

# Capacity Building on Vessel Innovation Symposium to Combat Marine Debris

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APEC Ocean and Fisheries Working Group

March 2024



**Asia-Pacific  
Economic Cooperation**





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# **Capacity Building on Vessel Innovation Symposium to Combat Marine Debris**

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**March 2024**

APEC Project: OFWG 08 2021A

Produced by  
Dr. Handy Chandra  
Indonesia

For  
Asia-Pacific Economic Cooperation Secretariat  
35 Heng Mui Keng Terrace  
Singapore 119616  
Tel: (65) 68919 600  
Fax: (65) 68919 690  
Email: [info@apec.org](mailto:info@apec.org)  
Website: [www.apec.org](http://www.apec.org)

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## 1. Introduction

The maritime sector is very important for the APEC economy. Sustainable marine ecosystems provide food from fish, seaweed, and medical materials from coral reefs. A healthy marine ecosystem can also be used as a marine tourism location which encourages the creation of various jobs for many people in the APEC economy, such as ship operators, hotel operators, restaurants, dive guides, fishing services, and others.

Marine ecosystems are currently threatened by marine debris, such as floating plastic, nets, bottles, etc. Marine debris was found washed up in coastal areas, polluting the surrounding area, while some were carried far away into the Pacific Ocean. Marine debris poses a major threat to marine ecosystems, wildlife, and human health. This is a global problem that affects oceans, seas, and coastlines around the world. The accumulation of marine debris is primarily caused by inadequate waste management practices, inappropriate waste disposal, and inadequate infrastructure for waste collection and recycling. Many economies are addressing this problem with their own strategies, with most initiatives focused more on terrestrial areas, specifically land, coasts, or cities. Meanwhile, dealing with marine waste that leaks into the sea and ends up in remote areas requires special technology and collaboration between economies with the same paradigm to produce effective solutions.

Vessel innovation plays an important role in the fight against marine litter due to its potential for effective and efficient waste collection, detection, and management. Traditional manual methods of cleaning and disposing of rubbish have proven inadequate in dealing with the large amount of marine litter in our oceans. Ship innovation provides sustainable and appropriate technology and engineering solutions that can improve the ability to find, track, and remove waste from the marine environment. It also allows the development of specialized vessels designed for efficient debris management and disposal.

The APEC OFWG 08 2021A project aims to help the economy deal with marine debris by using innovative vessel concepts and operational models. A three-day symposium involving 21 APEC economies was held in Indonesia, focusing on vessel innovation concepts, fleet management and collaboration in international waters to tackle marine litter.

The aim of the vessel innovation capacity building was to equip individuals, organizations and communities with the knowledge, skills, and resources necessary to effectively utilize vessel innovation in the fight against marine litter, particularly in the APEC Economies. Through capacity building, stakeholders can gain a comprehensive understanding of the latest advances in vessel



innovation, such as new technologies for debris detection and removal, vessel design and engineering, waste management techniques, and sustainable disposal methods. Capacity building also focused on training and education during the symposium on identifying and collecting marine debris. By raising awareness about the impacts of marine debris and providing specialized training, capacity-building initiatives increase the sense of responsibility and accountability among stakeholders.

This symposium invited experts, contributors, and participants to discuss and develop APEC Guidelines documents regarding dealing with marine waste using waste collection vessels.

## **2. Objective**

The aim of this symposium was to help the economy deal with marine waste by using innovative ship concepts and operational models. The experts, contributors and participants were involved in the development of Guidelines and Recommendations for ship innovation, fleet management and collaboration in international waters to combat marine litter. The other benefit was supporting aspects of capacity building through research and innovation mandated in the APEC Roadmap on Litter Sea.

This project activity was divided into 2 main activities as follows

1. The Research Task:
2. Capacity Building on Vessel Innovation Symposium to Combat Marine Debris

## **3. The Research Report**

The research activities that have been carried out in this project are:

### **3.1. Survey the quantity of plastic waste stranded on small islands and waste generation on small islands.**

The research location was in the Karimun Jawa Islands in Central Java Province, Indonesia (see Figure 3.1 and 3.2). This survey aims to determine the amount of marine debris, types and sizes of marine debris, handling of marine debris and other indicators as input in the basic design of innovative waste collection vessels. Based on the data collected, there were two tons of household waste produced every day. This number does not include stranded marine debris. The collection and management of marine waste has become urgent, one of which was with the help of waste collection ships. From the survey results, it was decided that the initial capacity of the trash cans on the vessel was 5 tons.



**Figure 3.1** Location of Karimunjawa Islands (red colored mark)

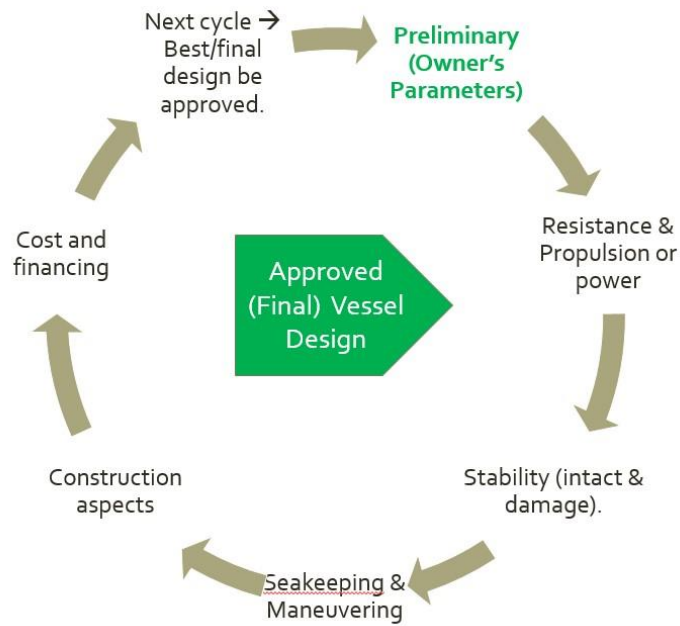


**Figure 3.2** Stranded marine debris in remote area of Karimunjawa (left), and Landfill facility with plastic waste shredder workshop (right)

**3.2. Develop a basic design of vessel innovation from Indonesia’s economic perspective. Including 2 (two) types of material for the vessel.**

In this activity, the basic design of the vessel innovation was carried out based on data collected from the survey results in the previous activity.

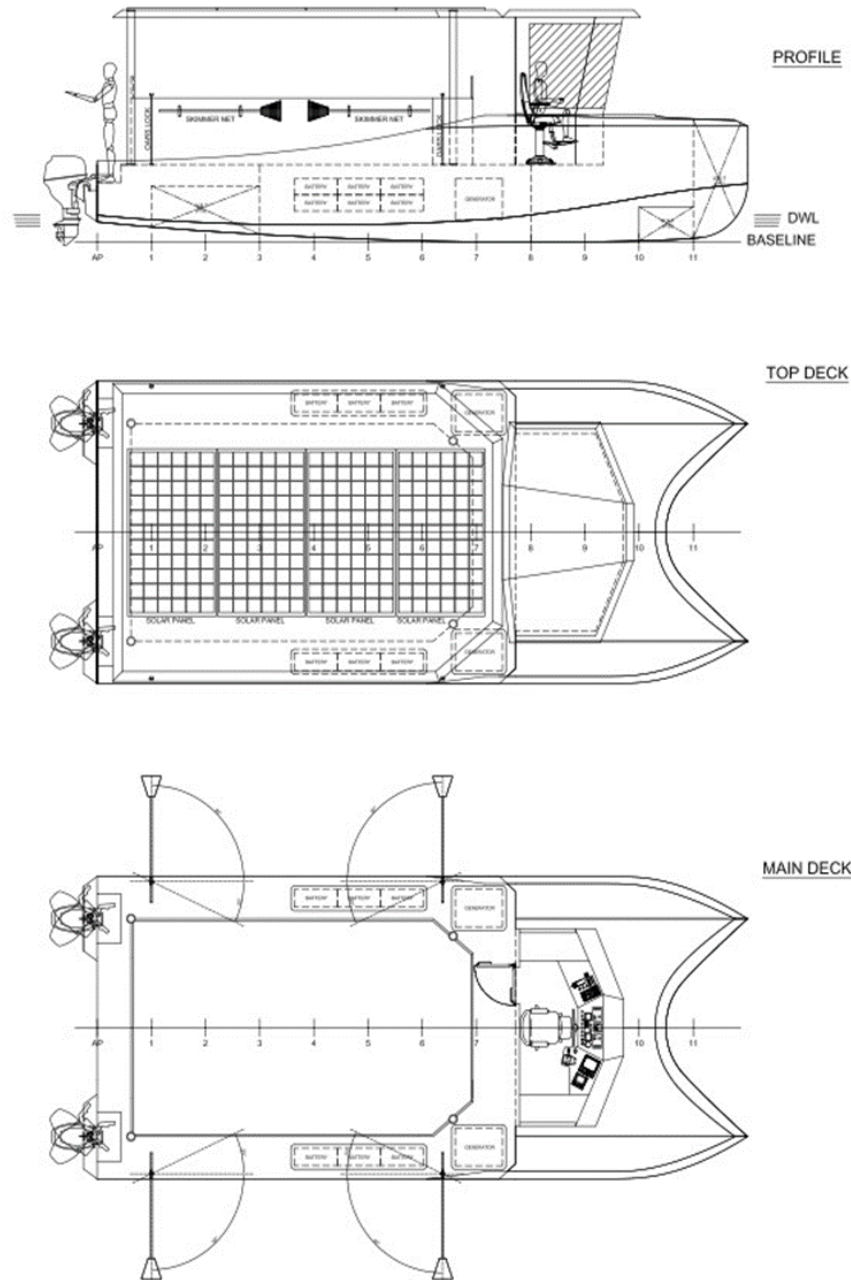
After carrying out the design cycle (as shown in Figure 3.3) for the best marine waste collection ship, the final design was obtained as in Figure 3.4. The first innovation was the bow (front) wheel position. This innovation was derived from discussions with a boat operator who uses a rear wheel position type and inhales waste gases during travel time.



