The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP)

National Paper

Improving the Safety of Navigation and the Sustainability of Shipping through the Introduction of Innovative Autonomous Shipping Technology in the Asia-Pacific Region

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Executive Summary

The shipping industry is facing challenges related to increasing traffic and environmental pollution, and the emergence of autonomous shipping technology presents opportunities and challenges in terms of navigation safety and sustainability of shipping. While European countries are currently leading in this field, countries in the Asia-Pacific region, such as China, Japan, Korea, Russia, and the USA, are actively developing autonomous shipping technology.

The International Maritime Organization (IMO) has initiated work on guidelines and regulations for autonomous ships through the Maritime Autonomous Surface Ships (MASS) Code expected to be a mandatory compliance by 2028, however, there are still regulatory and cybersecurity safety challenges to be addressed. To tackle these concerns, the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) is implementing a project to assess the readiness of selected Asia-Pacific countries, including Malaysia, in dealing with the challenges of autonomous shipping technology.

While each selected country has different priorities and levels of advancement in autonomous shipping technology, Malaysia’s main focus in this project is to align the country’s shipping regulations with the International Maritime Organization (IMO)’s Maritime Autonomous Surface Ships (MASS) Code, particularly on safety of navigation and sustainability of shipping.

This report of this project recommends and provide strategies for Malaysia to develop a national framework to face the potential impact of autonomous shipping in the country. The key strategies include enhancing navigation safety, promoting sustainable practices, improving cybersecurity measures, enhancing regulatory framework, and fostering collaboration with international organisations and countries in the Asia-Pacific region. By following the recommended strategies, Malaysia can capitalize on the opportunities presented by autonomous shipping while addressing challenges and ensuring safety and sustainability in maritime operations.

As for the Asia-Pacific, the recommendations to prepare the region for the unfolding of autonomous shipping include establishing regulations and guidelines that address safety and cybersecurity security issues, investing in research and development,
creating a skilled workforce, developing supportive infrastructure, encouraging collaboration and partnerships, and promoting public awareness.

1. Introduction

The shipping industry is vital for global trade, with over 90% of international trade being transported through sea routes and ports. However, the industry faces challenges such as congestion and pollution, which affect safety of navigation and environmental sustainability. The arrival of Industrial Revolution (IR 4.0) has introduced yet another challenge, as Europe and some countries in the Asia-Pacific are innovating the industry with autonomous shipping technology, adding further challenges to the existing safety and environmental concerns.

To address these challenges, the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) is implementing a capacity development project named 'Improving the Safety of Navigation and the Sustainability of Shipping through the Introduction of Innovative Autonomous Shipping Technology in the Asia-Pacific Region.' The project involves five Asia-Pacific countries which have potential for adaptation of these new innovations, namely India, Indonesia, Malaysia, Thailand, and Vietnam.

Each of the five selected countries has different priorities and levels of advancement in autonomous shipping technology. Given its strategic location along a busy shipping route in the Asia-Pacific region, it is only appropriate for Malaysia to capitalize on this technology to alleviate maritime traffic congestion and coastal environmental pollution. Through this ESCAP project, thus, it will help addressing Malaysia’s concerns about its potential impact on safety of navigation and environmental sustainability while countering cybersecurity risks and enhancing regulatory framework for shipping.

Faced with the coming of autonomous shipping, this paper recommends Malaysia to comply with guidelines in the International Maritime Organization (IMO)’s Maritime Autonomous Surface Ships (MASS) Code which is expected to be completed in
2025 and made mandatory in 2028, and collaborate with other Asia-Pacific countries for adapting the autonomous shipping technology. By following the recommendations in the report, Malaysia could enhance further the safety of navigation and sustainability of shipping while accelerating the adoption of this technology in the country.

2. Project Goal and Objectives

The primary goal of this project is to develop strategies for a national plan to adopt autonomous shipping technology in Malaysia, while considering initiatives for regional collaboration in the Asia-Pacific. To achieve this goal, the project has the following objectives:

a. Analyse the current development of autonomous shipping and its regulatory framework by the International Maritime Organisation (IMO).

b. Identifying the challenges and issues faced by Malaysia in adopting autonomous shipping technology in terms of safety of navigation and sustainability of shipping.

c. Suggest policy recommendations and strategies for adopting and promoting autonomous shipping in Malaysia.

 d. Building capacity in Malaysia and suggesting regional collaboration initiatives to face the emergence of autonomous shipping technology.

3. Autonomous Shipping Technology

The Fourth Industrial Revolution (IR4.0) is the current era of technological advancement that involves integrating all digital technology, including artificial intelligence (AI), the internet of things (IoT), and robotics, into industrial processes. One application of the IR4.0 is autonomous shipping technology, where ships are equipped with sensors and control systems that enable them to operate without human intervention. This technology represents a significant advancement in the industry, as it allows for safer navigation and cleaner shipping operations.
The development of autonomous shipping has significant impact on the shipping industry. While autonomous shipping has the potential to improve safety of navigation by reducing human error, it also poses new challenges that need to be addressed, such as cybersecurity risks and regulatory framework, and potential impact on labour markets and environmental sustainability.

Addressing these challenges will be crucial to ensuring that autonomous shipping can deliver its promised benefits. While other selected countries in the project may have different priorities and concerns, Malaysia’s main concern is its potential impact on the safety of navigation and sustainability of shipping. The cybersecurity risks and limited regulatory framework are the additional concerns for shipping in the country.

3.1. Development of Autonomous Shipping Technology

Europe is a pioneer in developing autonomous shipping technology. Various companies and organizations in the region are working on different aspects of the technology advancing from autonomous navigation, remote-controlled vessels to fully autonomous vessels as described below.

a. Autonomous Navigation: One of the early challenges in developing autonomous ships is creating an autonomous navigation system that can safely and accurately guide the vessel. Companies such as Wärtsilä and Sea Machines are working on developing navigation systems that use sensors, cameras, and artificial intelligence to navigate ships.

b. Remote-controlled Vessels: Another approach to autonomous shipping is the use of remote-controlled vessels. Rolls-Royce, for instance, has developed a system that allows a crew to remotely control a ship from a control centre on land. This technology can be used to operate ships in hazardous conditions or in areas with limited crew availability.

c. Autonomous Vessels: Currently there are several companies are working on developing fully autonomous vessels, which would not require a crew on board. For example, Norwegian fertilizer company Yara has partnered with technology
The firm *Kongsberg* to develop an electric, autonomous container ship that can transport fertilizer between the ports of Porsgrunn, Brevik, and Larvik in Norway.

The breakthroughs in the development of autonomous shipping have been published in various maritime publications. **Figure 1** below shows the illustration of an autonomous ship published by the Port Technology:

![Figure 1: The Illustration of an Autonomous Ship](https://www.porttechnology.org/)

3.2. **Autonomous Shipping in Europe & the Asia-Pacific Region**

Besides Europe, the development of autonomous shipping technology is also progressing rapidly in the Asia-Pacific, and we can expect to see more autonomous navigation systems, remotely-controlled and fully autonomous vessels in both these regions in the near future. The breakthrough in this technology is promising, with several projects and initiatives underway to develop and test this technology.

