black Swan' event, i.e. an event with a low likelihood of occurrence but one that would have a large impact, could have serious ramifications on maritime trade and even the global economy at large. The need for security agencies to remain vigilant remains of utmost importance.

Some security measures in the maritime space, however, have been taken in the wake of heightened fears of major maritime terrorist attacks. One key measure has been the implementation of the International Ship and Port Facility Security (ISPS) Code. The objectives of this code are to establish an international framework involving co-operation between government agencies, ensure collection and sharing of information, better coordination, provision of a methodology of security assessment, and to ensure that adequate and proportionate maritime security measures are in place. The code lays down plans for the security of ships, crew, equipment as well as ports (ISPS, 2004). Apart from the ISPS, there are port security protocols including the Container Security Initiative and Customs Trade Partnership against Terrorism, both efforts by the US. However, even as such initiatives are necessary, terrorist attacks at sea can still take place, as will be illustrated below.

In addition to the risk of attacks by militants, there is a related risk of regional conflict impacting trade in sea lanes. The Strait of Hormuz, in particular, has presented this risk. While the conventional blockades may not be possible for a variety of reasons, there exists a risk posed from unconventional sources. The dynamics of terrorism and conflict are discussed below.

2.2.2.1. Southeast Asia

There have been concerns over the links between piracy and terrorism in the Southeast Asian region, particularly in the Strait of Malacca and the tri-border sea area. Groups that have been involved in maritime terrorism include the Abu Sayyaf Group in the Philippines, which in 2004 sank the MV Super Ferry killing 116 people and injuring more than 300 (Storey, 2008). Yet another Filipino group that has a history of maritime violence is the Moro Islamic Liberation Front. In Indonesia, the Free Aceh Movement has also been linked with maritime political violence, although it has never been involved in attacks with mass casualties. The lack of empirical data due to definitional issues of maritime violence and language barriers make analysis of trends challenging.

Various intelligence and security agencies have also intercepted and arrested members of groups planning large attacks. For instance, in December 2001, Singaporean agencies arrested members of the Jemaah Islamiyah, who had been planning attacks on US naval vessels using high-speed boats packed with explosives. Similar intercepts were made of Indonesian and Malaysian terrorist groups in 2001. Other intercepts by Britain's Royal Navy revealed in 2004 that targets were not only naval ships, but also commercial vessels. The plots, some of which were linked to al-Qaeda, involved attacks on the Strait of Malacca to

disrupt trade. Yet another intercept by the United States revealed al-Qaeda's plans for using a 'floating bomb' in the region after hijacking a vessel (Storey, 2008).

Further, owing in part due to the differences in motivations and root causes of piracy and terrorism, there exist only a weak link between the two. There have been contrasting voices on the threats from the links between piracy and terror groups. While Singapore has flagged this concern in the past, Malaysia has claimed it has not found any link between the two (AP, 2005). Even though evidence of such links may not be apparent, the background conditions of the lack of economic opportunity, political disenchantment and exclusion can lead to such links strengthening over time, especially in the form of illegal arms trade, and armed pirate gangs evolving to take political stances, among others.

Because of such perceived risks of maritime terror attacks in the 2000s, combined with the incidence of piracy and armed robbery in the region, London based Lloyd's Market Association declared a 'War Risk Area' in much of Southeast Asia in 2005, which resulted in higher insurance premiums on vessels passing through the Strait of Malacca. The potential impact this listing could have had on trade in the region encouraged regional economies to take additional measures to address piracy, armed robbery and terrorism in the region (Ong, 2014). Eventually, the listing was removed in 2006 after some lobbying, although some areas in Indonesia continued to attract higher premiums.

2.2.2.2. Persian Gulf

The Persian Gulf has experienced war and conflict in the past few decades, including the Gulf Wars of 1980–1988 and 1991, and hostilities among the Arab states and Iran continue to play out in various forms today. There also is a presence of naval forces from the United States, United Kingdom and France in this region. At its narrowest point at the Strait of Hormuz, the entire channel falls either in the territorial waters of Oman in the south or Iran in the north.

Hostilities in the region have relevance to the energy markets as 20 percent of the overall oil exports globally come from this region, constituting nearly 35 percent of all exports by sea. The region has over 26 oil terminals. The risk of conventional wars and blockades, however, is low, as the Arab countries and Iran too depend on the channel for their exports and therefore have an interest in ensuring free movement. However, skirmishes between the navies in the region and the use of unconventional tactics and forces pose a risk to not just physical supplies, but also raise insurance premiums and influence oil prices.

Disputes and rivalries in the region emanate from several factors and play out in various realms. One such rivalry is between Iran and the Arab states in the region. Ever since a revolutionary government took over in Iran in 1979, there have been allegations by the Arab states of the Iranian regime promoting revolution in their countries. In 1980, Iraq under Saddam Hussein invaded Iran, which was supported by the Arab states. Owing to a lack of conventional military capabilities, Iran deployed unconventional tactics, including attacks on oil tankers and other energy infrastructure. In all, 168 vessels were attacked by Iran between 1981 and 1987. The lack of conventional capabilities has its roots in the suspension

of arms trade from the United States since the 1979 revolution. The targeting of tankers was an indirect assault on the 'financial backers of Iraqi forces' (CSIS, 2014) and a means of power projection in the face of international sanctions.

Further, there is an ongoing dispute over three islands between Iran and the United Arab Emirates, namely Abu Musa and the Greater and Lesser Tunbs, on the west of the Strait of Hormuz. The dispute began when British forces withdrew from the islands in 1971, which was followed by Iran taking control of these islands. Hostilities over these disputed islands continue to this day, as Iran has converted the islands to military sites, home to the Iran Revolutionary Guard Corps Army and Navy, apart from weaponry (IBT, 2012).

Yet another source of friction has been the signing of the nuclear deal after 12 years of negotiations between Iran and the P5+1 nations of United States, the United Kingdom, France, Russia, China and Germany. In Iran, the military and hard-line politicians had been lobbying for a nuclear weapons programme in Iran until the Supreme Leader Ayatollah Khamenei reiterated a fatwa banning nuclear weapons (Rocard, 2014). After years of hard negotiations, changing internal politics and geopolitics, a comprehensive deal was signed that will lift sanctions on Iran in exchange for cooperation that would limit Iran's development of its nuclear programme (Perthes, 2015). However, Arab states in the region have expressed disapproval of this deal. This deal, while arguably necessary, presents the risk of escalating tensions between the regional players.

Further, there is also an ongoing dispute between Iran and the United States over applicable laws of the sea. The US, Iran and Oman have different interpretations of international law regarding maritime claims and applicable navigation regime in the Strait of Hormuz. The UN Convention on the Law of the Sea (UNCLOS) allows coastal states to draw straight baselines along its coastline to claim 12 nautical miles of territorial seas. As the inbound channel is to the north of the outbound channel, every ship entering the Persian Gulf must at some point pass through Iranian territorial seas. UNCLOS has been in place since 1994, and has been ratified by Oman but not by Iran (although Iran is a signatory). The United States is the only maritime power that is not a party to the convention, citing which Iran has declared that countries that are not a party to the convention cannot avail themselves of transit passage in the strait[9]. On the other hand, the United States does not recognise the full extent of Iran's claimed territorial sea in the strait. It also does not recognise Iran's claim on Abu Musa and the Greater and Lesser Tunbs. Differences over the laws of the sea have led to skirmishes between Iran and the United States at sea (Valencia, 2015).

However, despite such differences and incidents, the Strait of Hormuz has largely remained immune to the wars and rivalries in the region. What it has had an impact on are insurance premiums and international oil prices (The Economist, 2015).

Next, in the region at large, there happen to be areas in control of militant groups such as the Islamic State in Syria and Iraq, and the Tehrik-i-Taliban Pakistan, and Jaish-e-Mohammad

[9] Warships belonging to the United States, however, only pass through Omani waters, according to Ivey (Ivey, 2015), a Lieutenant Commander in the United States Navy.

in Pakistan. These groups have carried out attacks entirely on land, but the risk of maritime attacks exists, in case their spheres of influence grow in the future. There already exist precedents of attacks at sea. For instance, in 2010, an al-Qaeda linked group attacked M Star, a Japanese oil super tanker, as it approached the Strait of Hormuz. The ship was carrying about half of Japan's daily need of oil. Fortunately, the explosion at the ship's hull did not lead to a leak of the oil (The Guardian, 2010).

In sum, while risks of conventional blockades and attacks on the Strait of Hormuz are low owing to the reliance of regional players on this strait for their own trade, risks of unconventional warfare remain. Additionally, states must be vigilant of terrorist attacks at sea.

2.2.2.3. Western Indian Ocean

In Yemen, there is an ongoing civil war, compounded by a military intervention led by Saudi Arabia. In March 2015, Houthis, a Zaidi Shia group that is dominant in the northern highlands of Yemen, overthrew the government in capital Sana'a. They began advancing south towards the Gulf of Aden, when a Saudi-led coalition launched air strikes to support pro-government forces in Yemen. Saudi Arabia has concerns over Iranian involvement in the Yemeni conflict, as it believes Iran is assisting the Houthis.