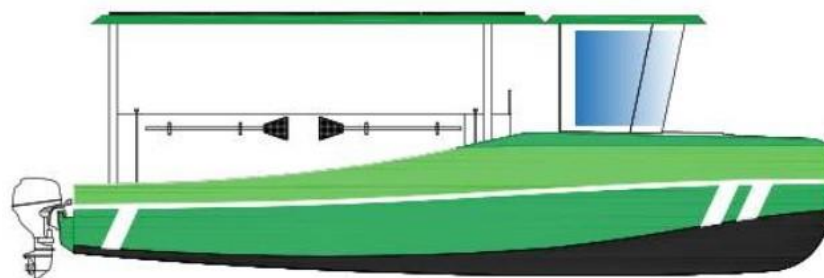
**Figure 3.3** The cycle of vessel design process

General Specifications & Dimensions:

Material	: Aluminum Construction
Total Capacity	: 5 Ton
Length O. A.	: 9.8 m
Depth	: 1.1 m
Beam	: 4.3 m
Draught	: 0.38 m
Solar Panel	: 2,840 Watt-Peak
Generator	: 8.5 Kva
Battery	: Lithium iron phosphate 48V 100 ah x 12 Unit
Service speed	: 8 knot
Max speed	: 10 knot
Engine power	: 2 x 14 hp
Type	: Outboard engine



**Figure 3.4** The basic design of Vessel innovation for collecting marine debris, by using electrical power (net zero emission). Hull material using aluminum.



**Figure 3.5** The vessel illustration side view.

### 3.3. The Guidelines and Recommendations

In accordance with the two previous activities, Initial Guidelines and Recommendations for Vessel Innovation to Combat Marine Debris were developed for discussion with economics experts at the symposium. It can be found in a separate report.

## 4. Capacity Building on Vessel Innovation Symposium to Combat Marine Debris Report

The Capacity Building on Vessel Innovation Symposium to Combat Marine Debris were divided into 2 (two) phases included:

**Phase 1**, the contractor together with the project supervisor has carried out preparatory work for the implementation of the symposium which includes:

- a) Prepare for the symposium, including identifying an event venue in Bali, Indonesia;
- b) Take an advance trip to survey the hotel venue and present the results to the Project Overseer (PO);
- c) Develop a list of speakers, experts, moderators, and participants for the symposium from APEC economies in collaboration with the PO team;
- d) Contact and invite the selected speakers, experts, moderators, and participants;
- e) Draft terms of reference for the symposium event;
- f) Draft and finalize the agenda for each session of the symposium;
- g) Disseminate the General Information Circular (GIC) for speakers and participants; and
- h) Compile presentation materials of the speakers.

**Phase 2**, Carried out Capacity Building on Vessel Innovation Symposium to Combat Marine Debris activities.

### Day 1 – Wednesday, 18 October 2023

#### Welcoming and Opening Ceremony

##### A. Event Report by Project Overseer

In his remarks, Project Overseers OFWG 08 2021A expressed his gratitude and honor to the participants for taking the time to attend this event. He presented a brief report view regarding the implementation of the Capacity Building on Vessel Innovation Symposium to Combat Marine Debris activities. He summarized a vision which mentioned in the Concept Note (CN) prepared on February 2021, which was the result of extensive research, analysis and collaboration within the APEC OFWG

with the aim to address pressing challenges in the APEC economic region. On July 2021, this Concept Note was endorsed by OFWG, and sponsored by Thailand and Chinese Taipei indicating their commitment to the team's shared vision. This support marks the first significant step towards realizing this project. Further in August 2021, this Concept Note was received and set the stage for the next phase. On May 2023, the OFWG 08 2021A contract was signed, formalizing the team's commitment and allowing it to take the final steps towards this symposium. On 18-20 October 2023 at the Truntum Kuta Hotel, Denpasar, Bali, Indonesia was the momentum to start the APEC OFWG Project Symposium 08 2021A. This symposium was attended by APEC Economies delegates, OFWG Indonesia focal point representatives, Ministry of Maritime Affairs and Fisheries (KKP), National Research and Innovation Agency (BRIN), the Ministry of Foreign Affairs (MFA), Marine Affairs and Fisheries of Bali Province, and the Environment Department of Bali Province, The SeaCleaners, and Speakers. In his speech, He conveyed his gratitude to the sponsoring economies, Thailand and Chinese Taipei, for their unwavering support and commitment to this project and also to the economies of People's Republic of China; Indonesia; Malaysia and Thailand who attended this event.

At the end of his remarks, he invited participants to embrace the spirit of this symposium by engage in meaningful discussions, share insights, and foster collaborations that would have a long-term impact and made the most of this opportunity and strive towards a more prosperous, sustainable and connected APEC community.

## **B. Opening Remarks from The National Research and Innovation Agency (BRIN) of The Republic of Indonesia**

The opening speech began with greetings and welcome to the honorable guest from APEC economy delegates and speakers who were able to attend this symposium in Bali. He explained how important a healthy marine ecosystem for the community. Pollution in marine ecosystems significantly threat the stability of marine ecosystems.

Marine debris is a persistent pollution problem throughout the oceans. The seas and waterways were polluted by a wide variety of marine debris, from tiny microplastics to abandoned ships. Marine debris can injure or kill marine and coastal wildlife; destroying and degrading habitat; interfere with navigational safety; causing economic losses for the fishing and marine industry; reducing the quality of life of coastal communities; and threaten human health and safety. There were initiatives from many economies, in domestic, regional and global contexts, to prevent marine pollution and combat marine litter. For example, Indonesia has an Indonesian Action Plan regarding Marine Plastic Waste

2017-2025. ASEAN economies launched a Regional Action Plan to Combat Marine Litter in ASEAN Member Economies (2021-2025).

One of the combating marine debris measurements is the innovation in the form of development of vessel to combat marine debris. The event Capacity Building on Vessel Innovation Symposium to Combat Marine Debris is very urgent with the hope that it will have a fruitful discussion and knowledge exchanges during this three-day symposium. After three days symposium we should have a formulated guidelines and recommendation document for marine debris countermeasures on the sea, coastal and small islands with vessel innovation, fleet management and collaboration in international waters.

BRIN supports research collaborations, which can use already established platforms, such as an open platform scheme, researcher mobility, researcher exchange, as well as research grants.

BRIN has three functions;

- The first one is the policy provider in form of policy papers - with policy recommendations based on the results of research and innovation - which should be submitted to ministries/governmental agencies.
- The second one is a funding agency. BRIN has several schemes of research grants to support research activities for Indonesian researchers (not only for BRIN researchers but also for researchers in universities and companies).
- The third one is the executing agency in which have 12 Research Organizations with 85 Research Centers.

In order to enhance ecosystem research and innovation in Indonesia, BRIN has established three strategic pillars:

1. Open platform infrastructure: BRIN provides sufficient research and innovation facilities and infrastructures for both BRIN and external researchers and innovators. Collaboration with BRIN's researchers will provide access for external researchers and innovators to these resources.
2. Researcher mobility: BRIN encourages the mobility of researchers, particularly in developing young talents. Scholarships are available to support Master's and PhD students through degree-by-research programs. Additionally, we offer research assistantships, postdoctoral fellowships, visiting researcher programs, and visiting professorships.
3. Research and innovation facilitation scheme: As a funding agency, BRIN offers various research grants to support Indonesian researchers, including grants for research-based start-up companies.