The advancement in autonomous shipping technology is expected to revolutionize the shipping industry by reducing costs, improving safety, and increasing efficiency. However, there are still regulatory and cybersecurity challenges that need to be addressed by countries in both regions before fully autonomous ships can become a reality.
3.2.1. Autonomous Shipping in Europe

Europe is at the forefront of autonomous shipping development, with a range of projects and initiatives aimed at advancing the use of these technology in commercial shipping operations. The region is actively developing autonomous shipping technology, with several ongoing projects and initiatives aimed at advancing the use of autonomous ships in commercial operations. Since the early 2010s, there were several projects and initiatives in the field of autonomous navigation, including:

a. **Maritime Unmanned Navigation through Intelligence in Networks (MUNIN):** This was a large-scale research project on autonomous navigation initiated with the support of the European Union (EU) starting in 2012. The project involved organizations from Germany, Norway, Sweden, Iceland, and Ireland. Its goal was to develop autonomous ships to be controlled by onboard automation under the supervision of a shore-based centre.

   The MUNIN project was completed in 2016 and it involved the development of technology for autonomous navigation, communication, and collision avoidance as well as the integration of these technology into a comprehensive autonomous shipping system.

b. **Autonomous Shipping Initiative for European Waters (Autoship):** The ‘Autoship’ project was initiated and implemented by a group of companies belonging to different countries in Europe, including Norway, Italy, Scotland, Belgium, and France. The project aims to test two different autonomous vessels in European waters; short sea shipping and inland waterway. It also explores the associated problems on autonomous shipping such as legal, technical, human-related, safety-related, ecological, and economical issues.

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3. https://www.autoship-project.eu/
c. **Kongsberg-Yara Birkeland**: The **Kongsberg-Yara Birkeland** project is autonomous shipping project implemented by Kongsberg with the support of the Norwegian government. The Norwegian technology company built an 80-meter electric container ship in December 2017 equipped with additional sensors, route and dynamic positioning systems, automatic mooring systems, remote control systems, and autonomous electric cranes. The ship went through testing in different stages, including supervised operation by a crew, experimental operation in remote mode with the crew on board, and finally, autonomous operation with a reduced crew. and as the world’s first zero emission container vessel⁴

**Figure 2** below shows the autonomous ship Yara Birkeland cruising in European waters:

![Figure 2: The Autonomous Ship Yara Birkeland](https://www.offshore-energy.biz/worlds-1st-zero-emission-container-vessel-yara-birkeland-delivered/)

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⁴ [https://www.kongsberg.com/maritime](https://www.kongsberg.com/maritime)

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d. **Advanced Autonomous Waterborne Applications (AAWA)**: The **AAWA** project was an international project launched by Rolls-Royce and funded by the **Finnish Funding Agency for Innovation (TEKES)** and implemented by a consortium that included Rolls-Royce, Deltamarin, Inmarsat, DNV, Intel, and the Technical Research Center of Finland (VTT). The project opened a test
zone and research center for autonomous ships in Finland, where tests of the remotely operated ferry *Falco* were conducted in 2018.⁵

e. **Advanced, Efficient and Green Intermodal Systems (AEGIS):** The AEGIS is a three year project, started in June 2020, with a total funding of 7.5 M€ from the European Union’s Horizon 2020 research and innovation program. The AEGIS consortium designed Europe’s next generation sustainable and highly competitive waterborne logistics system comprising more autonomous ships and automated cargo handling. The system proposed a concept with more and smaller ships that can be used to increased frequency, differentiate speeds, reduce terminal costs and reduce time in port for the larger ships as they will not need to call smaller ports.⁶

f. **The Central Commission for the Navigation of the Rhine (CCNR):** The CCNR adopted an initial international definition of levels of automation in inland navigation (Resolution 2018-II-16) in 2018. The CCNR has charged its Police Regulations Committee monitoring developments in automated navigation (from navigation assistance to fully automated navigation) and considering the possible need for regulatory measures. The centre published a list of research projects on the autonomous shipping including the Autoship and the AEGIS.⁷

### 3.2.2. Development of Autonomous Shipping in the Asia-Pacific Region

The Asia-Pacific region is home to some of the world's busiest ports and shipping routes, and as such, it is crucial for the industry to be ready to embrace the autonomous shipping technology. While the technology is still in its infancy stages, it is important for shipping industry in this region to prepare for its widespread adoption in the future. Currently some Asian ports such as the Port of Singapore have already started to explore the use of autonomous vessels, and there are ongoing trials and

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⁶ [https://aegis.autonomous-ship.org/](https://aegis.autonomous-ship.org/)

⁷ [https://automation.ccr-zkr.org/](https://automation.ccr-zkr.org/)
projects aimed at testing the feasibility of the technology. However, this innovation remains very new to most countries in this region.

Additionally, there are still many challenges that need to be addressed before autonomous shipping can become mainstream in the Asia-Pacific. One of the biggest challenges is the need to ensure that the technology is safe and sustainable. This will require the development of robust communication systems, navigation and control systems, and cybersecurity measures. Another challenge is a regulatory framework that need to be established to govern the use of autonomous vessels, including issues related to liability, insurance, cybersecurity and compliance with international maritime laws.

In this region, countries like China, Japan, the Republic of Korea, the Russian Federation, and the United States of America are leading the development of autonomous shipping technology. The development of autonomous shipping in these countries are as below:

a. **China**: China’s Ministry of Transport released a plan to develop intelligent shipping by investing heavily in autonomous shipping technology with research institutions such as the *Wuhan University of Technology* and *Shanghai Merchant Ship Design and Research Institute*, and state-owned shipping company *China Merchants Group* are investing in autonomous shipping technology.

In 2019, China conducted its first autonomous ship, namely the 13-meter *JinDouYun-0*. In 2021, the country launched its electric container ship *Zhi Fei*, which is equipped with autonomous navigation systems. China's advancement in autonomous shipping technology is driven by a combination of government support, technological advancements, and a desire to improve the safety, efficiency, and environmental sustainability of shipping operations. In the future, it is likely that Chinese companies and research institutions will play more significant role in shaping the future of the global shipping industry. Figure 3

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below shows the autonomous ship Jin Dou Yun -O completing trial voyage in China’s waters:

![Image](image.png)

Figure 3: The Autonomous Ship JinDouYun-0


b. **Japan**: The Japanese government set a goal to commercialize autonomous ships by 2025. In 2018, Japan established the **Centre for the Promotion of the Marine Innovation Strategy** and the following year launched the **Designing the Future of Full Autonomous Ship (DFFAS)** project.

In 2022, the Japanese autonomous container ship **Suzaku** demonstrated the use of a comprehensive fully autonomous navigation system, including remote control and land support. She navigated a round-trip route of 790 kilometers in Tokyo Bay using a comprehensive fully autonomous navigation system, and remote operation from the Fleet Operation Center in Chiba Prefecture.\(^9\) Figure 4 below depicts the autonomous Ship **Suzaku** and Fleet Operation Center in Chiba Prefecture in Japan.

Figure 4: The Autonomous Ship Suzaku and Fleet Operation Center in Chiba Prefecture, Japan.


The Republic of Korea: Republic of Korea's Ministry of Oceans and Fisheries has set a goal to have autonomous ships in operation by 2025. The Korean large conglomerates such as Hyundai Merchant Marine and Samsung Heavy Industries are some of the Korean companies that develop autonomous shipping to enhance the competitiveness and sustainability of its maritime industry.