It thus created a coalition of Sunni-majority Arab countries including Egypt, Jordan, Morocco, Qatar, Sudan, and the United Arab Emirates to counter the Houthis. The United States has conducted air raids, provided logistical and intelligence support to this coalition. Amid this conflict, al-Qaeda in the Arabian Peninsula has taken advantage of the disarray and occupied territory in Yemen. The conflict has also led to a humanitarian crisis, with internal displacement of people and the collapse of health and education (CFR, 2015).

Further, as discussed in Section 2.2.1.2, there is division within Somalia, apart from a lack of state capacity to deal with security threats comprehensively. Together, internal conflict in Yemen and the lack of state capacity in Somalia are being exploited by militant groups, in particular by Al Shabaab, which is a Somalia-based al-Qaeda affiliate. While the organisation has primarily operated on land, there are concerns over its operations in the maritime space and their engagement with pirates. For instance, a World Bank study stated that a part of the $385 million ransom money that Somali pirates extracted between 2005 and 2012 was used to finance militant groups including Al Shabaab (Roughneen, 2015). While the motivations of pirates and militant groups may differ, they use the same shortcomings and there is a risk of pirate groups evolving a political agenda.

The United States has conducted air strikes in Somalia against Al Shabaab, and these strikes increased in tempo in 2015. In all, the United States has invested over US$1.5 billion in building capacity of Somalia and African Union to enable them to provide security in their backyards. Further, neighbouring countries such as Ethiopia and Kenya have also played important roles in ground offensives and air strikes (CRS, 2016).

The risk of attacks on oil and LNG vessels in the Gulf of Aden and the western Indian Ocean in general is thus very real. Indeed, there happens to be a precedent of a major attack on a

vessel, as al-Qaeda had bombed USS Cole in the Yemeni port of Aden in 2000. More relevant to energy trade was an attack in 2002 on Limburg, a French oil tanker, using an explosive-laden boat. The explosion led to the death of one crew member and sent more than 90,000 barrels of oil pouring into the Gulf of Aden (BBC, 2002).

The conflicts and political instability on both shores of the Gulf of Aden is structural and rooted deep in historical events. The influence of militant groups has not waned, and state capacity to deal with them remains wanting. Human development indicators too remain depressed. While piracy in this region has fallen owing to increased naval presence and other measures, illegal activities at sea (such as fishing) continue unabated. For these reasons, a moderate risk of an attack on oil and LNG vessels exists.

2.2.3. Congestion and accidents

Congestion at sea can lead to delays and impose costs on companies. As of April, 2016, 200 million barrels of crude was waiting to be loaded or delivered. This has resulted in queues of super tankers on the world's busiest sea lanes. Ship tracking data reveal that 125 super tankers are waiting in line at ports, the combined cost of which is $6.25 million per day (Reuters, 2016).

A related aspect of maritime trade is accidents at sea, which in turn can lead to congestion and delays. For instance, in 2014, two container ships collided at the northern end of the Suez Canal, leading to severe interruptions and delays (Reuters, 2014). A similar incident occurred in 2015, when a Danish flagged ship and Liberian flagged ship collided in the Suez Canal in dense mist, which ended up delaying traffic for several hours (Business Insider, 2015).

The risk of congestion and accidents relevant to Asian energy imports is discussed below.

2.2.3.1 Strait of Malacca

The Straits of Malacca and Singapore are the second busiest in the world after Dover Strait in Europe. Being much wider than the Suez Canal, the Malacca and Singapore Straits accommodate six times the volumes of the navigational traffic compared to the Suez Canal. In deadweight tonnage terms, tankers have the largest shares among vessels transiting these straits.

The volume of traffic in these straits has been consistently rising over the years, which poses the risk of delays due to congestion, especially in the event of an accident or a resulting oil spill. In such a situation, a few vessels may have to divert to the Sunda, Lombok, or Makassar Straits, the routes of which are longer. Such detours could extend the navigation distance by up to 1,000 nautical milesThis implies an additional shipping cost of US$500,000 per ship per transit for a large vessel like a very large crude carrier (VLCC) (Sakamoto, 2008).

Between 1978 and 2003, 888 accidents were reported to have occurred in the Straits of Malacca and Singapore (Basiron and Hooi, 2007). From 2001 to 2007, 236 maritime casualties took place in the Straits of Malacca and Singapore. Most of these accidents involved collisions and explosions.

Such accidents have may lead to oil spills. To take an illustration, in August 2009, an oil tanker carrying 58,000 tons of naphtha oil collided with a bulk carrier in the Malacca Strait. This caused a massive explosion and fire resulting in nine casualties and an oil spill [The Nippon Foundation, 2009; Earth Times, 2009]. Yet another major collision took place in 1997 between MT Evoikos and MT Orapin Global in the Strait of Singapore. Transporting approximately 130,000 tonnes of heavy fuel oil, MY Evoikos created sustained damage to its three cargo tanks and spilled an estimated 29,000 tonnes of fuel into the sea. The cleaning up cost of this oil spill was approximately US$7,500,000, and it took 3 weeks to clean up.

However, the risk of individual instances of collisions blocking the straits even at some of the narrowest points on the straits is low. None the less, a few choke points along the navigation channel in the Singapore Strait are exposed to impacts from explosion hazards and toxic releases in case they happen. Accidents can hamper the petroleum and bulk traffic impacting countries that are dependent on these straits for their trade.

Accidents can also lead to vapour cloud explosions that can impact vessel crews and civilians in residential areas, requiring emergency evacuation measures. Losses could also be borne by businesses due to lost production time, emergency shutdown and process upsets due to workers' need to take protective action. These could result in high liabilities for businesses. Moreover, local governments and responders can face health risks, which could impact public risk perception and risk tolerance, resulting in possible changes in regulations.

However, the likelihood of any of the above events occurring is still relatively low, a**s** safety and mitigation measures in the industry do exist. Moreover, several policy measures have been taken in the past to mitigate accident risks in sea lanes. In particular, regional search and rescue exercises (SAREX) have been carried out in the ASEAN countries, the first of which was in 2001. Other SAREX exercises have been conducted periodically by countries in the region.

2.2.3.2 Panama Canal

The waiting time to enter the Panama Canal from the Pacific side has averaged 26 hours since 2011, while it has averaged 16 hours from the Atlantic side (Commodity Flow, 2015). At times, however, wait times can be high, as they were in October 2015, when ships had to wait over 10 days to transit the canal (ICIS, 2015). While average tonnage of ships since 2011 has not increased, the waiting time has built up, in part due to delays associated with canal expansion activity. Ongoing canal expansion activity will enable a new class of container vessel to navigate the canal, which could be twice as large as the existing vessels capable of transiting the canal. The largest ships that can navigate the canal are known as Panamax vessels, while after the expansion, the maximum size would be the referred to as the 'New Panamax' vessels. Currently, over 14,000 Panamax ships transit the canal each year (Mitchell, 2011). While canal expansion activities are ongoing, during periods of peak traffic, steps have been taken to ease congestion, including the postponement of non-critical maintenance work. Such steps reduced wait times by more than 60 percent in the final quarter of 2015 (ICIS, 2015).

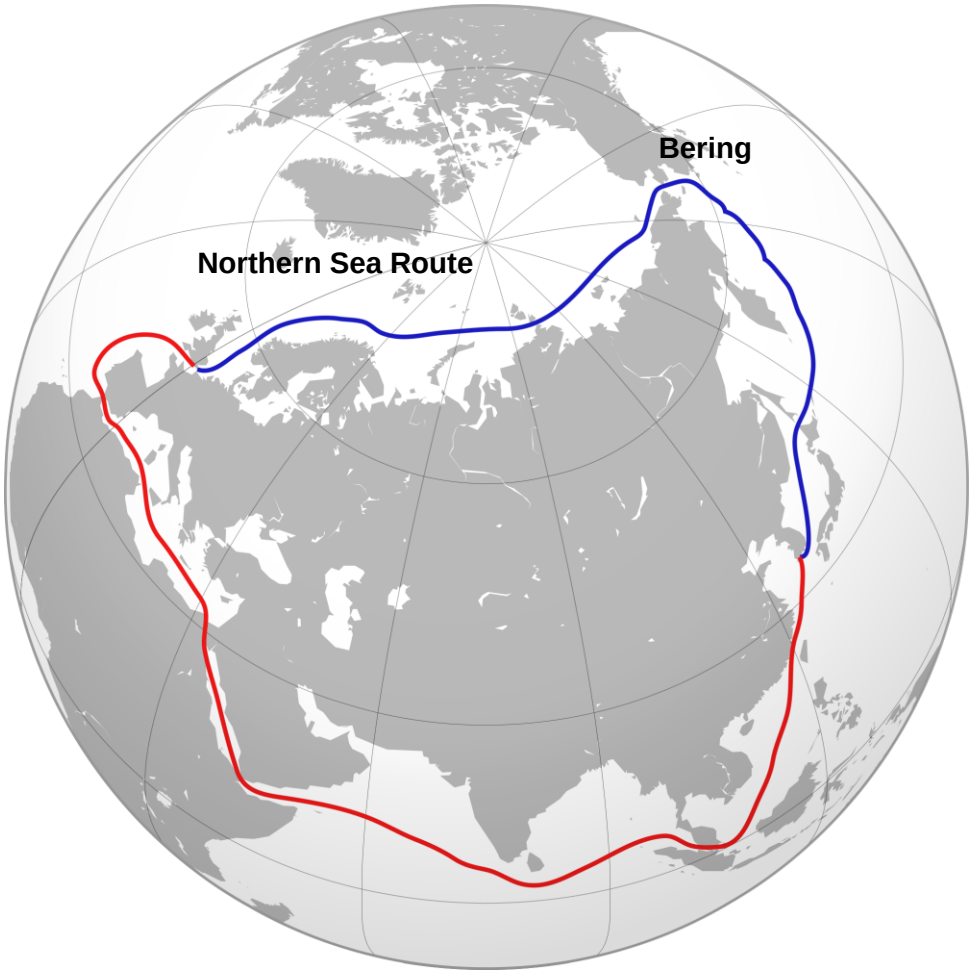
Further, 180 shipping casualties were reported between 1993 and 2013, although the safety record has improved markedly in the past few years, with only 27 casualties between 2003 and 2013. Bulk carriers, cargo ships and container ships had the highest casualties, accounting for over 75 percent of all incidents since 2002. There have been only six incidents involving LNG and petroleum product in this period. Contact with walls and collisions with vessels accounted for 60 percent of all incidents. The odds of a shipping incident occurring in the Panama Canal are around 1 FOR every 4,000 ships, compared to 1 for every 1,100 ships in the Suez Canal (Allianz, 2014). As the canal expansion nears completion, the entry of larger vehicles will pose new challenges in this regard.