However, these grants are awarded through competitive selection processes to ensure the quality of research.

This symposium were looking forward to the extraordinary results of this symposium which it would have a positive impact on marine ecosystem in the future.

### C. Opening Ceremony and Photo Group Session

The workshop was officially opened by Head of Economy and International Cooperation Bureau, Director of Environment, Maritime, Natural Resources, and Nuclear Policy - National Research and Innovation Agency, Dr.Ing. Muhammad Abdul Kholiq, MSc., IPU together with Project Overseer OFWG 08 2021A, Dr. Handy Chandra, Director for Asia-Pacific and African Intra and Inter-regional Cooperation, Mr. Tyas Baskoro Heru Witjaksono Adji, and Director of Research Vessel Fleet Management, Deputy for Research and Innovation Infrastructure - National Research and Innovation Agency, Dr. Nugroho Dwi Hananto, M.Si. This session was followed by a group photo session with all the APEC economy delegations.



**Figure 4.1** Opening group photo session

#### 4.1. Presentations of guest speakers

##### A. SESSION 1: Marine Debris Sources, Mitigations, and Solutions

The speaker in this first session was Mrs. Chalutip Jonchompoo. She is Director of Marine and Coastal Resources Research Center (Upper Gulf of Thailand) Samutsakhon province. Her specialty is marine endangered species ecology and conservation. She directs the marine mammal stranding



and rehabilitation program along the eastern Gulf of Thailand. In this session she presented the topic of Sources, Mitigation and Solutions for Marine Waste.

There were 3 issues raised by Mrs. Chalutip Jonchompoo’s presentation, including:

1. Land based, Pathways of plastic waste in the marine environment

Estimated global amount of plastic entering the ocean from land sources in 2010 based on pathways from primary production to marine plastic input.

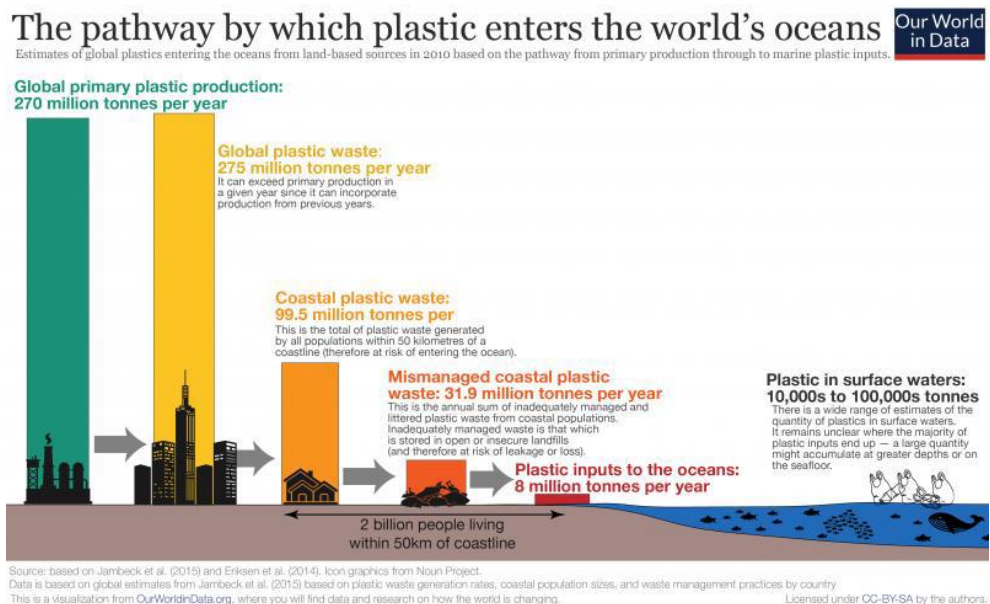


Figure 4.2 Pathways of plastic waste

2. Mitigations, and Solutions in Thailand

Thailand Roadmap on Plastic waste management



Figure 4.3 Thailand Roadmap on plastic waste management

### 3. Challenges in Thailand

Participation from government services, private companies, foundations, social enterprises and other civil society organizations in handling plastic waste



Figure 4.4 Thailand Roadmap on plastic waste management

The completed presentations can be found in the link

[https://drive.google.com/file/d/1WDNurvSRfrEcJDKlppV\\_FDvoctKVJIAq/view?usp=sharing](https://drive.google.com/file/d/1WDNurvSRfrEcJDKlppV_FDvoctKVJIAq/view?usp=sharing)

On the discussion session, participant were actively discussed regarding to this following.

Discussion on Waste Management in small island based on Thailand’s experience. Waste is big problem in Thailand. The plastic waste was transported from the island to the mainland. It is the provincial authority duty to manage their own waste in the area where the waste was generated. In the case of a small island, the best solution in the area with the approach by promoting the local community in the island, such as hotel/resort owner and island citizen to organize their own waste at the earliest stage before the waste were transported to the municipality. They organized it by listing the waste and measured. There is activity like operating a small incinerator However, air pollution become another problem from this operation. It is done by the local before it transported to mainland inside the province.

Regarding to the marine debris distribution has become a problem which occurred upon east and west monsoon season, Indonesia, in this case at Kuta Beach Bali also experienced it almost every year. One of research that has been done by researchers from Indonesia economy, Ms. Rinny Rahmania and Mr. Handy Chandra under the Ministry of Marine Affairs and Fisheries, foresee that

the seasonal pattern where the marine debris could be stranded to each area in Indonesia during the year. There is 92.5% of marine debris will be stranded inside the Indonesian territory but around 80% of marine debris will stranded in the beach in less than 6 months. Marine debris usually find stranded on Kuta Beach from October until March. It was verified by local informant that the source of this marine debris was not from local area. By using tracking tools of 22 drifters in Indonesia with one of these were drifted from Cisadane River. The buoys floated to Bali strait along with plastics waste from Northern Java. Model and prediction in economy level all over Indonesia had written in a book. It is found out on which season and month; the debris will be stranded in which area. This book will provide information to the local government to establish mitigation plan and its duration. This trans boundary issue urgently require collaboration between APEC economies to overcome this problem.

Thailand also has the same problem in both of monsoon. Inside area of the upper Gulf of Thailand who also affected but its distribution mainly in the Eastern Coastal and Southwest Coastal, monsoon marine debris would land on the beach. The Department of Marine and Coastal Resource (DMCR), Thailand, engaged with the local community, collected all the monsoon garbage and transported it to the mainland. It impacts marine life like small sea turtles and marine mammals. Affected by the monsoon marine debris is by-catch abandoned fishing gears.

Human behavior such as waste dumping to the river or beach, also experienced by Thailand. There are people who live resided along the river can be easily throwing garbage/waste to the river, even a big mattress for example. However, waste dumping activities to the river is illegal.

Thailand experienced a big flood 5 years ago and year 2022. The river mouth must be monitored if the volume of plastic is higher related to the capacity of runoff. There was a lot of illegal dumping, and it was hard to monitor. It is very difficult to protect the land from flooding. Thailand tries to do its best, if illegal dumping occurs, there was a penalty. However, in technical, protection in a wide water shed is still difficult. Local municipal will in charge in their jurisdiction, when this occurred, they know how to organize the water pathway before the raining season of runoff season. They will clear the water pathway to provide more run off high capacity. If the waste is loose down to river mouth, there was a set cage in the water gate that will hold the waste. Every water gate in Bangkok installed a debris fence to hold the waste running through the river mouth.

Thailand involved the partnership from the private sector due to the reason that the private sector more budget to support. Their involvement to the initiative were in short terms once a year. To maintain and keep the project more sustained in the long term, there are MOU (Memorandum of Understanding) for 5 years to do activities such like plantings mangrove forest, beach cleanup.

Together, public and private sector had strengthened the collaboration to manage plastic waste. The support by providing equipment and run the project operation such as hire the man hour and established a waste bank in the community. The waste has value by collecting and submitting it to the waste bank. It brings benefit to the local community and the waste can be used as source to produce a new product. There are 5 private company mostly in the oil company and plastic product in Thailand. The company know how to design the equipment, have the budget to design the vessel. This cooperation has benefited the government because they have the ability to create their own equipment to prevent the plastic waste.