In 2020, Republic of Korea launched the Korea Autonomous Surface Ship Project (KASS) to build 250 autonomous ships including car ferries and container ships by 2025. The project has achieved significant milestones, including the successful voyage of the LNG carrier Prism Courage by Avikus, an autonomous navigation company belonging to shipbuilders HD Hyundai.10

c. The Russian Federation: Since the early 2010s, the Russian Federation has been working on developing autonomous navigation technology for its commercial vessels. The nation completed the Autonomous and Remote Navigation Trial Project (ARNTP) between 2019-2021 involving a motor barge Rabochaya, a general cargo ship Pola Anfisa and a shuttle tanker Mikhail Ulyanov.11

Since the ARNTP successful completion, several commercial vessels have been using its autonomous a-Navigation systems. The development of autonomous shipping technology in Russia is expected to bring significant benefits to its maritime industry.

d. The United States of America. In the United States, the U.S. Navy and the Coast Guard were among the first organisations to explore the potential benefits of autonomous shipping.

In 2018, the United States' Department of Transportation established the Automated Maritime Navigation and Control System (AMNCS) project to develop and test autonomous technology for commercial vessels. Now the innovation is gaining momentum as technology companies and shipping firms are investing in autonomous shipping projects and promote U.S. leadership in autonomous shipping.12

4. The International Maritime Organization (IMO)’s Guidelines on Autonomous Shipping

While the innovation of autonomous shipping technology is progressing in Europe and the Asia-Pacific region, the International Maritime Organization (IMO), a specialised agency under the United Nations (UN), is working on developing guidelines and standards on the Maritime Automated Surface Ships (MASS) Code for the safety of navigation, as well as to reduce the environmental impact of autonomous ships. Though there are progress in these efforts, there are still challenges that need to be addressed before fully adopting the autonomous ships can become a reality.

The innovation in autonomous shipping technology is progressing from autonomous navigation, remotely-controlled vessels and autonomous vessels that can operate without crew onboard. However, the existing International Maritime Organization (IMO) instruments such as the International Convention for the Safety of Life at Sea (SOLAS), the Convention on the International Regulations for Preventing Collisions at

Sea (COLREG), the Convention on the Prevention of Maritime Pollutions (MARPOL), the Ballast Water Management Convention (BWMC), and the International Ship and Port Facility Security (ISPFS) Code are still inadequate to regulate the advancement in this technology.

This is because these International Maritime Organization (IMO)’s conventions were developed assuming a minimum level of manning onboard, will not be relevant as a regulation for autonomous shipping and there is a need for different approach in regulating autonomous ships. The International Maritime Organization (IMO) is developing a goal-based Maritime Autonomous Surface Ships (MASS) Code at the recent Regulatory Scoping Exercise (RSE). The code is be ready by 2025 and will address areas such as navigation safety, environmental protection, and human-machine interaction.\(^{13}\) The MASS Code is expected to be a mandatory compliance by member states in 2028, however, there are still challenges that need to be addressed by countries in the region before fully adopting the autonomous ships can become a reality.

As a preparation for its readiness to regulate the autonomous ships, the International Maritime Organization (IMO) published an article in 2018 on ‘IMO takes first step to address Autonomous Ships’ is in Figure 5 below:

\(^{13}\) https://www.imo.org/en/MediaCentre/PressBriefings/Pages/08-MSC-99-mass-scoping.aspx
Figure 5: The International Maritime Organization (IMO)’s Article: IMO takes first step to address Autonomous Ships

Source: https://www.imo.org/en/MediaCentre/PressBriefings/Pages/08-MSC-99-mass-scoping.aspx

5. Potential Impact of Autonomous Shipping in the Asia-Pacific Region

The Asia-Pacific region’s busy shipping lanes are essential for the movement of goods and people between different countries. These busy shipping lanes present significant challenges to navigation safety due to the heavy volume of traffic while frequent ship pollutions have also resulted in significant environmental degradation and habitat loss. Despite International Maritime Organization (IMO)’s conventions such as SOLAS, STCW, COLREG, and MARPOL are already in place to address these issues, more initiative is necessary to ensure the safety of its maritime traffic and the long-term health of the region’s marine ecosystems.
Now that the autonomous shipping is emerging in the Asia-Pacific, countries in the region are facing its impact on economic, technological, social security and human issues. For Malaysia, the **safety of navigation** and the **sustainability of shipping** are the two crucial challenges faced by the country as its maritime traffic is high and ecosystems are diverse.

### 5.1. Navigation Safety

Currently, the safety of navigation in the Asia-Pacific region is mitigated by the International Maritime Organisation (IMO)’s conventions such as the SOLAS, STCW and COLREG. The region also has the Regional Cooperation Agreement on Combating Piracy and Armed Robbery against Ships in Asia (ReCAAP) put in place for shipping companies to mitigate these risks.

However, the surfacing of autonomous shipping imposes a new challenge to these initiatives. This development poses significant challenges to navigation safety because the present International Maritime Organization (IMO) instruments were designed to regulate the conventional shipping. Now countries in this region must be ready to adopt the International Maritime Organization (IMO)’s **Maritime Autonomous Surface Ships (MASS) Code** and invest and collaborate with other international organisations and countries in the region to ensuring navigation safety. The adoption of autonomous shipping must not only benefit the industry, but it is important to ensure that it is done in a safe, reliable, and responsible manner.

### 5.2. Sustainability of shipping

The Asia-Pacific region is home to diverse marine ecosystems, including coral reefs, seagrass beds, and mangroves, which are critical for the region's biodiversity and provide numerous ecosystem services to local communities. The rapid and increase in shipping traffic in the region has resulted in significant environmental degradation, including pollution, and habitat loss.

In the Southeast Asia, several regional initiatives have been put in place to address these issues. Among them are the **ASEAN Agreement on Transboundary Haze**
Pollution to mitigate the impact of transboundary haze pollution on the environment and public health,\textsuperscript{14} and the Coral Triangle Initiative to conserve and sustainably manage the region's coral reefs and associated ecosystems.\textsuperscript{15} In shipping, countries in the region also comply with The International Maritime Organisation (IMO)’s International Convention for the Prevention of Pollution from Ships (MARPOL), Ballast Water Management Convention (BWMC) and the Sulphur Cap 2020 to prevent of marine pollution from ships.

Now, with the coming of autonomous shipping in the region, Countries expect to face its impact of environmental degradation, pollution, and habitat loss with its alternative and environmentally friendly fuels and more précised navigation equipment.

6. Current Challenges faced by Shipping in the Selected Asia-Pacific Countries including Malaysia

The ESCAP capacity building project focuses on five Asia-Pacific countries, namely Indonesia, India, Malaysia, Thailand, and Vietnam, aiming to prepare them for the adaptation of autonomous shipping technology. Besides less developed compared to their European and Asia-Pacific counterparts, these selected countries also have varying priorities and advancement in accessing to autonomous shipping technology among them. This discrepancy could potentially create an imbalance in the regional maritime industry, leading to a loss of competitiveness for these countries on the global stage.

The project aims in each target country to analyse their respective shipping landscape by considering the following points:

a. Identify challenges and issues associated with the emergence of autonomous shipping and assess its potential impact on their respective country.

\textsuperscript{15} http://ctatlas.coraltriangleinitiative.org/About/CTI
b. Recommend a strategy and provide policy recommendations to facilitate the smooth integration of autonomous shipping technology in their respective country.

For Malaysia, the main concerns as a Council Member of the International Maritime Organisation (IMO) are on issues of the safety of navigation and environmental sustainability.16 On the safety of navigation, Malaysia ensures its registered ships are complying to the International Maritime Organisation (IMO)’s instruments and ratifying them into force in Malaysia.17 Malaysia also actively participates in its initiatives and programs such as the Integrated Technical Cooperation Programme (ITCP)18 and the Joint Hydrographic Survey (JHS) of the Straits of Malacca and Singapore to enhance the safety of navigation in these straits.19 Together with littoral states of the Strait of Malacca, Malaysia also manages Traffic Separate Scheme to avoid collisions of ships and conducts Malacca Patrols to ensure the safety and security of ships passing through the strait.