2.2.3.3 Northern Sea Route

While climate change presents risks to maritime trade, it also opens up new channels of trade, which will involve its own set of risk dynamics. In particular, the Northern Sea Route (NSR) will be relevant to energy trade, as among other oil and gas fields, the Yamal LNG project with a terminal at Sabetta (expected to reach full capacity by 2021) located In the north of Russia, would benefit from sea trade with Asia via the Bering Strait, which separates Alaska (US) from Russia (Kallanish Energy, 2016). The NSR is not a single sea route, but an entire sea area north of Russia, as represented in Figure 2-8. It is navigable for only 20–60 days in summer due to the presence of Arctic ice cover in the winter (Javaid, 2014). The Bering Strait – used to enter the NSR from the east – saw traffic of 250 vessels in 2012, up from 130 in 2009 (Arctic Newswire, 2013).

With average global rising temperatures and melting polar ice, the NSR may remain open for periods of up to 170 days (in a 100-year scenario), increasing maritime trade on this route. Evidence already suggests that the Arctic ice is diminishing both in thickness and extension owing to climate change. The NSR could cut distances between Europe and Asia by as much as 50 percent compared to existing sea lanes in use, including the Suez and Panama Canals (Ragner, 2008).

Figure 2-8. The Northern Sea Route



Source: Wikimedia Commons.

Water depths in the various straits along the NSR are not very large. The Bering Strait ranges between 30 and 40 metres (but is 50 miles wide), while the shallower straits such as Yugorskiy Shar, Sannikova, and Dmitriya Lapteva are between 8 and 15 metres. Due to meteorological conditions, visibility can also be low due to snow, winds, and ice (ABS, n.d.).

The vessels that can navigate the NSR are currently much smaller than the Suezmax vessels (i.e. the largest vessels that can navigate the Suez Canal), and need to be 'ice-strengthened'. Further, even during summer months, the ice conditions on this route are unpredictable, which can add to delays. Oil and gas exports form a significant share of trade in the NSR. Currently, most shipments move from the Varandei terminal at the north of Russia towards Western Europe. As the NSR becomes increasingly navigable and major oil and gas export projects get further developed – including both Varandei and Yamal – shipments headed towards Asian countries will grow. Additionally, while there has been no 'ordinary'

commercial transit by a non-Russian vessel in the NSR that may change with more predictable ice patterns and longer periods of navigability caused by climate change.

Due to the need for the ice-strengthening of ships, ice breaking escorts and possibility of damage, ship operators have to deal with the risks of higher costs and insurance premiums, even as the distance is shortened. There are also challenges posed due to jurisdiction and regulations. For instance, Russia demands (i) notifications by all vessels entering its 200nautical mile EEZ, (ii) an application for guiding of vessels, and (iii) a mandatory 'ice breaker' fee to use the route. Stringent regulations are also in place over ice-class standards of vessels, IMO Guidelines for Ships Operating in Arctic Ice-Covered Waters, and stricter port state regulation in the EU and other nations, which make it more challenging for shipping companies to use the NSR for trade.

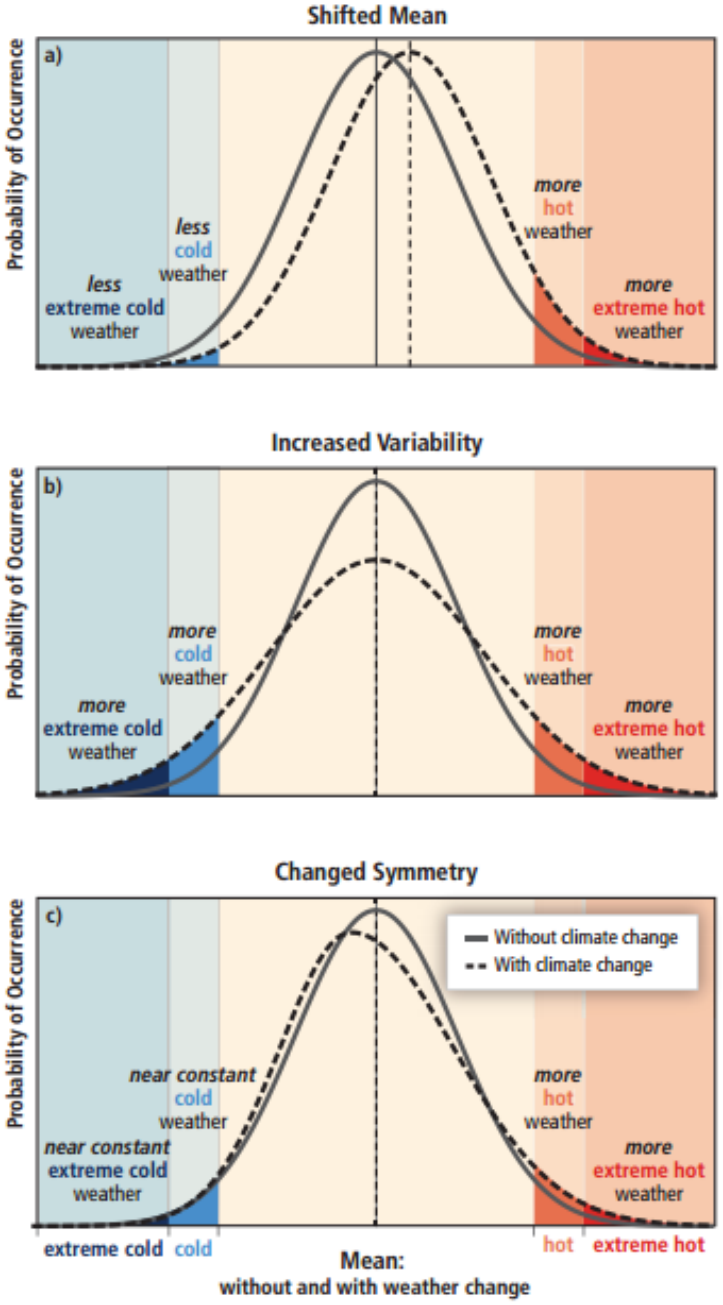
Further, while Russia claims that all straits between the Russian Arctic archipelagos and the mainland are its internal waters, the United States claims they should be considered international straits open to transit passage (Ragner, 2008). Geopolitics in the region has also been influenced by non-Arctic nations launching Arctic missions, and disagreements that Russia has had with other littoral Arctic states over the extent of its exclusive economic zones and delineation of boundaries (Javaid, 2014). Clarity over jurisdictions and ease of transit regulations will play a major role in the development of this sea route, however, it may take up to 30 years of changing climate for this route to become a reliable alternative to other routes. Therefore, risks and uncertainty will continue to affect shipping in the NSR for the foreseeable future, and trade will remain low due to geographic and meteorological reasons.

2.2.4. Extreme weather events

The Intergovernmental Panel on Climate Change's (IPCC) 'Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation' (SREX) reports that 'A changing climate leads to changes in the frequency, intensity, spatial extent, duration, and timing of extreme weather and climate events, and can result in unprecedented extreme weather and climate events.' Climate change is expected to impact global temperatures by increasing the mean temperatures and increasing variability, as represented in Figure 2-9. Thus, extreme climate events such as typhoons would increase in frequency and intensity.