The Public Private Partnership (PPP) which define from one of participant is a collaboration entity between public and the private sector, together provide funding to conduct the project and then pay back to the entity which owned by public and private, but in the case explained answer in point 4, it seems the private provide funding to run project by the public. It's not like business to business but like private to business. The speaker answered that the local community have their own responsibility, they need budget to organize it. it's a good opportunity to initiative this project in Thailand which started in the Gulf of Thailand area by facilitate a discussion with private sector, local government, all stakeholders such as the leader of the villages on how to start. It can start with the private sector who would provide the initial budget and the benefit from the budget management can be used to contribute to the community. The first step, government and private sector have to provide the initial investment such like buy back the waste, develop infrastructure such as construction or some equipment, in a long-term, it can be handed over to manage by the local community. There is one showcased in the Rayong River around 5 to 10 km that the local community protects and take ownership of responsibility.

The next step is to keep raising the local society awareness. Thailand has start this program step by step. The first step starts from municipality leader, as the chairman of the local committee to manage the fund and take benefit from the funding waste management. The first key is to find a strong leader who can be found at temple like a monk master to lead less awareness community and the second one is find a strong community to participate in the project.

Thailand has roadmap of plastic waste management which divided into 3 phases. The achievement is finished for the first phase in 2019, we stop to use the cap and plastic cover of the water bottle. The second phase in 2007, increased up to 100% plastic waste to go to the recycling system. Around 50% the plastics was collected, go through to the recycling system around 50%, and wanted to increase more in the process when we sorting, when at the start and try to push the process at the pre-consumption phase, to promote in the communities to increase more success. The prevention to

reduce the use of plastic waste also promoted by Indonesia economy, the case in Bali province that has regulations regarding beach waste and limitation of single use plastic. Almost in modern shop, there is no longer plastic bag and Styrofoam is being used. This regulation can reduce generating waste to the sea.

However, it is quite challenging and it is not easy to handle the less awareness and to comply to principal and the people. The highlight is to do from the small communities and developed it to make it bigger. The measurement, regulation or equipment is almost from the post-consumption already. Therefore, it is causing of higher cost for the solution. The challenge is to change the habit. Community participation is the key to achieving the target.

There is an example at the Rayong province with Rayong River. There are companies in many sectors. The mitigation plan and action must prevent from the earliest phase in the consumer side. Know how exactly the plastic enters the river and know where the location. After the post-consumption stage, the plastic already distributed to somewhere. Then choose the right equipment to take the event in that area and operate it for a certain time. The volunteers can come for events, daily, monthly or yearly. The approach to keep the continuity to protect the area was to give more value to the Rayong River in Rayong Province. By promoting that area as a tourism destination, the community and tourists can gain awareness for not throwing any garbage to that area. By doing this step by step, there are some of area that have beautiful canals and cultures. The canal cleans up and promoted as tourist area. It's like a soft power and no need to use strong regulation It's the key to protect that area. However, for a large scale is still quite difficult which is why to start step by step and from the small scale. The other approach to reduce waste is to provide a guideline for the company to choose eco-friendly substitute material. This program is under The Ministry of Industry. Local community in that area can produce a new substitute material such as from water hyacinth plant, peanut bean which can be use as material substitute which biodegradable.

In Thailand some of marine debris that landed on the beach, has easy access to be cleaned by local government and community. However, it has difficult access to be cleaned if the marine debris landed in the mangrove forest area. Stranded marine debris volume may varies upon the monsoon season and may arrived on a different area. When a big patch of stranded marine debris found by a local/fisherman, this information will be reported to the local government. By using a fishing boat, fishing boom is being used to drag the marine debris patch from the sea shore/coastal water as cost efficiency solution.

DMCR has developed a database information for the type and classification of plastic found in the garbage river to support the private and government sector. DMCR provide report of the composition

of the plastic waste types, volume/dimension, brand, barcode, etc. Stakeholders such as government and the respective industry/company to use this database to provide information and monitor of marine debris/plastic waste distribution they were produced. This to promote awareness to the respective company to pursue their corporate social responsibility and establish cooperation with stakeholders such as the local government, community and the companies, and waste recycling company involved in the recycling chain.

The waste has value and it can be use as recycling material to create a new recycled product such as new plastic roof from bottle caps, also buy back by catch/discarded fishing gears to make a new one. The local government provide capacity building on how to recycle to the community, machine, tools/equipment, supported by private company for the operation budget or other contribution such as build a small recycle factory. The government encourage the cooperation between the private company and the local community. Many sectors are involved. The vocal point related to waste in Thailand belong to the Department of Pollution Control, which acts as the economy coordinator under the Ministry of Natural Resources and environment and also DMCR is like one of the co-coordinators in the issue of marine debris, so there are two main organization in Thailand.

## **B. SESSION 2 - Philosophical Aspects in Designing Innovative Vessels to Combat Marine Debris**

The speaker on session 2 was Mr. I Ketut Aria Pria Utama. He is Professor of marine hydrodynamics at the Institut Teknologi Sepuluh Nopember (ITS) since 2007. His research focus includes the resistance and seakeeping analysis of mono and multi-hull vessels, study into the correlation of biofouling growth against ship resistance and powering and thus energy efficiency, development of ocean renewable energy focusing on the investigation of vertical axis ocean current turbine and floating solar farming, and maritime education.

He presented Philosophical Aspects in Designing Innovative Vessels to Combat Marine Debris. The discussion topic included:

1. The story and fact of marine waste
  - a. The Ocean is full of harmful pollution, including harmful plastics—the byproduct of centuries of accelerating industrial production.
  - b. Micro-plastics are especially dangerous because they are difficult to remove from the environment, and they (and the toxic chemicals they contain) can easily be absorbed by living things, intentionally or unintentionally.

## The Ocean Plastic Problems (some examples)

- (1) A seabird is eating plastic
- (2) Plastic wastes are spreading a beach area
- (3) A sea turtle mistakes a plastic bag for food



Figure 4.5 The ocean plastic problems

2. Innovative vessels (around the world) to combat marine debris.
  - a. Developing economies with less hi-tech can use their available local source, whilst considering the standard of safety at sea
  - b. Developed and rich economies can use modern technology vessels Fast development in artificial intelligent (AI) can even provide us with autonomous vessels
  - c. The process of cleaning the sea rubbish must be followed with educating people, especially the young generation Development of autonomous technology



**Innovative Vessel**  
(Fishing vessels are used to collect garbage, case study in the Pacific region)

Instead of catching fish in the ocean, fishermen use their fishing boats to collect rubbish:

1. Fishing boat catches a lot of fish in the ocean.
2. Fishing boat collected huge plastic-waste.




**Innovative Vessel** (ship equipped with bucket to collect garbage from sea, case study in Kota Kinabalu, Malaysia)

A group of people on a boat  
Description automatically generated

Waste collection vessel dispatched to clean up waters off Kota Kinabalu at Sabah, Malaysia. The vessel has the capacity to collect one tonne of rubbish and during the one week test, it has collected lots of plastic caps, food packages, plastic bottles, straws, and diapers.



Figure 4.6 Innovative vessel, Pacific Region (left), and Innovative vessel, Malaysia (right)



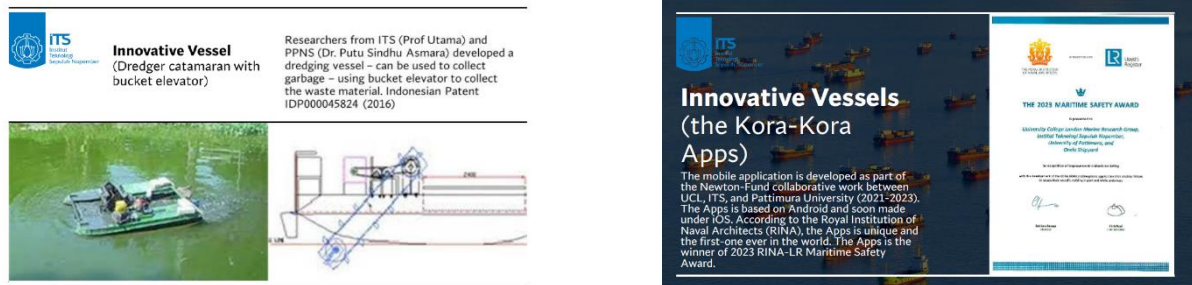
**Innovative Vessel** (case in Amsterdam: leisure, cleaning, and educating people)

Fishing for plastics is the latest way to clean up Amsterdam's canal. Plastic White offers visitors an opportunity to see the city by boat while also cleaning up its waterways. The plastics are then recycled and used the repurposed material to build boats.