To address the concerns on environmental sustainability, Malaysia collaborates with the International Maritime Organisation (IMO) to promote sustainable shipping practices and reduce the carbon footprint of the maritime sector. Besides ratifying the MARPOL, BWMS and the Sulphur Cap 2020, Malaysia adopted the IMO’s Initial Strategy on Reduction of Greenhouse gas emissions from Ships which aim to reduce the carbon intensity of shipping by at least 40% by 2030 and to pursue efforts to phase out greenhouse gas emissions from shipping as soon as possible. Additionally, Malaysia also established marine protected areas to protect the marine species and mangroves which are important for the sustainability of coastal environment.

17 Hj Baharin Abdul Hamid, The Role of the Marine Department Malaysia in Ensuring Safe and Secure Navigation, Malaysia a Maritime Nation, 2021, pg 338
6.1. **Safety of Navigation in the Strait of Malacca**

Malaysia has always expressed concerns regarding the safety of navigation in the Strait of Malacca, which is one of the busiest and most important shipping lanes in the world. The Strait of Malacca connects the Indian Ocean and the Pacific Ocean, and over 100,000 vessels pass through the strait each year. The high traffic volume and narrow width of the strait present challenges for safe navigation, and there have been several incidents in the past, including collisions, groundings, piracy and the recent fire involving a tanker ship.

Malaysia has been working closely with other littoral states in the Strait of Malacca to address these concerns. In 2004, Malaysia, Singapore, and Indonesia established the **Malacca Strait Patrols** to enhance maritime security and safety in the strait. The three countries also collaborate to manage the Traffic Separation Scheme (TSS) in the strait as depicted in the **Figure 6** which helps to prevent collisions by separating northbound and southbound traffic.

![Figure 6: The Traffic Separation Scheme in the Strait of Malacca](https://mehsoms.net)

*Source: https://mehsoms.net*

Furthermore, Malaysia has taken steps to enhance its own maritime safety and environmental protection capabilities. The country has established the Malaysian Maritime Enforcement Agency (MMEA) to enforce maritime laws and regulations, including those related to safety and environmental protection. Malaysia has also implemented various measures to address marine pollution, such as the Marine Pollution Prevention Act and the National Oil Spill Contingency Plan.
The Malaysian Maritime Enforcement Agency (MMEA) making its presence felt in Malaysia’s surveillance systems is reported by a local media as in the Figure 7 below:

![Figure 7: The Malaysian Maritime Enforcement Agency (MMEA) making its presence felt in Malaysia’s Surveillance Systems](https://www.thestar.com.my/business/sme/2014/03/05/big-blip-on-the-radar-sme-makes-its-presence-felt-in-malaysias-surveillance-systems/)

6.2. **Sustainability of Shipping in Malaysian Waters**

Malaysian waters are home to several important marine ecosystems, including coral reefs, mangroves, and seagrass beds, which are vital for maintaining biodiversity and supporting the livelihoods of coastal communities. However, climate change and international shipping pose significant threats to these ecosystems as they impacted marine and coastal environment.

To promote sustainable shipping practices and reduce the environmental impact of the industry, thus, Malaysia took the initiatives to involve in the International Maritime Organisation (IMO)’s Green Voyage 2050 project as illustrated in the Figure 8. The project is initiated by the Norwegian Ministry of Climate and Environment with participation of some IMO’s member states including Malaysia through the Ministry of Transport and the Marine Department. Among these initiatives are measures to
reduce greenhouse gas emissions from shipping, such as promoting the use of alternative fuels and adopting energy-efficient technology.\textsuperscript{20}

![Figure 8: Malaysia's Participation in the International Maritime Organisation (IMO) Green Voyage 2050](image)

\textit{Source: The Ministry of Transport, Malaysia}

7. Malaysia's Commitment to Enhance the Safety of Navigation & the Sustainability of Shipping

Malaysia's commitment to enhance the safety of navigation and sustainability of shipping as evident through ratification of the IMO conventions, establishment of the MMEA, and investment in sustainability of shipping. These efforts aim to ensure the safety and security of maritime traffic and protect the country's marine environment. Malaysia has made significant efforts to realise these commitments can be described as below:

\textsuperscript{20} https://www.malaymail.com/news/malaysia/2021/11/10/
7.1. **Safety of Navigation in the Strait of Malacca**

To enhance the safety in the Strait of Malacca, Malaysia ensures vessels passing through this important sea lane of communication are complying to the International Maritime Organisations (IMO)’s conventions related to navigation safety such as the International Convention for the Safety of Life at Sea (SOLAS), the International Ship and Port Facility Security Code (ISPFS), and the International Convention on Standards of Training, Certification and Watchkeeping for Seafarers (STCW). For enforcing maritime laws in the Strait of Malacca, the Malaysian Maritime Enforcement Agency (MMEA) monitors and regulates maritime traffic and respond to any incidents that may occur in the strait. Photo of the Malaysian Maritime Enforcement Agency (MMEA) Vessels patrolling in the Strait of Malacca is shown in the Figure 9 below:

![Image of Malaysian Maritime Enforcement Agency Vessels](FAZALUMAR.png)

Figure 9: The Malaysian Maritime Enforcement Agency (MMEA) Vessels in the Strait of Malacca

*Source: The Malaysian Maritime Enforcement Agency (MMEA)*

For better coordination of enforcement of maritime law on navigational safety and sustainability of shipping, Malaysian Maritime Enforcement Agency (MMEA) also working closely with the Royal Malaysian Navy (RMN) and the Malaysian Marine Department and enforcement agencies of other littoral states through its regional commands and bases as shown in the Figure 10 below:
To effectively monitor vessel traffic operating in the Strait of Malacca, Malaysia invested in modernizing its navigational aids and technology, including the development of a Vessel Traffic Management System (VTMS).\(^2\) The VTMS relies on various data from radar, the automatic identification system (AIS), the Global Navigation Satellite System (GNSS), VHF radio communication, CCTV and weather monitoring system combined to provide real-time vessel tracking and monitoring capabilities of vessels passing the strait.

Figure 11 depicts a typical Vessel Traffic Management System (VTMS) system in operation to track in real time and monitor positions of vessels using the radar, AIS, GNSS, VHF radio communication, CCTV and weather monitoring system:

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\(^2\) https://rds.co.in/marine/
Despite Malaysia’s commitments to enhance the safety of navigation through enforcement of maritime law and tracking of vessels by the Vessel Traffic Management System (VTMS), major marine incidences such as ship fires and groundings happened in Malaysian waters in the recent years. As an example, in May 2023, a fire broken out on of a Gabon-registered tanker heading towards Singapore from China at 37.5 nautical miles northeast of Tanjung Sedili in Malaysian waters. The incident resulted in three missing crew. The photo of the tanker engulfed in fire is depicted in the Figure 12 below:

Figure 12: Photo of a tanker engulfed in fire in the Malaysian waters
For the safety of navigation in the future, the autonomous shipping technologies are expected to minimise the occurrence of incidents at sea and eliminate needless voyages which will be illustrated in the Figure 14.