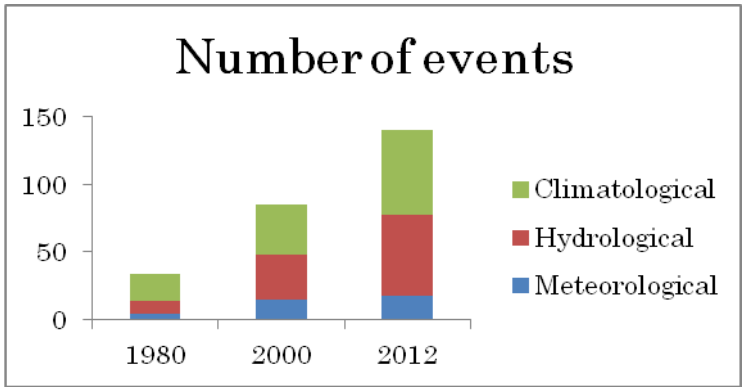
In fact, climatological, hydrological, and meteorological events are already rising. Figure 2-10 below shows this trend in the case of Southeast Asia.

Figure 2-9. Impact of Climate Change on Temperatures



Source: IPCC SREX.

Figure 2-10. Rising Trend of Climatological, Hydrological, and Meteorological Events



Source: Munich Re, NATCat Service.

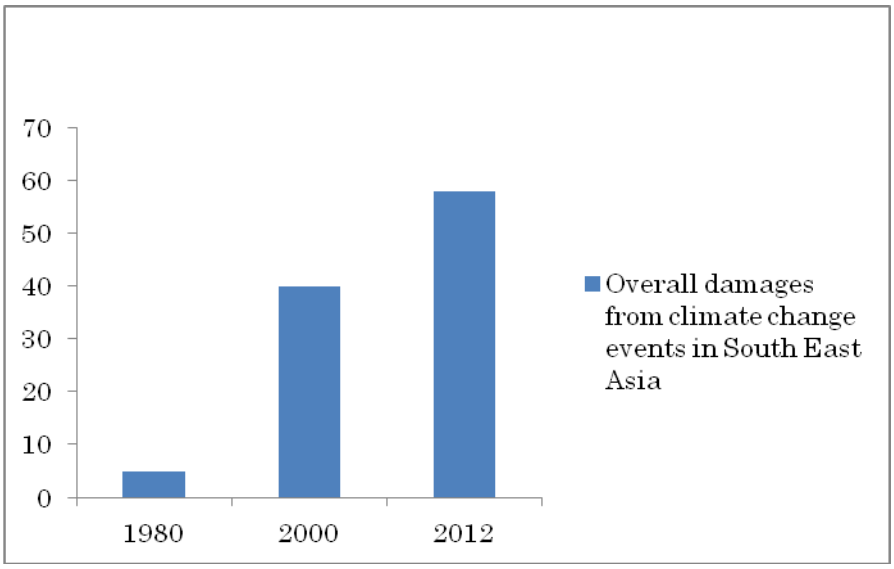
Tuleya (2004) suggests that there is a chance of increases in tropical cyclone intensity in Southeast Asia. Tropical cyclones can bring wind and storm surges which can pose risks for maritime movements for oil and LNG. Analysis from the Munich Re database shows a strong upwards trend in insured losses caused by severe convective storms (Figure 2-11). These damages and occurrence are likely to increase with the adverse impacts of climate change. In particular, the northern part of the Southeast Asian region has a chance of being affected by change in tropical cyclone characteristics (Tuleya, 2004). Knutson and Tuleya, (2004) through a modelling study, validates the likely increase in wind intensity (stormy winds) in the Southeast Asian region which can impact the sea lane movement of oil and LNG.

Vos et al. (2010) also substantiate this finding, indicating a rise in climatological events and damages in the Southeast Asian region in future. This can in future impact the sea lane traffic.

The IPCC SREX report reveals that there would be a shift in mean temperatures within the Southeast Asian region. Along with this, temperature variability can also increase in the region with an increasing occurrence of storms and typhoons. All these can potentially affect maritime trade and the economic outputs of the industries dependent on maritime trade.

Further, studies such as that of Cai et al. (2014) suggest that extreme El Nino events will increase in frequency due to climate change, and these would have 'profound socio-economic consequences'. While this could impact economic development, piracy, and political movements there could be direct impacts on maritime trade. Already, El Nino weather phenomenon has been blamed for congestion at the Panama Canal in October 2015, when wait time for vessels increased to as much as 10 days (ICIS, 2015) (Hutchins, 2015). Extreme weather events also increase instances of accidents and casualties in the Panama Canal, therefore increasing costs and delays, as has already proven to be the case (Allianz, 2014). As such El Nino activity increases in frequency, steps will need to be taken to manage maritime trade and minimise delays.

Figure 2-11. Damages from Climate Change Events in Southeast Asia (US$ billion)



Source: Munich Re, NATCat Service.

Chapter 3

Risk Mitigation Measures and Strategies

The trends, nature, and causes of key maritime risks were discussed in Chapter 2. While the dynamics of each varies by geography, some overarching measures and strategies can help mitigate risks in maritime trade, particularly those of energy. The risk mitigation measures for piracy, terrorism, and regional conflict have an overlap, which is why they have been grouped in one section. This is followed by measures to mitigate congestion and accident risks, and finally, risks due to extreme weather events.

3.1. Piracy, terrorism, and regional conflict

1. Electronic identification tags to monitor vessels should be developed and common codes should be used internationally to ensure successful monitoring of sea lanes by various maritime security agencies.

2. Regional agreements should facilitate joint naval, coast guard and ground operations, and 'hot pursuit' chases of pirate vessels. Further, there should be a consolidation of forces and coordination of activities where possible. Coast guards and navies of various countries should work together to fight both illegal fishing and underground market for petroleum products.

3. Private security agencies should be regulated under an international or regional treaty agreeable to all participating countries. Such a treaty should also include floating armouries to ensure the regulation of privately held arms in international waters.

3.2. Congestion and accidents

1. There will be a need to implement an integrated accident risk management approach and prepare joint contingency plans in case of closure of the straits. Contingency plans need to be constructed after thorough risk assessments of the environmental, social and economic impacts of accidents in the straits. An expert and steering committee can conduct a quarterly review of the risk assessment framework. As an outcome of this assessment, a security incident multi-layer reporting system and network should be developed.

2. The development of alternate channels for maritime trade in the case of blockages caused due to spills and accidents. In the case of Asia, the Lombok Strait and other straits in the region must be developed as alternates to the Strait of Malacca. Development of aids to navigation and patrolling of coast guards at sea in these alternate straits will be particularly critical.

3.3. Extreme weather events

1. Investing in the latest weather forecasting systems and developing channels of communication to ensure dissemination of accurate information regarding extreme weather events will be necessary. Early warning systems, communication with disaster management teams, and alternative navigable routes should be disseminated regularly to all sea lane navigators and crew members.

2. Compilation of and training in best practices in navigating in times of extreme weather events will be valuable to ensure delays and damage due to such events is minimised.

Chapter 4

Sea Lane Security in the Selected East Asia Summit Countries

4.1. Indonesia

4.1.1. Introduction

Indonesia's energy demand will continuously grow in the next 1 or 2 decades. As domestic oil and gas production declines, Indonesia will rely on import for the supply of oil, liquefied petroleum gas (LPG), and liquefied natural gas (LNG). The Institute of Energy Economics, Japan (IEEJ) projected that oil imports of the Association of Southeast Asian Nations (ASEAN) will increase from 1.987 million barrels per day (mb/d) to 6.525 mb/d, and Indonesia is a major part of this increase. Meanwhile, Indonesia LNG import is projected to grow to 5 million tonnes (MT) in 2020, 9 MT in 2030, and 12 MT in 2040. On the other hand, LPG import demand will grow from 3.3 MT in 2013 to 3.7 MT in 2025 and 4.3 MT in 2040 (Indonesia Energy Outlook, 2015).

In 2014, Indonesia mainly imports crude oil from Saudi Arabia, Nigeria, Azerbaijan, Algeria, Russia, Angola, Brunei Darussalam, and Malaysia. Among those countries Saudi Arabia, Azerbaijan, and Nigeria are the main suppliers of oil for Indonesia. The import in 2020, 2025, and 2040 most likely come for the same sources with a possible increase in the role of Russia as Indonesia and Russia achieved an agreement to build a refinery in Tuban East Java in 2016.

In addition to crude oil, Indonesia is an oil products importer. Total import in 2014 was about 33 million kilolitres and mainly imported from Singapore, Japan, and Korea. In the next decade, products import may keep growing. But it will depend on what additional refinery can be added successfully.

Indonesian import of LNG may start in 2018 or 2019 to meet growing domestic demand. Most likely the source will be Middle East producers such as Qatar and Iran. But imports from Australia and Russia also seem attractive.

Currently, for LPG Indonesia mostly imports from Qatar and Iran. Import sources of LPG in the future will likely come from the Middle East, Africa, Asia, Australia, and Russia.