Figure 4.7 Innovative vessel, Amsterdam

3. Example of development at ITS
  - a. Dredger catamaran with bucket elevator
  - b. The use of fishing vessels and Kora-Kora Apps



**Figure 4.8** Innovative vessel, Dredger Catamaran by ITS (left), Innovative fishing vessel and Kora-Kora App by ITS (right)

4. Conclusions
  - a. Marine debris (particularly plastics waste) has devastated the marine environment, and the situation is getting worse if proper actions are not taken into consideration.
  - b. That garbage has caused economic loss billion USD and killed more and more marine habitats.
  - c. There are seven (7) actions may be conducted to reduce and minimize the effects.
  - d. Innovative ideas based on technology (e.g., innovative vessels) and functional changes of tools (e.g., the use of fishing vessels to collect rubbish) can be used to combat marine debris.
  - e. Educational aspects (e.g., initiated in Amsterdam) should be taken into consideration.

The completed presentations can be found in the link:

<https://drive.google.com/file/d/17NoBAEakv2WOyImFI-M7Q2-J6GO86IPY/view?usp=sharing>

On the discussion session, participant were actively discussed regarding to this following.

The Kora-kora application can be used to test the character of the stability. The color indicator green and red. The red color indicator mean that the ship is not stable. They have to reduce its load until the indicator turning green. Green color indicating that the ship is safe to return to the port. It is the standard of naval architecture. This application is simple, cheap, and easy to use by the ship crew to check the stability of their ship. The application does not work well in bad weather. The application is used to check stability while on board. After checking the status in the application, they must return to the port and shall return to take another load. He will continue to develop the system and explore a lot of other possibilities to be developed by the academy/campus with focus on understanding the machine learning and control system.



There is suggestion to define location where marine debris vessel should be operated. Survey and study on how the marine debris distribution each year shall be taken. By using the satellite image to check, when the marine debris came to Central Java for example, the local government in Central Java should be informed and provide suggestion on how to do more awareness to their communities and stakeholders. When the marine debris were close to shore, the vessel can operate there with the fully caution of safety. The wave must be calm around below 2-3 meters or can use less people or autonomous vessels, or cleanup the stranded marine debris directly at the beach. Stability of the marine debris vessel operation must be considered as one of safety indicator. Sometime, the vessel overloaded by a lot of marine debris in a single trip which it will causing instability and can put the vessel and crews' unsafety.

Recommendation on marine debris vessel design compare among the others vessel on safety perspective, he suggested that the multihull model like Catamaran and Three Catamaran is the safest one. The catamaran design is better because there is a space between the two holes that can be used to load the marine debris. Ensure the grip tools that being used to grab marine debris is stable. Fishing net can be use as tool to collect it, or use excavator to bring the garbage up into the bucket. When the load is full the vessel can return to the shore. This technique should be appropriate and affordable.

### **C. SESSION 3 - Sharing Session of Debris Carrier/Collecting Vessel Implementation in APEC Economies.**

Sharing session was filled by presentation and discussion from APEC Economies from Indonesia; Malaysia and Thailand. The discussion of this session was a panel discussion consist of Expert, Ms. Rinny Rahmania and APEC Economies participant from Indonesia; Malaysia and Thailand. Questions from the participants was taken to be discuss with the panelist.

#### **Indonesia**

##### **The Reality of Collection/Cleaning Vessel in Indonesia**

Presented by Daud Saputra Amare Sianturi, Researcher, Research Center for Environmental and Clean Technology National Research and Innovation Agency (BRIN), Indonesia.

The development of marine debris vessel is to address the issue of coastal water pollution, port, rivers, and the sea. Marine debris vessel can be as one of the solutions for handling marine debris. First vessel named KM Telok Betong, has hull type catamaran with payload of 5-ton, powering: fuel. Its operation in Lampung Province and function to clean up waste on the water surface at ports or

coastal areas. Vessel named Sea Hamster with the L (Length): 7,5 meter; B (Breath): 2,5 meter; H (High): 1 meter; Vs (Speed): 5-13 Km/H; hull type: catamaran; payload: 1,2 Ton; powering: fuel; crew: 4-6 persons. Its work operation located at Bekasi River with function to collect waste in rivers or calm waters.

The third vessel named Mobula 8. It has specification hull type: catamaran; material: aluminum certified; BV (Bureau veritas) engine: 90 to 150 HP (Horsepower); Hull Length: 9.20 meter; hull width: 2.10 m/3.40 meter with inflatable floats; light weight/payload: 2.4 tons; draft: 0.8 meter; crew: 2 to 3 members. Its work operation at Bali with function to collect marine debris.

The issues on the implementation of vessel operation in Indonesia are high operational budget for transporting waste from the island to the landfill, individuals who are not aware of environmental issues, policy rules that have not been fully implemented by the entire community, limited land space on small islands for waste management.



Figure 4.9 Telok Betong vessel (left), and SeeHamster vessel (right)



Figure 4.10 Mobula 8 vessel

The completed presentations can be found in the link:

<https://drive.google.com/file/d/1FZGGZZzaH0gfQnwM5t4iGAYZnP5gxQWU/view?usp=sharing>

## Thailand

### Vessels To Combat Marine Debris in Thailand

Presented by Mr. Watcharapong Chumchuen, Department of Fisheries, Ministry of Agriculture, Thailand.

Thailand has 6 operating waste collecting vessels, under DMCR Thailand in 6 coastal provinces. Its working operation are at Rayong and Phuket Province in 2019, Songkhla and Samut Sakorn Province in 2020, and Surat Thani and Trang Province in 2021. Vessel named DMCR01 has specifications of LOA= 13.33 meters; breath= 3.55 meters; draft= 1.25 meters; hull type: monohull; engine power: 180 Hp; power source: fuel; maximum speed: 6.6 knots; waste carrying capacity: 4 Ton; other function: oil spill recovery system. The vessels named DMCR 03 and 04 have specification LOA= 15.24 meters; breath= 3.85 meters; draft= 1.50 meters; hull type: monohull; engine power: 550 Hp; power source: fuel; maximum speed: 12 knots; waste carrying capacity: 4 Ton; other function: oil spill recovery system.

The issues on the implementation of vessel operations in Thailand are debris collecting operation in shallow waters, operation budget limitation, financial support through public-private partnerships, raising awareness to minimize plastic pollution from land-based sources and upstream.

Innovations of other institutes in Thailand are from the Department of Public Works and Town & Country Planning, named DPT57: Hyacinth harvester, Bangkok Metropolitan Administration named Trash/Hyacinth Collector, Private Sector named ECO CLEANUP22: Debris collector. There is innovation and development of unmanned debris collector vessels from Thoen Vocational College and Kasetsart University.

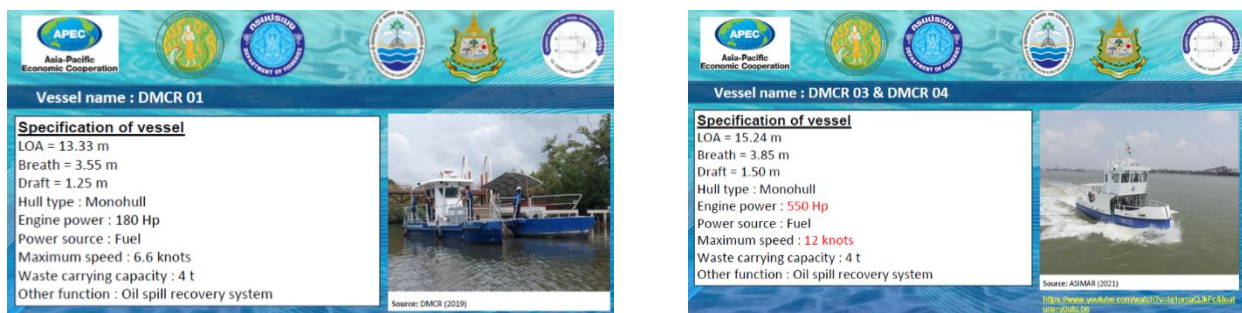


Figure 4.11 DMCR 01 vessel (left), and DMCR 03 & DMCR 04 vessel (right)

## Malaysia

### Challenges and Opportunities: Innovative Design of Green Sea Cleaner Boat

Presented by Assoc. Prof. Ir. Dr. Ahmad Fitriadhy, Program of Naval Architecture, Faculty of Ocean Engineering Technology and Informatics, Universiti Malaysia Terengganu, Malaysia.

Ms. Puteri Arlis Tsharina binti Jazlan 'Arif explain that there are several programs who run by private sectors, but it was not officially documented by the government. Malaysia is at the preliminary stage on developing vessel innovation, this is why they were attend this symposium to get some insights from other APEC economy. Malaysia has vessel named Ocean Cleanup Interceptor 005 which operated at Declan River. It is one of the rivers used for shipping activities and as heavy industry area. The operation of this vessel is under a private company. Malaysia wants to have another vessel. It is a collaboration with another private company for this interceptor with functions to clean up the river, to do some monitoring efforts, and as vessel to transport the marine debris/waste/garbage from the island to the mainland. This is because incinerator is not available, so the waste need to be transported and recycled in mainland. This initiative provided by the private company, monitored by local government. This symposium will list on where to start, discuss an issue and challenges. Malaysia has Marine Litter policy 2013 addressing technology, and how to reduce marine debris.