7.2. **Sustainability of Shipping**

Malaysia has taken steps to address environmental sustainability through the adoption of various policies and acts as below:

a. **The National Policy on Climate Change.** The national policy on climate change in Malaysia, known as the National Policy on Climate Change, was launched on July 24, 2009. The policy was introduced by the Malaysian government as a comprehensive policy framework to address climate change issues, promote sustainable development, and mitigate greenhouse gas emissions in the country. It aimed to provide a strategic direction for climate change-related initiatives and actions across various sectors in Malaysia.

b. **The National Biodiversity Initiatives.** Even though does not have a specific national biodiversity policy, Malaysia has implemented various initiatives to protect its biodiversity and natural resources. These initiatives outline the conservation and sustainable management of Malaysia's biodiversity, but they are not standalone national biodiversity policies.

c. **The Renewable Energy Act (REA).** The REA was enacted in April 2011 to provide a legal framework for the development, promotion, and utilization of renewable energy in Malaysia. It established the Sustainable Energy Development Authority (SEDA) as the governing body responsible for administering and implementing the Act. The REA aims to increase the share of renewable energy in Malaysia's energy mix, attract investments in renewable energy projects, and promote sustainable development.

To promote coastal environmental sustainability and mitigate the impact of climate change, the relevant agencies in Malaysia collaborate with the International Maritime Organisation (IMO) and other regional intergovernmental organisations for protecting the marine environment, supporting sustainable development, and ensuring a prosperous future for coastal communities.
Despite various steps to address environmental sustainability through the adoption of various policies such as the National Policy on Climate Change, the Renewable Energy Act (REA) and the National Biodiversity Initiatives, ship collisions and marine pollutions still happened in the Malaysian waters.

In July 2022, an oil spill occurred when the UK-flagged containership Zephyr Lumos collided with the Maltese-flagged bulk carrier Galapagos some 14 nautical miles off Kuala Sungai in the Strait of Malacca. The containership’s bow struck the bulk carrier’s starboard side, causing a hull breach that then caused a yet-undetermined quantity of oil to leak into the surrounding waters. Fortunately, no injuries have been reported on either vessel. Figure 13 shows an oil spill from a tanker’s collision in the Strait of Malacca:

![Image of oil spill](https://www.bairdmaritime.com/ship-world/boxship-world/oil-spill-sighted-in-strait-of-malacca)

Figure 13: Photo of an oil spill from a tanker’s collision in the Strait of Malacca

In the future, the autonomous shipping technologies will be able to reduce environment impact through the use of alternative energy and reduced emissions which will be have positive impact on the sustainability of shipping to be illustrated in the Figure 14.

8. Potential Impact of Autonomous Shipping in Malaysia

From a long-term perspective, the autonomous ship is expected to bring about navigation safety, sustainability of shipping, economic, technological, social, seafarers
and legal impacts in shipping such as reform workstyles in ocean transport, reduce workload on crew members, reduce logistics costs as illustrated in the Figure 14 below:

Figure 14: An Illustration of Long-Term Impact of Autonomous Shipping

Source: https://www.mol.co.jp

In Malaysia, however, the surveys with stakeholders in shipping sector through the online questionnaires (as attached in the Annex A of this report) revealed that the main impact of the autonomous shipping technologies are the improved navigation safety and the enhanced sustainability of shipping. In additional, there are also other potential threat such as cybersecurity vulnerabilities and the current weakness of regulatory framework on autonomous shipping that needs to be addressed to ensure the safe and sustainable adaptation of these technologies.

8.1. Improved Safety of Navigation

The potential impact of innovative autonomous shipping on safety of navigation could be both positive and negative. The autonomous shipping potentially improves the safety of navigation by reducing human errors, providing better situational awareness, and improving response time. By using advanced sensors, computer systems, and artificial intelligence (AI), autonomous ships can navigate more accurately and avoid collisions with other vessels, obstacles, or hazards. This could help prevent accidents and reduce the risk of environmental damage caused by oil
spills or other incidents. However, there are other potential risks and challenges to this technology. Their positive and negative impact are described as below:

8.1.1. Positive impact:

a. **Reduced human error**: Autonomous ships are expected to reduce human errors, which are the primary cause of maritime accidents, by replacing human crew with advanced sensors, artificial intelligence, and automation.

b. **Better situational awareness**: Autonomous ships are equipped with advanced sensors that provide a more comprehensive and accurate view of the ship's surroundings, including weather, currents, and other ships' positions, which could help avoid collisions.

c. **Improved response time**: Autonomous ships can respond faster to changing conditions because they are equipped with advanced technology, and the decision-making process is more automated, reducing the time required to assess the situation and take action.

8.1.2. Negative impact:

a. **Cybersecurity risks**: Autonomous ships are vulnerable to cyber-attacks, which could disrupt their navigation and cause safety hazards.

b. **Lack of human oversight**: Autonomous ships rely on advanced technology, which could fail, and in the absence of human oversight, this could lead to dangerous situations.

c. **Regulatory challenges**: There is currently no comprehensive and limited regulatory framework for autonomous ships, and legal issues regarding liability in case of accidents involving autonomous ships remain unresolved.

8.2. **Enhanced Sustainability of Shipping**

Like any green initiative, the autonomous shipping could both positively and negatively impact the environmental sustainability and climate change. While the
autonomous shipping potentially improves coastal environmental sustainability and mitigate climate change by reducing emissions and increasing the use of renewable energy, the technology poses potential risks and challenges to the environment. Their positive and negative impact are as described below:

8.2.1. Positive impact:

a. **Reduced emissions**: Autonomous ships are expected to be more energy-efficient than traditional ships, as they can optimize their speed and route, leading to a reduction in greenhouse gas emissions and air pollution.

b. **Increased use of renewable energy**: Autonomous ships can be designed to run on renewable energy sources, such as solar or wind power, reducing reliance on fossil fuels.

c. **Improved coastal monitoring**: Autonomous ships equipped with sensors and data analytics can help monitor and detect changes in coastal environments, such as water quality, pollution levels, and marine life, helping to improve sustainability.

8.2.2. Negative impact:

a. **Potential for environmental accidents**: Autonomous ships may be more vulnerable to accidents, such as oil spills or collisions, which could have severe impact on the environment.

b. **Disruption of marine life**: The noise generated by autonomous ships may have adverse effects on marine life, disrupting their migration patterns and causing stress and harm.

c. **Limited regulatory framework**: The current regulatory framework for autonomous shipping is limited, and there is a risk that environmental regulations could be overlooked or inadequately enforced.
8.3. **The Strength, Weakness, Opportunity & Threat (SWOT) Analyses for Impact of Autonomous Shipping on Shipping in Malaysia**

To further study the significance of these positive and negative impact of autonomous shipping on shipping in Malaysia, two sets of **Strength, Weakness, Opportunity & Threat (SWOT) Analysis** were carried out in this project. The SWOT Analysis for its impact on the *safety of navigation* and the *sustainability in shipping* in Malaysia are respectively described in **Table 1** and **Table 2** below:

**Table 1: The SWOT Analysis for the potential impact of Autonomous Shipping on the Safety of Navigation in Malaysia**

<table>
<thead>
<tr>
<th><strong>Strengths:</strong></th>
<th><strong>Weaknesses:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Safety improvement:</strong></td>
<td>Lack of human oversight: Potential for technology failures that may lead to dangerous situations.</td>
</tr>
<tr>
<td>Significantly reduce human errors &amp; improve safety of navigation and a decreased risk of collisions.</td>
<td><strong>Regulatory challenges:</strong> The lack of a comprehensive regulatory framework poses challenges in addressing liability and safety standards.</td>
</tr>
<tr>
<td><strong>Enhanced situational awareness:</strong> A Better awareness of their surroundings, enabling them to avoid collisions.</td>
<td><strong>Limited Regulatory Framework:</strong> Requires adequate regulatory framework to regulate safety of navigation of autonomous shipping.</td>
</tr>
<tr>
<td><strong>Faster response time:</strong> Quick respond to changing conditions and make decisions.</td>
<td><strong>Opportunities:</strong></td>
</tr>
<tr>
<td><strong>Threats:</strong></td>
<td><strong>Environme ntal sustainability:</strong> Optimize routes, speeds, and fuel consumption, leading to reduced emissions &amp; improved environmental sustainability.</td>
</tr>
<tr>
<td><strong>Public acceptance:</strong> The acceptance by the public and maritime stakeholders may pose a challenge, as they are concerned about safety, job displacement, and loss of human oversight.</td>
<td><strong>Real-time risk management:</strong> Advanced technology enables autonomous ships to collect and analyse environmental data, respond to risks promptly, and mitigate potential accidents or environmental damage.</td>
</tr>
<tr>
<td><strong>Cybersecurity vulnerabilities:</strong> Susceptible to cyber-attacks and pose safety and security risks.</td>
<td><strong>Economic implications:</strong> The implementation of autonomous shipping may impact the job market for maritime personnel, requiring measures for retraining and transition.</td>
</tr>
</tbody>
</table>
Table 2: The SWOT Analysis for the potential impact of Autonomous Shipping on the Sustainability of Shipping in Malaysia

<table>
<thead>
<tr>
<th>Strengths:</th>
<th>Weaknesses:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Reduced emissions:</strong> Autonomous ships can optimize routes and speeds based on real-time data, leading to reduced fuel consumption and greenhouse gas emissions.</td>
<td><strong>Potential for environmental accidents:</strong> Although autonomous ships can enhance safety through reduced human error, the risk of accidents such as oil spills or collisions still exists.</td>
</tr>
<tr>
<td><strong>Increased use of renewable energy:</strong> Autonomous ships reduces reliance on fossil fuels, further reducing emissions and promoting a shift towards cleaner energy options.</td>
<td><strong>Disruption of marine life:</strong> The noise generated by autonomous ships can have adverse effects on marine life, including disturbance to migration patterns.</td>
</tr>
<tr>
<td><strong>Improved coastal monitoring:</strong> Autonomous ships can provide real-time monitoring of coastal environments. This enables better understanding of water quality, pollution levels, and marine life.</td>
<td><strong>Limited regulatory framework:</strong> The current regulatory framework is still evolving and may not sufficiently address environmental sustainable practices and proper enforcement when autonomous vessels are emerging.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opportunities:</th>
<th>Threats:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Improved environmental sustainability:</strong> Presents an opportunity to significantly reduce emissions and improve energy efficiency in the shipping industry.</td>
<td><strong>Potential environmental accidents:</strong> Oil spills, collisions, or other incidents involving autonomous ships can impact on marine ecosystems, coastal areas &amp; biodiversity.</td>
</tr>
<tr>
<td><strong>Real-time monitoring and response:</strong> Allow for more effective monitoring and response to environmental risks, such as oil spills, or other ecological threats.</td>
<td><strong>Disruption of marine ecosystems and wildlife:</strong> The noise generated can disrupt marine ecosystems, affecting the behaviour &amp; migration patterns of marine life.</td>
</tr>
<tr>
<td><strong>Advancements in sustainable technology:</strong> Provides an impetus for advancements in sustainable technology such as more energy-efficient designs, and innovative solutions to minimize the environmental footprint of shipping operations.</td>
<td><strong>Inadequate enforcement of environmental regulations:</strong> The lack of a comprehensive regulatory framework poses challenges in ensuring proper enforcement of environmental standards.</td>
</tr>
</tbody>
</table>
8.4. Findings of the Strength, Weakness, Opportunity & Threat (SWOT) Analyses

From the Strength, Weakness, Opportunity & Threat (SWOT) analysis on the safety of navigation, the potential impact of autonomous shipping in Malaysia shows several strengths, such as safety improvements and enhanced situational awareness, along with opportunities for environmental sustainability and real-time risk management. However, weaknesses related to cybersecurity vulnerabilities, lack of human oversight, and regulatory challenges should be carefully addressed to mitigate potential risks. Additionally, threats such as public acceptance and economic implications require proactive measures to ensure successful implementation.

From the Strength, Weakness, Opportunity & Threat (SWOT) analysis on the sustainability of shipping, while autonomous shipping presents significant opportunities for improving sustainability of shipping, there are also weaknesses and threats that must be addressed. Minimizing the risk of environmental accidents, mitigating disruption to marine life, and establishing comprehensive and enforceable regulatory framework are essential to ensuring the safe and sustainable implementation of autonomous shipping practices.

The findings of these SWOT analyses show that there are four key challenges of autonomous shipping which have significant impacts in both the safety of navigation and the sustainability of shipping in Malaysia (as marked in blue). These key challenges are improved safety of navigation (strength), reduced environmental impact (opportunity), increasing cybersecurity risks (threat), and limited regulatory framework (weaknesses) as described below.

a. Improved Safety of Navigation (Strength in the Safety of Navigation)

1) Autonomous shipping reduces the risk of human error
2) Advanced sensors, computer systems, and AI can enhance navigation safety
3) Improved efficiency and reduced costs
4) Need to improve the existing Vessel Traffic Management System (VTMS) to track autonomous shipping
b. Reduced Environmental Impact (Opportunity in the Sustainability of Shipping)
   1) Autonomous shipping can reduce greenhouse gas emissions
   2) Use of alternative fuels and energy-efficient technology
   3) Potential for better management of marine ecosystems and reduced pollution

c. Increasing Cybersecurity Risks (Threat in the Safety of Navigation)
   1) Autonomous ships are vulnerable to cyberattacks
   2) Threats to safety and security protection
   3) Need for strong cybersecurity measures and regulations

d. Limited Regulatory Framework (Weakness in both the Safety of Navigation and the Sustainability of Shipping)
   1) Limited regulatory framework on autonomous shipping poses a challenge
   2) Need for international regulations such as the IMO’s MASS Code to ensure safe and sustainable implementation
   3) Malaysia can work with other countries to collaborate on autonomous shipping

9. Recommendations for Malaysia to Prepare for the Emergence of Autonomous Shipping

The Malaysia is to prepare for the emergence of autonomous shipping, focusing on the safety of navigation, sustainability, cybersecurity, regulatory framework, and regional collaborations. The recommendations to enhance safety of navigation include developing regulations and guidelines, investing in training and education, establishing a monitoring system, collaborating with international organizations, and conducting regular safety assessments. The recommendations to improve sustainability of shipping include developing a sustainable shipping strategy, encouraging the use of clean energy sources, developing a waste management system, promoting sustainable port infrastructure, and collaborating with stakeholders. Additionally, Malaysia may have to mitigate the cybersecurity risks, enhance regulatory framework and collaborate with international organizations and countries to prepare for the potential impact of autonomous shipping.
9.1. Safety of Navigation

As autonomous shipping becomes more prevalent in Malaysia's waters, the government should take proactive measures to ensure the safety of navigation. Below are some recommendations for the government to prepare for the potential impact of autonomous shipping in terms of safety of navigation:

a. **Develop regulations and guidelines**: The government should establish regulations and guidelines for autonomous ships operating in Malaysian waters based on the International Maritime Organisation (IMO)’s Maritime Autonomous Surface Ship (MASS) Code. These regulations should cover aspects such as communication protocols, collision avoidance systems, emergency response procedures, and cybersecurity measures.