Crude oil, oil products, LPG and LNG imports are transported by sea. Sea transportation also plays a very important role in securing domestic fuel in Indonesia as the country is archipelagic, consisting of 17,550 islands. As an archipelagic state Indonesia is bound by the United Nations Convention on the Law of the Sea (UNCLOS) to provide safe and secure

transit in archipelagic sea lanes in Indonesia. Considering those conditions, safe and secure sea lanes are important to Indonesia.

4.1.2. Sea lanes of communication

Indonesia has great interest on safe and secure sea lanes of communication. Considering Indonesia's import of crude, oil products, LPG, and LNG in the future will come from the Middle East (Saudi Arabia, Qatar and Iran), Africa (Nigeria, Angola), Australia, Singapore, Korea, Japan, and Russia, the supply of Indonesia's energy will be affected by the sea lane situation that connects the Middle East to Asia, Africa to Asia, Australia to Asia, and Northeast Asia to Indonesia.

As a littoral state, Indonesia is bound by UNCLOS 1982 to provide safe transit and innocent passage in Indonesian water. Indonesia has designated archipelagic sea lanes in addition to sharing the Malacca Strait, the busiest sea lane in Asia.

Three archipelagic sea lines are designated by Indonesia. The first is the sea lane connecting India to the South China Sea and Northeast Asia through Sunda Strait. The second is the sea lane connecting the Indian Ocean to the South China Sea and Northeast Asia through Lombok Strait and Sulawesi Strait. The third lane is the Ombai–Wetar Straits route near Timor used by local shipping, including vessels proceeding between Australia and the Java Sea and to East Asia.

The Strait of Malacca is 600 miles long and provides the main corridor between the Indian Ocean and the South China Sea. The strait is relatively shallow at about 23 metres deep in most points and narrow, 1.5 miles wide at the narrowest point. Growing oil demand in East Asia projected will increase number of the tanker pass through the strait from 7,723 in 2014 to 11,615 in 2030 and 12,211 in 2040. Increasing numbers of tankers passing through the strait will increase the risk of safety and security.

The Lombok Strait in Indonesia is wider, deeper, and less congested. It is located between the islands of Bali and Lombok. The minimum passage width of Lombok Sstrait is 11.5 miles and the depth is greater than 150 metres. Lombok becomes an alternative and safer route for super tanker. Ships travelling in Lombok Strait usually pass through the Makassar Strait located between Kalimantan and Sulawesi. The strait is 11 miles wide and 600 miles long. An estimated 3,900 ships transit through Lombok Strait annually. In terms of value, more than 140 MT of goods worth $40 billion pass through the Lombok Strait.

The Sunda Strait, located between Java and Sumatra, is about 50 miles long and 15 miles wide. The strait has limited depth and strong current made it less favourable for ships to pass through. Ships with deep drafts and over 100,000 deadweight tonnage (DWT) usually do not transit the strait. About 3,500 ships, equal to 15 million metric tons of good, pass through the strait annually.

The thirds designated archipelagic sea lane of the Ombai–Wetar Strait is extremely deep and good for ultra large crude carriers.

Indonesia ASL has been an alternative for very large tanker bound for East Asia – either Japan, Korea, or Taiwan. In 2011, about 0.9 trillion cubic feet of LNG from Australia bound for Japan and Korea passed through the strait.

Figure 4-1. LNG Transport through Lombok Strait

Source: U.S Energy Information Administration (EIA) (2013).

In addition, about 0.4 million barrels of crude oil are transported through the Lombok Strait and some also through Sunda Strait.

In case the Malacca Strait is closed due to accidents or terrorist attacks or has congested traffic, the Lombok and Sunda Straits could be viable alternatives. However, the diversion route from the Malacca Strait to the Lombok Strait will increase the distance by 2,500 nautical miles, equal to 168 voyage hours and is estimated to increase the transportation costs by 20 percent.

Figure 4-2. Oil Transported through Lombok and Sunda Straits

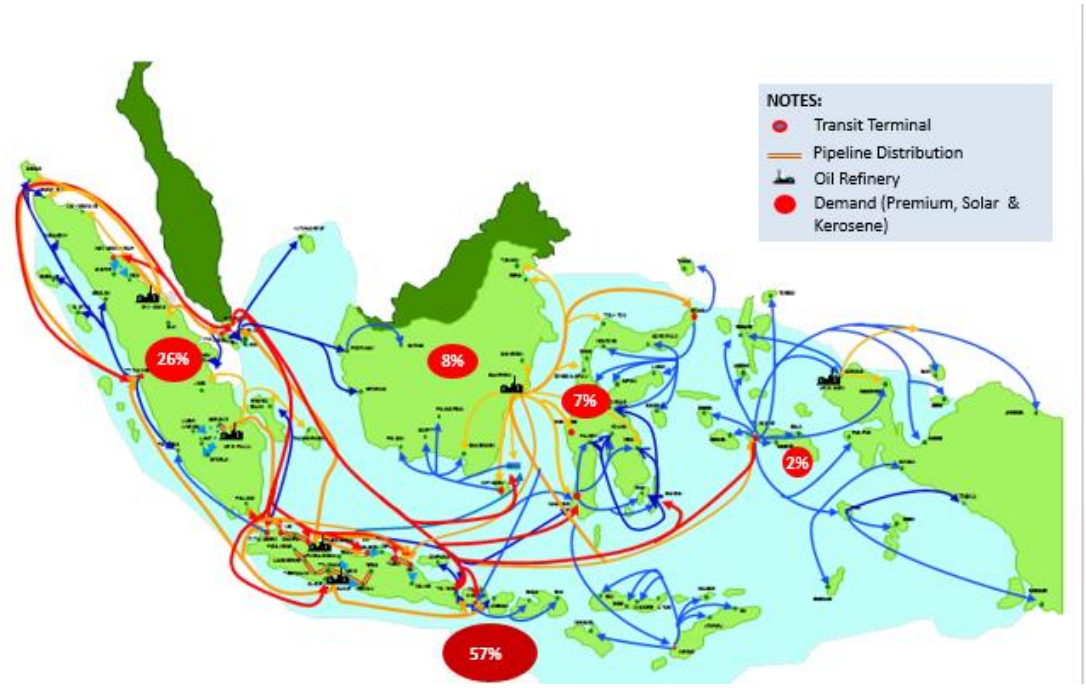
Source: U.S Energy Information Administration (EIA) (2013).

4.1.3. Domestic fuel distribution

Sea transportation plays a vital role to fuel distribution in Indonesia. LPG is transported from the refinery or imported to 21 LPG terminals and distributed to around 350 LPG filling/bottling stations. To transport LPG Indonesia currently employs three VLGCs, 6 semi-refrigerated tankers (10,000 MT), and nine pressurised LPG tankers (1,800 MT).

Fuel (premium [gasoline], solar [diesel] and kerosene) is transported to 109 fuel terminals by 203 tankers from 6 domestic refineries or imported terminals.

Figure 4-3. Indonesia Domestic Fuel Distribution



Source: Ministry of Energy and Mineral Resources, Indonesia.

4.1.4. Risks to Indonesia's sea lanes and energy security

As described in Chapter 2, several risks that may hamper energy supply include accidents, piracy, terrorist acts, or extreme weather that affect sea lanes. Indonesia is not special and is prone to those risks.

Shipping is a risky activity, where accidents and casualties are common. The Malacca Strait is prone to accidents, either collisions or groundings. Several notable accidents had happened in the Malacca Strait that heavily impacted Indonesia waters in terms of oil spills or chemical leaks.

Table 4-1. Notable Accidents in Sea Lines of Communication

Date	Vessel Name	Type of Oil and HNS	Quantity of Spillage (barrels)	Location and Cause
6/1/1975	Showa Maru	Crude	54, 000	Singapore Strait/ Grounding
12/7/1978	Tadotsu	Crude	293, 000	Malacca Strait (Dumai)/ Unknown
20/9/1992	Nagasaki Spirit and Ocean Blessings	Crude	100, 000	Malacca Strait/ Collision
15/10/1997	Evoikos and Orapin Global	Crude	175, 000	Singapore Strait/ Collision
21/5/1999	Sun Vista	Fuel Oil	14, 000	Malacca Strait/ Sinking
3/10/2000	Natuna Sea	Crude	49, 000	Singapore Strait/ Grounding
13/6/2001	Indah Lestari	Phenol	89	Johor Strait/ Sinking
25/05/2010	MV Waily and MT Bunga Kelana 3	Light Crude Oil	18, 000	Singapore Strait/ Collision

Source: Authors.

As the volume of the traffic increases in the Strait of Malacca and other Indonesian navigable waters, the risk of accidents certainly will increase. Besides accident risk, energy transport in Indonesian waters has both symmetric and asymmetric threats. Symmetric threat is considered as traditional threat such as armed robbery and piracy. Although the risk from armed robbery and piracy is considered high in Southeast Asian waters, concerted efforts to curb the activity most likely will bring down the risk.

On the other hand, an asymmetric threat to energy transportation has also become eminent. Asymmetric threat refers to a non-traditional threat by non-state actors with tactical methods and strategic objectives. Terrorism, sabotage, and suicide bombing are examples.