#### INNOVATIVE DESIGN OF GREEN SEA-CLEANER BOAT

- **Design of a Green Cleaner Ship**
  - *An Innovative Approach to Combating Marine Debris and Advancing Sustainable Maritime Practices.*
- **Key Features**
  - **Minimizes Wake-Wash Motion:** Innovative design minimizes disturbance to marine ecosystems and coastal areas.
  - **Electric Propulsion:** Utilizes electric propulsion, reducing emissions and fuel dependency.
  - **Solar Panel:** Generating power for the electricity on board.
  - **Geometry:** Emphasizing its unique design with two parallel hulls.
  - **Environmentally Friendly:** Offers an eco-friendly alternative to traditional vessels.
  - **Cleaner and Sustainable:** Represents a cleaner and sustainable solution for maritime transportation through applying an autonomous marine debris detection.



**Figure 4.12** Innovative design of green sea-cleaner boat

The completed presentations can be found in the link:

<https://drive.google.com/file/d/1wjZcsrXw3Lf4IISySb-SyyNWiuX3D3MA/view?usp=sharing>

The discussion session, Mr. Ahmad Fitriadhy provided his opinion on the implementation of conceptual modeling where this is crucial in the identification and detection of marine debris originating from various sources and eventually making their way into the ocean. To effectively address this issue, there was a significant requirement to collect and analyze data related to marine debris tracking. To facilitate this process, the establishment of a specialized task force is essential, tasked with the primary duty of sourcing, compiling, and disseminating the necessary information pertaining to marine debris sources and movements, thus contributing to more comprehensive and informed management strategies.

Marine debris database contain specific data of its distribution, their final destination in which area and how to obtain the data were questioned by one of participant. Mr. Wacharapong Chumcuen from Thailand suggested to provide a general recommendation on what APEC economies should do such as to have Geospatial Information System (GIS) URL link. Research that had been done by reseracher from Indonesia economy delegate, Ms Rinny Rahmania that they had 3 years research project to model, foresee the pattern of marine debris movement, where the marine debris reach their final destination and stranded on which beach/area. The finish model had been validated using satellite imagery. However, it was agreed that an online platform to input data about marine debris information such as type, size, etc had become urgently necessary.

Mr. Ahmad Fitriadhy said that over three years research , the extensive research project that explored multiple facets of marine debris had been conducted. This study utilized advanced modeling techniques and satellite imagery analysis to foresee the patterns of marine debris movement and to pin-point potential locations where the marine debris might eventually accumulate in which beach areas. The result of ground truthing had approximately similar with the model. The document is available and can be share to other participant as initial step to predict and mitigate territory and in which season, especially in area coastal resources, or Marine Protected Area (MPA) etc. APEC Economies shall move forward by using this information as reference to tackle marine debris. By using the information which can be found online in a website, composing marine debris real time information among APEC members as part to action in combating marine debris. Malaysia economy delegation, Mr. Edy Mustaqim bin Muhammad suggested to have a GIS simulation. Malaysia has platform with GIS integration to help identify it. Mr. I Ketut Aria Putra Utama, speaker from Indonesia mentioned that Institut Technology Surabaya, Indonesia has a joined work collaboration with Putrajaya Malaysia, to build a web platform with the information.

## Day 2 – Thursday, 19 October 2023

### D. SESSION 4 - Technical Discussion of Draft Document The Initial Guidelines of Capacity Building on Vessel Innovation To Combat Marine Debris – Chapter 1-3

Discussion of the draft document of Guidelines and Recommendation Document for marine debris countermeasures on the sea, coastal and small islands with vessel innovation, fleet management and collaboration in international waters, followed by short introduction about marine debris waste management and vessel operation. This discussion was intended to provide input and accommodate it to the draft document of Guidelines and Recommendation Document which this session was led by Mr. I Ketut Aria Pria Utama, and moderated by Mr. Ahmad Fitriadhy.

Minor corrections to the sentences and typos as well as additional information are made directly during the discussion with corrections and input as follow:

1. There were improvements to the sentence structure in the document which were immediately corrected in this session.
2. Chapter I. Introduction

**Point B. Background on Marine Debris** was changed to **B. Definition on Marine Debris**

In Chapter I. Introduction, **Point D. Purpose of capacity building on vessel innovation**, in the last paragraph the following input is proposed:

It was suggested and agreed by forum:

- a. to put the information on the term of resources
- b. put in term of capacity building, training, educating people

#### **Input:**

a strategy emerges to combat marine debris globally in conclusion. This starts with capacity building, empowering communities and individuals through education and practical skills, equipping them to tackle these problems. Concurrently, innovative vessel development takes the lead, merging advanced technology with consideration for the sustainability of the marine ecosystems. The vessels design shall utilize eco-friendly technology and innovative methods to streamline cleanup efforts and enhance effectiveness. This harmonious approach ensures that marine life and ecosystems are safeguarded, marking substantial progress in the fight against marine debris. It's a tale of knowledge, technology, and environmental responsibility working together to protect our oceans for future generations and ensure that vessel development takes into account the impact of marine life etc.

### 3. In Chapter II. Understanding Marine Debris

1. Chapter II, Point **A. Definition and types of marine debris** was changed to **A. Category of marine debris**.

- a. In the first paragraph of Chapter 2, Point A, it is recommended to add categories as known as Classified of the marine debris.

2. Chapter II, **Point B. Sources and Impacts of marine Debris** was changed to **Point B. Sources of marine Debris**

3. Chapter II, **Point B.1. Land-based sources**, there was an additional sentence in the last paragraph as follows:

Addressed the issue of marine debris originating from land-based sources in Indonesia aligns with several Sustainable Development Goals, including SDG 14 (Life Below Water), SDG 11 (Sustainable Cities and Communities), SDG 12 (Responsible Consumption and Production), SDG 15 (Life on Land), and SDG 6 (Clean Water and Sanitation). Improvements in waste management, pollution reduction, and conservation efforts can help mitigate the impact of marine debris on the marine environment and contribute to broader sustainable development objectives

4. Chapter II, **Point B.2. Ocean-based sources**, there was an additional sentence in the last paragraph as follows:

In response to this issue, MARPOL Annex V addressed the management of marine pollution from ships, particularly garbage. Relevant Sustainable Development Goals (SDGs) include SDG 14 (Life Below Water) and its targets on reducing marine pollution, SDG 12 (Responsible Consumption and Production) for responsible waste management, and SDG 15 (Life on Land) for land-based ecosystem protection to prevent contamination of oceans and marine environments. Addressed marine debris is vital for ocean sustainability and global conservation efforts.

5. Chapter II, added Point **C. The Impact of Marine Debris**

6. Chapter II, **Point D.1 Global scale and complexity** (Previously Point C1.), there was an additional sentence and input in the last paragraph as follows:

**Several current challenges associated with addressing this issue:**

Data Collection and Monitoring: Comprehensive and real-time data on the sources, types, and distribution of marine debris are essential for informed decision-making. Data collection and monitoring efforts need to be improved and standardized.

**Input:**

- a. in chapter should mentioned the impact in general
- b. in chapter 5 should mention specific challenges in each economy

**4. In Chapter III. Overview of Vessel Innovation**

In Chapter III, Point A. Lesson Learned from Previous Vessel Innovation to combat Marine Debris in Indonesia Economy, after the fifth paragraph, a new paragraph was added as follows: The second innovation, which is the use of an electric power system with net zero emissions for the marine debris collecting vessel, aligns with several Sustainable Development Goals (SDGs), primarily those related to sustainable energy, climate action, and environmental conservation:

- a. **SDG 7 - Affordable and Clean Energy:** This innovation promotes the use of clean and renewable energy sources, as evidenced by the inclusion of a solar panel system. It supports SDG 7's target to ensure access to affordable, reliable, sustainable, and modern energy for all.
- b. **SDG 13 - Climate Action:** By utilizing an electric power system with net zero emissions, the vessel contributes to mitigating greenhouse gas emissions. It aligns with SDG 13's objective to take urgent action to combat climate change and its impacts.
- c. **SDG 14 - Life Below Water:** The innovation in this marine debris collecting vessel directly supports SDG 14 by working to prevent and reduce marine pollution, including marine debris. The electric power system and cleaner energy sources contribute to the goal's aspiration to conserve and sustainably use oceans, seas, and marine resources.