b. **Invest in training and education**: The government should invest in training and education programs to equip mariners, port operators, and other stakeholders with the skills and knowledge necessary to work with autonomous ships. These programs should cover topics such as autonomous technology, safe navigation practices, and emergency response procedures.

c. **Improve monitoring system**: The government should improve the Vessel Traffic Management System (VTMS) a monitoring system to track the movements and activities of autonomous ships in Malaysian waters. This would enable authorities to detect any potential safety issues or violations of regulations and take appropriate actions.

d. **Collaborate with international organizations**: The government should collaborate with international organizations such as the International Maritime Organization (IMO) to develop global standards and best practices for autonomous shipping. This would help ensure that Malaysia's regulations and guidelines are aligned with international standards and facilitate the safe and efficient operation of autonomous ships in Malaysian waters.
e. **Conduct regular safety assessments**: The government should conduct regular safety assessments of autonomous ships operating in Malaysian waters. These assessments should evaluate the performance of autonomous technology, identify potential safety risks, and make recommendations for improvement.

9.2. **Sustainability of Shipping**

As the possibility of autonomous shipping becomes more imminent in Malaysia's waters, the relevant governmental agencies should take proactive measures to mitigate the potential impact of autonomous shipping on **coastal sustainability**, **marine pollution**, and **climate change**. Below are some recommendations for the government to prepare for the potential impact of autonomous shipping in these areas:

a. **More stringent enforcement on environmental laws**: The government should carry out more stringent enforcement by the Malaysian Maritime Enforcement Agency (MMEA) to reduce the environmental impact of shipping activities in Malaysian waters. The enforcement agency should have a contingency plan if autonomous shipping emerges in the vicinity in the future.

b. **Encourage the use of clean energy sources**: The government should incentivize the use of clean energy sources such as electric power, hydrogen fuel cells, and renewable energy sources in autonomous ships operating in Malaysian waters. The potential impact of autonomous shipping, both positively and negatively, will serve as a good reason for the country to reduce the carbon footprint of shipping activities and contribute to mitigating climate change.

c. **Promote sustainable port infrastructure**: The government should promote the development of sustainable port infrastructure that reduces the environmental impact of shipping activities. The potential emergence of autonomous shipping serves as a catalyst for the country to build sustainable port infrastructure such as shore supply using alternative energy and implementing green transportation systems.
d. **Collaborate with stakeholders**: The government should collaborate with stakeholders such as the shipping industry, environmental organizations, and local communities to develop and implement sustainable shipping practices. This would help ensure that Malaysia's sustainable shipping strategy is aligned with the needs and priorities of all stakeholders and benefiting from the impact of autonomous shipping.

### 9.3. Mitigating Cybersecurity Risks

In Malaysia, the **Cyber Security Malaysia (CSM)** and the **National Cyber Security Agency (NACSA)** play a central role in developing and maintaining a robust and dynamic security framework in the country. The government also developed a **National Cyber Security Policy (NCSP)** and the **Malaysia Cyber Security Strategy (MCSS) 2020 – 2024** to strengthen its cybersecurity domain.

In the Strait of Malacca, the **Vessel Traffic Management System (VTMS)** based in Port Klang serves as a good monitoring system for vessels passing through this busy sea lane. However, as the Vessel Traffic Management System (VTMS) relies on data from various sources, such as the automatic identification systems (AIS), and the Global Navigation Satellite System (GNSS) are combined to obtain necessary information to position, monitor and track ships, the system could be interfered by **jamming** and **spoofing** by hackers. Without functioning Vessel Traffic Management System (VTMS), collision may occur in this busy strait.\(^{22}\) Figure 15 below depicts a typical Vessel Traffic Management System (VTMS) control centre:

As autonomous vessels are equipped with sophisticated equipment and sensors, the emergence of these vessels in the Strait of Malacca poses potential challenges to the existing Vessel Traffic Management System (VTMS). In anticipating the cybersecurity threats, it is essential for Malaysia to invest in the following measures to counter the risks:

a. Enhance the existing Vessel Traffic Management System (VTMS) monitoring system on cybersecurity to counter autonomous ships’ vulnerability to cyberattacks.

b. Promote information-sharing on cybersecurity to prevent threats to safety and security protection.

c. Establish a regional task force on mitigating cybersecurity risks to strengthen for strong cybersecurity measures and regulations.

d. Coordinate training on countering cybersecurity measures.

9.4. Enhancing Regulatory Framework

As autonomous shipping becomes more prevalent in the region, Malaysia's government should collaborate with regional organizations and nations to prepare for the potential impact of autonomous shipping in terms of safety of navigation, coastal
sustainability, marine pollution, and climate change. Below are some recommendations for the government to collaborate with regional organizations and nations in these areas:

a. **Enhance regulatory framework with international organisations on safety of navigation & sustainability of shipping**: Malaysia's government should further enhance regional collaboration with organizations such as the Association of Southeast Asian Nations (ASEAN), the Indian Ocean Rim Association (IORA), the Asia-Pacific Economic Cooperation (APEC), the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) and the International Maritime Organization (IMO) to share knowledge, expertise, and best practices on autonomous shipping. This would enable Malaysia to learn from the experiences of other countries and contribute to the development of regional regulations and guidelines.

b. **Collaborate with international organizations to develop global standards**: Malaysia's government should collaborate with regional organizations and nations to improve and integrate their Vessel Traffic Management System (VTMS) monitoring systems to track the movements and activities of autonomous ships in the region. This would enable authorities to detect any potential safety issues or violations of regulations and take appropriate actions.

c. **Promote Information-sharing**: Malaysia’s government should promote information-sharing among regional organizations and nations to share data and information on autonomous shipping. This would facilitate the development of regional regulations and guidelines and enable authorities to detect and respond to safety issues in a timely manner.

d. **Collaborate with stakeholders to develop and implement safe & sustainable shipping practices**: Malaysia’s government should collaborate with regional organizations and nations to develop and implement safe & sustainable shipping practices to address the potential impact of autonomous shipping on coastal sustainability, marine pollution, and climate change. The
task force should develop strategies and measures to mitigate the impact of autonomous shipping on the environment and local communities.

e. **Coordinate Research and Development in Autonomous Shipping Technology**: Malaysia’s government should collaborate with regional organizations and nations to coordinate research and development on autonomous shipping technology. This would facilitate the development of new technology and solutions to mitigate the environmental impact of shipping activities in the region.