Considering the source of crude and products import for Indonesia any accident or blockage in sea lanes such as the Hormuz Strait or the Malacca Strait will pose a serious threat to Indonesian energy security in two ways. First, the blockage will delay the supply of crude oil for Indonesia refineries that may lead to shortage of oil products. Second is the indirect impact of a blockage in the Hormuz and Malacca Straits to countries from Indonesia imports fuels from that may reduce the ability to supply fuel to Indonesia. The impact will be

identical – supply shortage. If the supply shortage lasts a long time, it may seriously impact Indonesia's economy and may lead to social unrest.

As Indonesia also imports oil products from Northeast Asia such as Japan, Korea, and Russia, there are several straits of strategic importance to Indonesia such as the Straits of Tsushima, Tsugaru, Osumi, and Soya (La Perouse). These straits are key to product transport from Russia and Northeast Asia to Indonesia. The closure of these straits may seriously impact Indonesia's fuel supply.

4.1.5. Risk mitigation

Accident Prevention and response

A high probability of accidents, such as collision and grounding in Indonesia's navigable waters including the Malacca, Sunda, and Lombok Straits, stimulates the Indonesian government to increase the safety of the navigational systems by introducing a traffic separation scheme in the Malacca, Sunda, Lombok, and Ombai–Wetar Straits.

Indonesia set up the Maritime Safety Board to comply with International Maritime Organization (IMO) Flyer No. 79. The Maritime Safety Board is equipped with infrastructure such as:

1. Maritime SAR with the Global Maritime Distress Security and Safety System (GMDSS)
2. Traffic monitoring, consisting of automatic identification system, base station, long-range camera, and radar coastal surveillance
3. Fishery protection, vessel monitoring ship, and ground station
4. Marine safety broadcasts, supporting the Maritime Regional Coordinating Center (MRCC) and the Regional Coordinating Center (RCC).

Marine pollution monitoring

In case of oil spill risk, Indonesia has developed a company-level response plan, a regional response plan, and a national response plan. The system, supported by oil trajectory prediction, and oil containment facilities, regularly conducts exercises to increase the readiness of the system to any possibility of oil spill.

Indonesia's geographic conditions are prone to supply disruption of fuel due to accidents in refineries, transportation, and weather. In order to respond to the disruption risk, Indonesia has developed a regular, alternative, and emergency supply scheme to reach any consumer in Indonesia.

Regional Cooperation

The safety and security of shipping, especially for oil and gas transport, is complex. National measures to secure the safe transportation have limitations. In such cases, regional and multilateral cooperation is important.

In addition to individual measures, there have been efforts of bilateral and multilateral cooperation. Among notable cooperation efforts are:

1. Joint patrols of the Malacca Strait. Indonesia and Singapore established Indonesia–Singapore coordinated patrols in the Singapore Strait. This has involved the setting up of direct communication links between their navies and the organisation of coordinated patrols every 3 months in the strait. Singapore and Indonesia have also set up a joint radar surveillance system, known as Project SURPIC, for Surface Picture, which will monitor traffic in the Singapore Strait.

   Indonesia and Malaysia also decided in 1992 to establish a Maritime Operation Planning Team to coordinate patrols in the Straits of Malacca. The Malaysia–Indonesia coordinated patrols are done four times a year, and so is the Malaysia–Indonesia maritime operational coordinated patrol, which are conducted together with other maritime institutions, such as customs, search and rescue, and police forces from the two countries.

2. ASEAN. The Bali Accord II, adopted at the ASEAN Summit in Bali in October 2003, declared that maritime issues and concerns are transboundary in nature and therefore shall be addressed regionally in a holistic, integrated, and comprehensive manner. The Plan of Action of the proposed ASEAN Security Community also included recommendations to cooperate mutually and to coordinate border patrols to combat terrorism.

3. The ASEAN Petroleum Safety Agreement is especially designed to assist countries in supply disruption on mutual benefit basis.

4. Private initiatives have also taken place. A Japanese refiner, under the coordination of the Petroleum Association of Japan, launched a stockpile base of oil spill response equipment since 1996. The association conducted joint exercises with Pertamina and the Oil Spill Combat Team, which is a private oil spill response services company.

4.1.6. Effectiveness of existing measures

Considering the occurrences of attacks to ships travelling in Indonesian navigable waters, current measures both at the country, regional, and multilateral levels still bear weaknesses. Among the weaknesses are the vast size of Indonesian navigable waters the need forf significant infrastructure to ensure security. Continuing developing country capability is very important to Indonesia.

Meanwhile, multilateral cooperation bears a risk of being ineffective, mostly because of the lack of trust among stakeholders, asymmetric benefits, and political issues.

4.1.7, Recommendations

1. Improving mutual trust among stakeholders
2. Promoting cooperation on capacity building among the stakeholders
3. Improve coordinated response to any attacks or casualties

4.2. Thailand

4.2.1. Introduction

In 2015, Thailand's demand for crude oil (and condensate) and natural gas is 1,120 kbd and 5,100 mmscfd, respectively. Seventy-two percent (875 kbd) of crude oil demand is imported, of which 573 kbd is from the Middle East. Current natural gas import accounts for 29 percent (1,480 mmscfd) of Thailand's demand, most of which is through pipelines from offshore fields in Myanmar. Thailand's LNG import facility is located at the Map Ta Phut Industrial Port on the eastern coast in Rayong province. Current LNG regasification capacity is 5 mmtpa, with an expansion of 5 mmtpa to be completed in 2017. From 2.5 mmtpa in 2015, LNG import is projected to increase to around 22–24 mmtpa in 2030–2035 period, accounting for about 70 percent of total natural gas demand.

With the emphasis on increasing the blending percentages of biofuels (ethanol and FAME) from renewable resources in its transport fuel mix, Thailand's oil demand plan for the next 20 years does not anticipate additional requirements for new refining capacity. However, with declining indigenous crude oil and condensate production, the total volume of crude and condensate will increase to around 1 million barrels per day, most of which will come from producers in the Middle East and West Africa. Therefore, it is foreseen that the security of the Malacca Strait sea lane will pose a critical issue that may cause serious impact on energy supply to the Thai economy, both for oil products for its transport fuels and petrochemicals feedstock and LNG for its power generation. Natural gas currently accounts for 65 percent of the fuels used in power plants, and it is projected that during the next 20 years, natural gas will remain the main source of fuel for power generation, accounting for 55–60 percent.

4.2.2. Thailand's approach to sea lane risk mitigation

Relying on import for most of its crude oil requirements, market price stability and supply security have been high on the government agenda. To provide price stability, Thailand has employed an oil fund scheme that adds a 'fee' onto the retail price of gasoline and diesel during periods of 'low price', and uses the fund to cushion the rapid increase in oil price during highly volatile periods. To mitigate the impact of possible supply disruption (either in the Strait of Hormuz or the Malacca Strait), the Thai government has imposed on refiners

and traders a mandatory reserve requirement equivalent to 6 percent of crude oil processed for domestic sale in a year for refinery, and 1 percent (down from previous 6 percent) of products traders sell in the domestic market in a given year. The cost of this reserve requirement is passed on to consumers in the form of a price premium above the reference Platts price. However, the 22-day crude oil reserve is deemed inadequate in the event of a major disruption, and the government has been promoting for an additional scheme to increase the reserve to the International Energy Agency (IEA) recommended level of 90 days. It is uncertain how such a strategy will materialise in the foreseeable future.

Another approach to mitigate the impact of crude oil supply disruption is to draw on cooperation with East Asian crude oil importing countries in building a 'Malacca-bypass channel' through southern Thailand. The projects being proposed under this approach are either the construction of a canal ('the Kra Canal Project') connecting the Andaman Sea with the Gulf of Thailand, or a pipeline 'land bridge' connecting receiving ports on the west coast of southern Thailand to a loading port on the east coast. It is doubtful whether this type of mega project could be realised.

As Thailand is developing its LNG regasification infrastructure, options to build additional LNG receiving terminals on the west coast facing the Andaman Sea are under consideration. One option is to build an LNG receiving terminal integrated with the natural gas import pipeline on the Myanmar side. The capacity of this terminal could be 5 mmtpa to supplement (and in the future replace) natural gas production from offshore fields in Myanmar. However national security is a main concern in implementing this approach. Other options include the construction of an integrated LNG receiving terminal with a dedicated power plant in the south of Thailand on the west coast facing the Andaman Sea.

With increasing development of natural gas supply infrastructure (pipeline networks) in ASEAN countries and growing natural gas markets, it seems that the most effective (and efficient) strategy to reduce the risk of major disruptions in LNG supply is to build an interconnected ASEAN gas infrastructure (either physically through interconnected pipelines or logically through LNG trades). This approach will not only provide optimum benefits for ASEAN countries, but will form the foundation of a region-wide natural gas market.