**Figure 4.13** Day 2, Session4 - Technical Discussion of Draft Document



## E. Short Introduction About Marine Debris Waste Management and Vessel Operation

In this session, Mr. Antoine Iche from the SeaCleaners provide initial explanation prior the field trip, He explained the history of the SeaCleaners, the efforts to raise public awareness of the risks of plastic waste, and how they carry out marine waste handling activities using the Mobula 8 ship, both in Bali and internationally. The SeaCleaners Institute continues to develop new innovative ship technology to handle marine waste more efficiently.



**Figure 4.14** Short Introduction About Marine Debris Waste Management and Vessel Operation, by Mr. Antoine Iche form The SeaCleaners

On discussion session speaker share his knowledge and experience. The SeaCleaners do research and develop new systems and technology. Share it by having a new training and do collaboration with the government. It enables exchange learning of knowledge from stakeholders which are The SeaCleaners, government and local community and accommodate inputs and informations to make improvement. Base operation is in Europe, collaborate with partners, informants (fishermen), and/or communities around the coastline, using satellite imagery and drones. This shared data can be used by other people.

The vessel will operate efficiently by using data. The vessel operator must obtain and have the data of what and where to collect, the weight and volume, type and share this data. Training is important to be provided for the crew on how daily monitor should be done, what to collect, monitor the type of waste, weigh and compare monthly data. The crew must understand was it effective or not before do the operation, and know where the right location. Key component in monitoring: what is in the location, know the area, do the collecting, and monitor what, weight, the environment (the water

current), the size of vessel. Understand what will be collected. Interview the operator to obtain data, create baseline data and analyze daily, monthly, etc.

Mr. Liu Zhenghua from People's Republic of China, emphasized the important to learn and know where the distribution of marine debris and share the experience on how to handle it. The key involvement with International Maritime Organization, vessel should comply with class society, international and economy. This will be the next future project in every environment, river, bay, coastal. He did appreciate the input to improve this living draft from APEC Economies, Non-Governmental Organization (NGO), local government, etc. He said without understanding the real problem, we just talk about the design. By considering the experience of people who work in the field can provide better design to combat marine debris. He has excitement to visit The SeaCleaners and know how the operation and management.

## **F. SESSION 5 - Field Trip: The SeaCleaners**

On this occasion, the symposium participants visited The SeaCleaners to increase their insight and experience regarding the handling of marine waste in Bali.

It was explained about The SeaCleaners concern for the environment, especially in handling marine waste in Bali Sea. There are three (3) main activities of the The SeaCleaners in preserving the environment, including:

1. Provide education to the general public, especially the younger generation, regarding the threat of plastic waste. The SeaCleaners actively campaigns for this in community, organizations, schools, educational institutions and other related parties. In its implementation, The SeaCleaners adapts local wisdom to have acceptance by the local community and its culture.
2. Obtain information related to marine waste collected, location, types of waste and the process of marine waste and other related matters
3. Marine debris cleaning on the coast of Bali is carried out by using a Mobula 8 vessel. Participants were invited to see the Mobula 8 vessel, as well as a presentation about how the Mobula 8 vessel operates, from how the ship is operated to collect marine debris.



**Figure 4.15** Field Trip to The Seacleaners

### **Day 3 – Friday, 20 October 2023**

#### **G. SESSION 6 - Symposium's Final Document: Guidelines and Recommendation**

In session 6, the participants were discussed Chapter V. Capacity Building Scenario During 3-days Symposium, in the framework of finalizing guidelines and recommendation document for marine debris counter measures on the sea, coastal and small islands with vessel innovation, fleet management and collaboration in international waters. This session was led by Mr. I Ketut Aria Pria Utama, and moderated by Mr. Ahmad Fitriadhy.

The results of the session 6 discussion are as follows:

1. Section V, point A. Identification of current marine debris collecting/carrier vessel in each APEC Economies
  - a. Change of Table 3 to Example of Marine Debris of Carrier Vessels. Then the General Dimensions Column becomes Principal Particular.
  - b. For this table Indonesia completed the vessel information:
    - i. Monohull, Garbage carrier ship
    - ii. Monohull, Inter- Island garbage carrier boat
    - iii. Catamaran, Marine debris collecting boat

- c. Information from Malaysia will be sent after returning from the symposium. Especially, for implementation in Port Klang River Project.
  - d. Thailand included a photo of the vessel from their presentation. More information will be added after symposium, by using email
  - e. The People's Republic of China stated that pictures and information will be sent after the symposium, as permission from other departments is required. If approved, it will continue with some information.
  - f. From the results of the participants' discussions, to complete the information in table 3, it was agreed that there would be additional vessel location maps for each economy in this document.
  - g. Comments from Mr. Handy Chandra in this discussion asked each member of the economy to include the specifications of their respective economies. Then comments from Mr. I Ketut Aria Pria Utama asked that every member of the economy share their learning.
2. Section V, point B. Sharing best practices and lessons learned from vessel innovation project, Comments from Mr. I Ketut Aria Pria Utama to provide prudent details on what we mentioned in point A. and ensure that some of the innovations have been tested.
  3. Section V, point C. Collaboration Model for Future Actions to maximize impact and efforts.

## **H. SESSION 7 and 8 - Future Collaboration Opportunity in Managing Marine Debris and APEC recommendation**

In session 7 and 8, the participants provided conclusions from the previous discussion, as follows:

### **A. Summary The Importance of Capacity Building On Vessel Innovation to Combat Marine Debris**

The importance of the symposium can be accepted by all participants. Almost all representatives from economies show their concern regarding Marine debris by implementing many vessel innovations in the rivers and coastal areas.

Other than economic participation in cleaning marine debris there was participation from non-governmental organization in People's Republic of China; Indonesia; Malaysia and Thailand. The collaboration among economics and non-governmental organizations in the APEC communities can foster the effectiveness of cleaning marine debris.

The capacity building for managing marine debris from upstream to downstream is vital. The current symposium was only one part of the down stream's activities to handle marine debris. The comprehensive action is required to combat Marine debris issues.

The development of a website plays a prominent role in the APEC region, where the importance of addressing marine debris cannot be overstated. This website harnesses cutting-edge technology, utilizing satellite imagery, GIS, and various other tools to not only detect but also track marine debris in real time. The real strength of this platform lies in its ability to be shared seamlessly among APEC member economies, fostering collaboration on an unprecedented scale. It stands as a centralized hub of comprehensive data on online marine debris, offering a treasure trove of information for all APEC economy members.

By providing a shared platform for real-time tracking and data sharing, it greatly assists APEC economies members in their collective battle against marine debris. In a world where marine pollution poses a grave threat to ecosystems and economies alike, this innovative approach is an effective solution. The real-time tracking capabilities ensure that no marine debris hotspot goes unnoticed, facilitating timely and targeted cleanup efforts. Furthermore, the centralized data repository streamlines the process of data analysis and decision-making, enabling APEC economies to develop more informed and coordinated strategies for combatting marine debris. With this website, APEC member economies have a powerful tool at their disposal, one that unifies their efforts, enhances their understanding of the problem, and ultimately empowers them to take meaningful action. This collaborative approach, rooted in advanced technology, epitomizes the spirit of APEC and its commitment to addressing shared challenges. Merely, in light of the persistent threat of marine debris to marine ecosystems and coastal communities, this website exemplifies the power of a united front against this pollution.

## **B. Final Thoughts on The Future of Vessel Innovation in Preserving Marine Ecosystems**

1. The innovation in terms of combatting Marine debris by using vessels it is not only creating new technologies. It is also using appropriate, existing and cheaper technologies.
2. Sharing the best practices among the APEC economies is vital to combat Marine debris regionally and globally. In the end, human welfare can be preserved by preserving good marine ecosystem from marine debris.
3. The need of specific guideline to design innovate vessels to combat Marine Debris among APEC Economies
4. The need of each delegation at the end of the discussion, considering that there was a lot of information on the APEC economy that had not been accommodated, to finalize this document

the participants agreed to complete each other's lack of information via email to the project overseer.