10. **Strategies to develop a National Framework for Autonomous Shipping in Malaysia**

To prepare for the emergence of autonomous shipping, it is recommended that Malaysia is to develop a national framework on its adoption of technology and align its regulatory framework with the International Maritime Organisation (IMO)’s **Maritime Autonomous Surface Ships (MASS) Code** on autonomous ships expected to be made mandatory compliance in 2028. The strategy of this framework should include investing in technological infrastructure, enhance navigation safety, promote sustainable shipping, develop a skilled workforce and foster collaboration as described as below:

a. **Invest in Technological Infrastructure**: Malaysia should invest in the necessary technological infrastructure to support the development and operation of autonomous ships, including satellite communications, positioning systems, and cybersecurity. This infrastructure should be developed in partnership with the private sector, academia, and international organizations.

b. **Enhance Navigation Safety**: Malaysia should enhance navigation safety by promoting the use of advanced technology such as collision avoidance systems, electronic chart displays, and automated identification systems. This technology should be integrated with Malaysia's existing maritime infrastructure, such as the **Vessel Traffic Management System (VTMS)**, to ensure seamless communication between autonomous and manned vessels.
c. **Promote Sustainable Shipping**: In anticipating the emergence of autonomous shipping, Malaysia should continue to promote sustainable shipping practices by encouraging the use of low-emission fuels, such as liquefied natural gas (LNG) and biofuels. Malaysia should also promote the use of energy-efficient technology, such as hull coatings and propellers, to reduce fuel consumption and greenhouse gas emissions.

d. **Develop a Skilled Workforce**: In anticipating the emergence of autonomous shipping, Malaysia should develop a skilled workforce to support the development and operation of autonomous ships. This workforce should include seafarers with specialized training in autonomous ship technology and cybersecurity, as well as engineers, data analysts, and other professionals with expertise in the design, development, and maintenance of autonomous ships.

e. **Foster Collaboration**: Malaysia should foster collaboration with other countries, international organizations, and the private sector to promote the safe and sustainable development of autonomous shipping. This collaboration should include sharing best practices, exchanging information on emerging technology, and developing common standards and guidelines for the safe and sustainable operation of autonomous ships.

11. **Recommendations for the Asia-Pacific Region to Prepare for the Emergence of Autonomous Shipping**

The emergence of autonomous shipping technology requires Asia-Pacific region to prepare by establishing regulations and guidelines that address safety, security, privacy, and liability issues. Investing in research and development, creating a skilled workforce, developing supportive infrastructure, encouraging collaboration and partnerships, and promoting public awareness are also essential. Governments, research institutions, private organizations, and stakeholders in the shipping industry should work together to accelerate the adoption of autonomous shipping technology and ensure their safe and responsible deployment.
Below are some recommendations for Asia-Pacific countries to prepare for the emergence of innovative autonomous shipping technology:

a. **Establish regulations and guidelines**: Asia-Pacific region should establish regulations and guidelines to govern the deployment of autonomous shipping technology. These regulations should address safety, security, privacy, and liability issues which is aligned to the International Maritime Organisation (IMO)'s Maritime Autonomous Surface Ships (MASS) Code.

b. **Invest in research and development**: Governments, research institutions, and private organizations in the Asia-Pacific region should invest in research and development of autonomous shipping technology to accelerate their adoption and improve their safety and reliability.

c. **Develop a skilled workforce**: Countries in the Asia-Pacific region should focus on developing a skilled workforce that can operate and maintain autonomous shipping systems. This includes training programs, certification courses, and incentives for professionals in the field.

d. **Create supportive infrastructure**: To support autonomous shipping technology, countries in the Asia-Pacific region need to develop infrastructure such as ports, berths, navigation aids, and communication systems that are compatible with this technology.

e. **Encourage collaboration and partnerships**: International organisations such as the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) are to encourage collaboration and partnerships among stakeholders in the maritime industry, including shipowners, technology providers, port operators, and regulators. This will help to accelerate the adoption of autonomous shipping technology and ensure that they are deployed in a safe and responsible manner.

f. **Promote public awareness**: International organisations and governments should promote public awareness of autonomous shipping technology to
ensure that people in the region understand the benefits and potential risks associated with this technology.

12. Conclusion

In conclusion, the report highlights the challenges and issues associated with autonomous shipping technology in the Asia-Pacific region, with a specific focus on Malaysia. The report recommends that Malaysia develop a national framework to address the impact of autonomous shipping on navigation safety, sustainability, cybersecurity risks, regulatory framework and collaboration with international organisations. The strategy of the framework should include investments in infrastructure, efforts to enhance navigation safety, promotion of sustainable practices, development of a skilled workforce, and collaboration with international organisations and countries in the region.

In preparing the unfolding of the autonomous shipping, it is crucial for Malaysia to prioritize safety of navigation and sustainability of shipping as it embraces autonomous ships. By aligning its regulatory framework with the International Maritime Organization (IMO)'s Maritime Autonomous Surface Ships (MASS) Code expected to be made mandatory compliance in 2028, Malaysia can integrate autonomous shipping technology into its maritime industry and leverage the opportunities presented by this technology while effectively addressing regulatory and safety challenges. With a comprehensive framework in place and collaboration with regional partners, Malaysia can position as a leader in the adoption and implementation of autonomous shipping, contributing to the advancement of the maritime industry in the region.

For the Asia-Pacific region, it is recommended that international organisations such as the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) is to establish regulations and guidelines, investing in research and development, develop a skilled workforce, create supportive infrastructure, encourage collaboration and partnership and promoting public awareness to prepare the region for the spring up of autonomous shipping.
Annex A: Project Questionnaires (Referred in the Paragraph 10 of this report)

*Questionnaires to engage stakeholders of a country on how and the readiness to face the challenges of the emergence of autonomous shipping, safety of navigation and sustainability*

The United Nations Economic and Social Commission for Asia and the Pacific (ESCAP) is implementing a project on ‘Improving the Safety of Navigation and the Sustainability of Shipping through the Introduction of Innovative Autonomous Shipping Technology in the Asia-Pacific Region.’

The project aims to address the above challenges by developing regional knowledge products and supporting national and regional implementation initiatives to facilitate the introduction of innovative autonomous shipping technology. The project involves five selected Southeast Asian and South Asian countries, namely India, Indonesia, Malaysia, Thailand and Vietnam with the ESCAP acts as the secretariat.

At the national level, the project aims to enhance our capacity in this area with a hope to develop national implementation plans in the respective country in the future. Malaysia, as a maritime nation strategically located in the centre of busy shipping route has strong incentives to introduce this technology due to current situation with maritime traffic congestion, maritime accidents and strains caused by the expected growth of the new innovative technology. These include some advances in their technical and legal for autonomous shipping.

Here, the project will mobilise the existing mechanisms for a regional dialogue on sustainable maritime connectivity to help Malaysia to consider a national approach to implementing autonomous shipping technology which, while complying with the future IMO standards, reflects the situation in the country as a maritime nation.

In the online survey of this project, below are the questionnaires to engage stakeholders in Malaysia’s shipping industry on their readiness to face the challenges of autonomous shipping in the future:

1. How familiar are you with the concept of autonomous shipping?
2. How do you think autonomous shipping will impact the maritime industry in our country?
3. How prepared do you think our country is to adopt autonomous shipping technology?
4. What are some of the potential benefits of using autonomous shipping, and how could they benefit our country?
5. What are some of the potential risks and challenges associated with autonomous shipping?
6. How do you think the safety of navigation could be impacted by autonomous shipping?
7. What steps do you think our country should take to ensure that the adoption of autonomous shipping is done safely and responsibly?
8. How do you think our country could support the development and deployment of sustainable autonomous shipping?
9. What are some of the key factors that need to be considered when developing regulations for autonomous shipping in our country?
10. What role do you think stakeholders should play in the development and implementation of autonomous shipping regulations and guidelines in our country?

Note:
1. This survey is conducted on-line through questionnaires interview with stakeholders in the shipping sector using google form.
2. The answers and feedback from the interviewees are collected on-line for the Strength, Weakness, Opportunity & Threat (SWOT) analyses for the potential impact of autonomous shipping on the Safety of Navigation and the Sustainability of Shipping.
3. Any additional feedback or comments can be emailed to the National Consultant of the project Cdr Ang Chin Hup (R) at cdr.angch@gmail.com