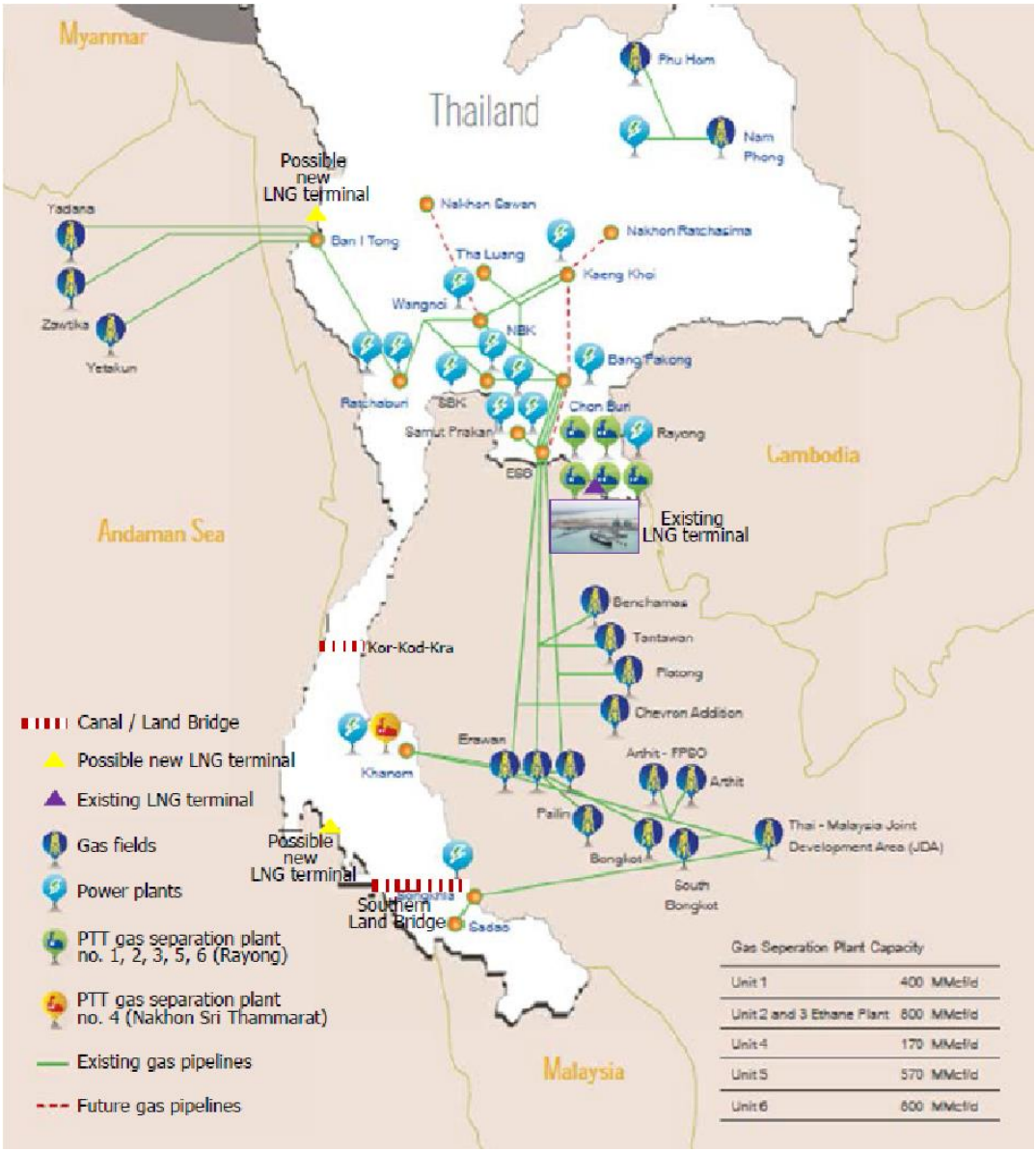
4.2.3. Thailand's participation in regional sea lane risk mitigation

In additional to these internal risk mitigation efforts, Thailand has played an active role as a participant in various proactive shipping security measures, such as the TSS, AIS, and ReCAAP. Thailand Maritime Enforcement Coordinating Center (THAI-MECC) has been established to coordinate marine activities related to piracy prevention, such as the ReCAAP. THAI-MECC has the responsibility to prevent and suppress unlawful marine acts as well as coordinate with any related units on the prevention and suppression of piracy.

The prevention and suppression of offences concerning piracy have been Thailand's ongoing strategy and policy that require attention from many organisations such as the Royal Thai Navy, the Marine Department, and the Control Division of Commercial Vessels. In order to fulfil such tasks, Thailand has adopted high-tech software and hardware such as a satellite

network control system to track all ships' global positioning system (GPS) and many computerised tracking interfaces (this could include AIS and TSS). In addition, Thailand has also liaised with Malaysian and Singaporean government agencies in dealing with various operations related to the prevention and suppression of offences concerning marine activities. The coordination includes the organisation of workshops and/or conferences for officers from these organisations. One recent workshop was 'The Situation of Piracy and Armed Robbery in Strait of Malacca and South China Sea' and 'The Guide for Tankers Operating in Asia Against Piracy and Armed Robbery Involving Oil Cargo Theft' held by the ReCAAP Information Sharing Centre (ISC) Singapore for THAI-MECC on 29 March 2016.

Figure 4-4. Energy Infrastructure in Thailand



Source: PTIT public company.

4.3. China

4.3.1. Introduction

China is the largest oil consumer and the third largest LNG consumer in the world. Statistically, approximate 75 percent of crude oil import and 23 percent LNG import are transported through the Malacca Strait from the Middle East, Africa, and Europe into China every year. China's foreign energy dependence remains high and is estimated to keep strengthening in the following decade. Therefore, maintaining sea lane security from the Middle East to China, especially the sea lane security of oil and LNG trade routes, conforms with China's national interests and strategic concerns.

Since 2012, China has officially put forward 'building an ocean power' as one of its national strategic aims. As one of the stakeholders of the South China Sea region and the major user of the Malacca Strait, China has made great efforts in guaranteeing the sea lane safety of this region. In addition, China's government is willing to cooperate with all parties in good faith to jointly work for ensuring the security of energy trade routes within this area.

4.3.2. China's increasing dependence on foreign energy

According to the 'Report of Domestic and International Oil and Gas Industry 2015' published by the China National Petroleum Corporation Economic and Technology Research Institute, China's dependence on foreign oil for the first time exceeded 60 percent in 2015; the oil products imports has grown by a large margin for 3 years.

It is estimated that, under the current policies scenario, by 2020 China's dependence would reach 63 percent andLNG 37.84 percent. Following that, figures may slightly decrease to 62.69 percent and 37.12 percent by 2030. However, if the government adopted and practised eco-friendly energy strategies in the coming decades, the figures would therefore grow to 62.41 percent and 36.67 percent by 2020; then, shrink to 59.02 percent and 32.96 percent by 2030. The decreasing dependence on foreign oil and gas after 2020 could result from China's systematic optimisation, according to the 'World Energy China Outlook 2015–2016' of the Chinese Academy of Social Sciences Innovation Program.

Considering China's present high dependence on foreign energy, a large share of which has to be transported through maritime choke points and the sea lanes in the South China Sea, the government thus should attach importance to the energy trade routes within this region. In addition, China's concerns of maintaining oil and LNG trade routes security could be higher in the foreseeable future.

4.3.3. China's concerns on the Malacca Strait

The Malacca Strait is one of the most strategically important maritime chokepoints in the world, the security of which cannot only directly influence the international energy market and world economy, but also can profoundly affect regional and international political patterns as well as the development of countries involved.

The Malacca Strait bridges the East and the West. According to the latest annual reports from the US Energy Information Administration (EIA), over 100,000 vessels pass through the Strait of Malacca each year, carrying about one-fourth of the world's traded goods, the total value of which are estimated over US$940 billion. Besides, as the shortest sea route between energy suppliers from the Persian Gulf and Africa and Asian markets, the strait conveys 5.5 billion barrels of oil and 4.2 trillion cubic feet of LNG every year, which takes 70–80 percent of China's, over 90 percent of Korea's, 90 percent of Japan's, and 98 percent of Taiwan's energy imports.

China is the major user of the Malacca Strait. In statistics, over 60 percent of vessels passing through the strait are from China. Thus, the security of the Malacca Strait is important for China.

In 2003, former President Hu Jintao, for the first time, stated China's concern over the security of the Strait of Malacca, during the Central Economic Working Conference. In 2007, during the 11th China–ASEAN leaders' meeting in Singapore, ex-Premier Wen Jiabao emphasised that China was committed to maintaining security of the Malacca Strait through dialogue and cooperation, and was willing to actively participate in the relevant cooperation projects. In addition, the new generation of China's government led by President Xi Jinping also attaches great importance to the security of the strait. China's concerns are as follows:

- **Security of Malacca Strait**

The Strait of Malacca is under joint jurisdiction of Singapore, Malaysia, and Indonesia. However, the three countries view piracy and maritime safety of the strait differently: Singapore regards it as a security issue; Malaysia sees it as a political issue; while Indonesia does not regard it as an issue at all. The differences of these countries' views may, to some extent, affect their cooperation in countering maritime piracy and terrorism in this area. Besides, none of the three countries are powerful enough to guarantee the safety of this maritime choke point from piracy, armed robbery, and terrorism. As a result, the number of actual and attempted attacks in this region grows year after year (Table 4.2), according to data from ReCAAP ISC. Although some political issues and misunderstanding between China and the countries remain unsolved, China still tries hard to promote the confidence building with all these parties, and is willing to assist them in jointly maintaining the security of the Malacca Strait.

Table 4-2. Locations of Actual and Attempted Attacks, 2010–2014

Locations	2010	2011	2012	2013	2014
Indonesia	40	46	81	106	100
Malacca Strait	2	1	2	1	1
Malaysia	18	16	12	9	24
Singapore Strait	3	11	6	9	8
Total	63	74	101	125	133

Source: IMB (2015a).

- **Increasing risk of marine accidents**

Besides the hydrogeological characters of the Malacca Strait, a narrow flat stretch of water and sandy mud bottom, lack of effective and efficient traffic management and extreme weathers, the increasing volume of traffic results in a significant rise in the risk of marine accidents. It is reported that the number of marine accidents in the strait is three times those of Suez Canal's and over five times in the Panama Canal. China, as the major user of the Malacca Strait, has to take greater risks and pay higher costs accordingly. To improve the situation, on the one hand, China has made efforts to enhance confidence building and cooperation among parties across the fields of combatting maritime terrorism and training on joint search and rescue, among others. On the other hand, China is actively exploring alternatives to mitigate the risks and protect its national interests.

- **The increasing costs in the Strait of Malacca**

Due to the increasing volume of traffic and the threats of piracy, armed robbery, and terrorism, the cost of using the Strait of Malacca is rising accordingly. For instance, in 2005, Aegis Defence Services once led a risk assessment on the Malacca Strait and classified the strait as a high-risk zone. Then, the result was taken by Lloyd's Market Association's Joint War Committee, which later declared that the Malacca Strait was in jeopardy of 'war, strikes, terrorism, and related perils', and added the strait to the committee's list of high-risk areas. As a consequence, the insurance cost of vessels navigating through the Strait was doubled. Although, in the end, some of insurance and reinsurance companies compelled not to do so at once, the event reveals the change in the Malacca Strait and pushes its users to seek for better alternatives.

4.3.4. Risks and China's efforts

Many risks are threating the security of trade routes in the South China Sea, such as the South China Sea disputes and possible regional conflicts, piracy and maritime terrorism, marine accidents and pollution, and extreme weather events and natural disasters.

Piracy has been a traditional problem in the South China Sea. Statistics show that there was a sharp increase in maritime piracy in the late 1990s following the massive unemployment and political instability caused by the Asian financial crisis. Stepping into the current century, according to the International Maritime Bureau, piracy, including attempted theft and hijackings, is still a regional threat to tankers. In 2008, there were only 13 actual attacks on vessels underway in the southern area of South China Sea. In 2010, there were 36 actual and attempted attacks in the Strait of Malacca, Singapore Straits, and the South China Sea. This number rose substantially to 44 in 2011 and 90 in 2014, according to the latest statistics published in the ReCAAP ISC Annual Report.

Maritime piracy often interweaves with terrorism. The former is used as a tool by terrorist groups. Since the international community has worked hard to freeze the capital of terrorist groups, they tend to acquire funds through activities of pirates. They may create a hazard by crashing a vessel containing dynamite or even weapons of mass destruction in a port or a harbour.

These major threats, together with other factors, like natural disaster, the deterioration of the oceanic environment, and even potential conflicts arising from overlapping sovereignty and jurisdiction claims in the region, bring about difficulty for maintaining maritime safety and security.

In order to mitigate these risks to maintain sea lane security, China has already made great efforts.

China values marine development and its rights and interests in oceans and seas. Especially in recent years, the government has formulated and promulgated a series of national strategies and initiatives for this purpose. For instance, in 2012, China clearly set forth maintaining its marine rights and interests and building an ocean power as a part of the 'Great Efforts to Promote Ecological Civilization Construction', stated in the 'Repot to the 18th People's Congress of Communist Party of China' during the 8th Collective Study of the Political Bureau of Central Committee of Communist Party of China held in 2013. President Xi Jinping further pointed out that: building an ocean power is significant for promoting sustainable and healthy economic development, maintaining national sovereignty and security, and developing interests, among others; and in September and October of the same year, Premier Li Keqiang promoted 'the Belt and Road Initiative', during his state visit in Asia and Europe. In addition, a key point for the government is how to effectively and economically guarantee the security of sea lanes.

China actively engages in prompting confidence building and cooperation in the South China Sea area on both regional and international levels. So far, some achievements, such as the

ReCAAP, the Malacca Straits Coordinated Patrol, the Regional Maritime Security Initiative, have been working well.

In addition, China encourages littoral states around the South China Sea to deepen economic cooperation by taking the opportunity of China's 'One Belt, One Road' strategic initiative and to share common responsibilities of tackling non-traditional security challenges, which could effectively eliminate the roots of piracy and other crimes at sea. Besides, it also encourages more international organisations and institutions, such as the International Maritime Organization, to play a positive and effective role in upgrading confidence building and capacity building of littoral states as well as promoting the maritime navigation orders under the UNCLOS, the Declaration on the Conduct of Parties in the South China Sea, and the Code of Conduct in the South China Sea to guarantee the safety of sea lanes.

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Appendix Summary of the Workshops

1st workshop (4 February 2016)

Attendees:

- Mr Shigeru Kimura (Chair): Special Advisor to Executive Director on Energy Affairs, ERIA
- Dr Tetsuo Morikawa, Gas Group Manager, IEEJ
- Mr Siddharth Singh: Area Convenor and Research Associate, TERI
- Dr Han Phoumin: Energy Economist, ERIA
- Mr Rafiqan Ghani: Fleet Operations & Technical Services, Petronas LNG
- Dr Gusti Suarnaya Sidemen: Deputy Director for Technical and Environmental Regulation and Compliance, Ministry of Energy and Mineral Resources
- Dr Shao-Yuan Wu: National Institute for South China Sea Studies
- Mr Siri Jirapongphan, Executive Director, Petroleum Institute of Thailand

Session 1: Introduction:

Dr Morikawa and Dr Singh outlined the scope of the study.

Session 1: Presentation by members

Dr Sidemen and Mr Ghani presented sea lane security issues in Indonesia and Malaysia, respectively. Dr Sidemen detailed existing measures like navigation aids, emergency response schemes, and regional cooperation. Mr Ghani outlined Malaysian authorities in relation to sea lane security and introduced his own experiences of sea lane passage as an LNG tanker captain.

Session 2: Presentation by members

Dr Wu presented China's stance on sea lane security mainly in the South China Sea. He identified environmental issues (oil leakage, explosion, and GHG emissions) and terrorism and piracy are the challenges for sea lane security, and suggested cooperation through China's Maritime Safety Authority. Dr Jirapongphan's presentation was distributed by ERIA to the participants due to his absence.

Session 3: Discussion and way forward

Participants agreed on the report contents and division of roles.

2nd Workshop (10 May 2016)

Attendees:

- Mr Shigeru Kimura (Chair): Special Advisor to Executive Director on Energy Affairs, ERIA
- Dr Tetsuo Morikawa, Gas Group Manager, IEEJ
- Mr Siddharth Singh: Area Convenor and Research Associate, TERI
- Dr Han Phoumin: Energy Economist, ERIA
- Dr Gusti Suarnaya Sidemen: Deputy Director for Technical and Environmental Regulation and Compliance, Ministry of Energy and Mineral Resources
- Dr Shao-Yuan Wu: National Institute for South China Sea Studies
- Dr Siri Jirapongphan, Executive Director, Petroleum Institute of Thailand

The objectives of the meeting were to 1) critically review chapter submissions, 2) discuss integration of full report, and 3) discuss report dissemination strategies.

Session 1: Briefing of draft final results of oil and LNG trade flow in 2040 by IEEJ

Mr Kimura delivered the opening remarks, followed by a presentation by Dr Morikawa on the findings highlighted in the first chapter. The discussion that followed focused on standardisation of units and related issues.

Session 2: Presentation of Thailand's country strategy

Mr Jirapongphan presented Thailand's concerns over sea lane risks and their country strategy to mitigate risks. The development of alternate channels of navigation and the diversification of energy infrastructure was discussed. It was decided that specific measures will be highlighted in the final chapter draft.

Session 3: Briefing of draft final results of risk analysis of sea lane security of oil and LNG

Mr Singh presented the chapter on sea lane risks and discussed risk mitigation measures. This was followed by a discussion on the inclusion of Western Indian Ocean into the report. Further, a discussion was had on quantitative risk assessment of sea lane security. It was eventually decided that while Western Indian Ocean will be included, quantitative assessment will be dropped for the purpose of this report.

Session 4: Presentation of Indonesia's and China's country strategy

Mr Sidemen and Dr Shao-Yuan Wu presented the country strategies to mitigate sea lane risks for Indonesia and China, respectively.

Session 5: Roundtable Discussion on 'Risk Mitigation Strategies'

Working group participants discussed risk mitigation strategies and the structure of the report. It was decided that there would be a separate chapter listing risk mitigation strategies followed by country specific strategies.