The document of the discussion can be found at link:

<https://docs.google.com/document/d/18i2fjjRSg4o4KbvA0ZyvOrFBBtssM66/edit?usp=sharing&oid=102618797137144612407&rtpof=true&sd=true>

At the end of the event the participants filled out an evaluation form regarding the implementation of this activity, as required by APEC. After that, the event was closed by the Director of Research Ship Fleet Management, Deputy for Research and Innovation Infrastructure, Mr. Nugroho Dwi Hartanto



**Figure 4.16** Group photo at the end of the workshop event

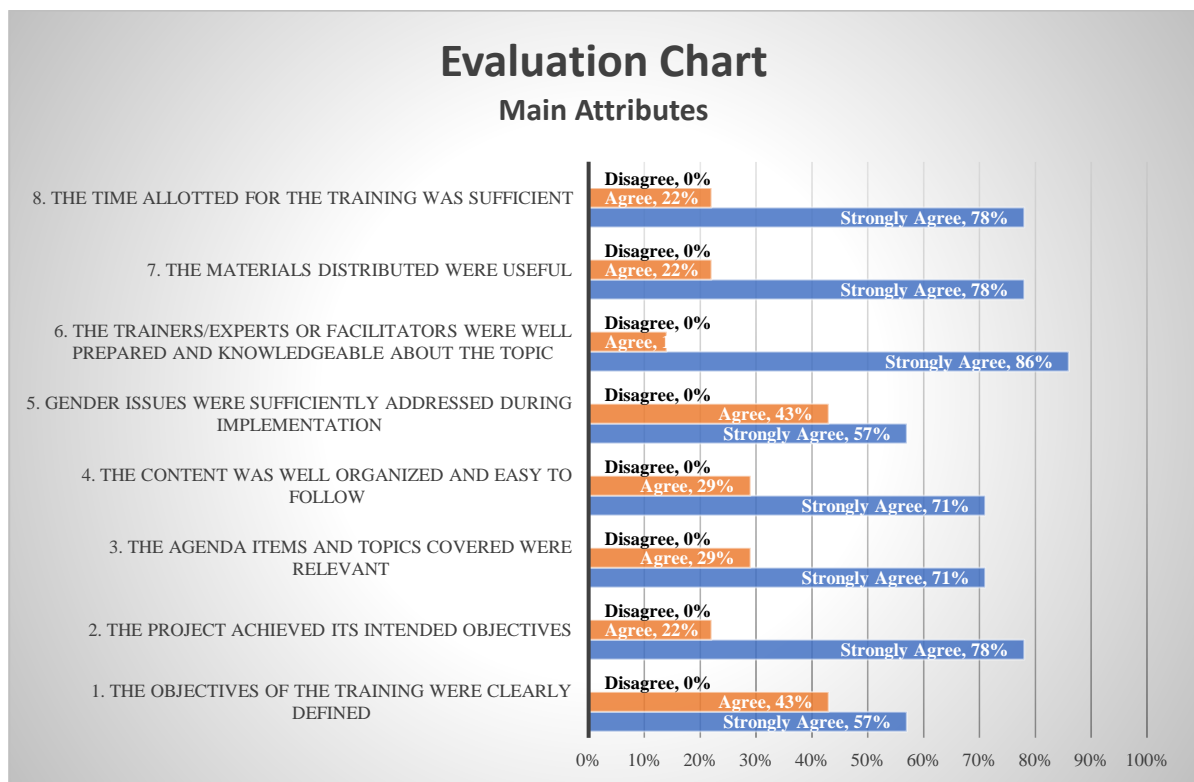
## WORKSHOP EVALUATION

At the end of the workshop attendees were requested to provide feedback on the suitability, interest, length, and topic selection of the workshop among other things. Fourteen attendees filled the form (shown at the end of this document) and the results are as follows:

The first section asked attendees to score several attributes of the workshop in a scale from 1 to 5 where 1 was completely agree and 5 was completely disagree. Table 1 shows the results for the main attributes.

	Evaluation	Strongly Agree	Agree	Disagree
1	The objectives of the training were clearly defined	57%	43%	0%
2	The project achieved its intended objectives	78%	22%	0%
3	The agenda items and topics covered were relevant	71%	29%	0%
4	The content was well organized and easy to follow	71%	29%	0%
5	Gender issues were sufficiently addressed during implementation	57%	43%	0%
6	The trainers/experts or facilitators were well prepared and knowledgeable about the topic	86%	14%	0%
7	The materials distributed were useful	78%	22%	0%
8	The time allotted for the training was sufficient	78%	22%	0%

**Table 4.1** The results of main attributes



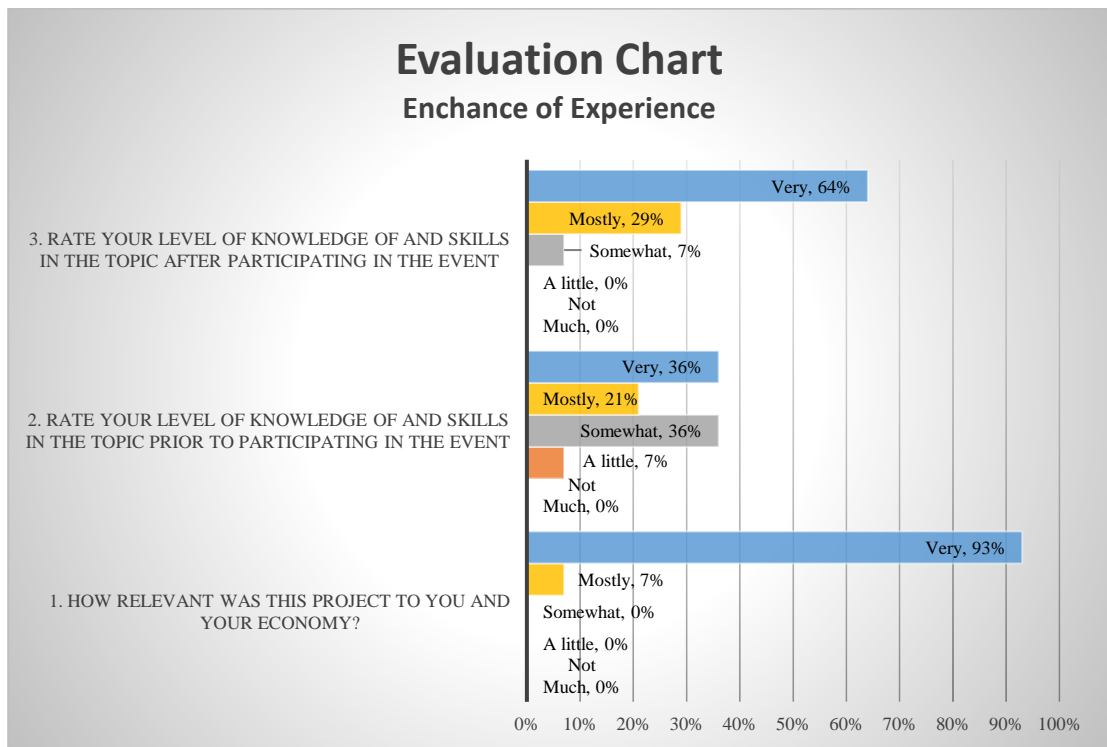
**Figure 4.17** Evaluation Chart of Main Attributes

Table 2 shows the results for the experience enhancement attribute.

	Evaluation	1	2	3	4	5
		Not Much	A little	Somewhat	Mostly	Very
1	How relevant was this project to you and your economy?	0%	0%	0%	7%	93%
2	Rate your level of knowledge of and skills in the topic prior to participating in the event	0%	7%	36%	21%	36%
3	Rate your level of knowledge of and skills in the topic after participating in the event	0%	0%	7%	29%	64%

**Table 4.2** The results of the experience enhancement attribute





**Figure 4.18** Evaluation chart for Enhance of Experience

The very strong results are very encouraging for OFWG and demonstrates a strong appetite and need for further work in this area.

The form also asked the audience about the length of the workshop, the materials, meeting space, overall program, and to suggest other topics. The majority of the attributes were judged to be very good, and good by the majority of attendees with some indicating excellent. The quality of the presenters, in particular, were praised during the day and received very high marks.

The feature most appreciated by participants was the opportunity for discussion during the day. They feel it is important to be able to voice their understanding in groups, discuss and test their knowledge.

Attendees were also asked to provide areas for improvement. Comments for this question included:

1. Send all the materials to participants ahead of time for preparation.
2. Provide contrasting case studies of best vs worst practice.

Thinking of the future, the audience was asked to provide topic suggestions for future workshops.

The suggested topics include:

1. Identification of current Marine Debris collecting/carrier vessel in each APEC Economies.
2. Collaboration Model for Future Actions to maximize impact and efforts
3. Developing APEC Marine Debris observing system projects
4. Analyzing the effectiveness of vessel innovation strategies

5. The development of a website plays a prominent role in the APEC region, where the importance of addressing marine debris cannot be overstated.

# 1. Appendix

## Appendix I: Agenda

### Day 1 – Wednesday, 18 October 2023

08:00-09:00 (Local Time / WITA)	<b>REGISTRATION</b>
09:00 - 09:10	<b>Welcome Speech</b> <ul style="list-style-type: none"><li>• Ministry of Marine Affairs and Fisheries of Republic of Indonesia</li><li>• National Research and Innovation Agency of Republic of Indonesia</li></ul>
09:30 - 10:15	<b>Opening ceremony and welcoming address</b> <ul style="list-style-type: none"><li>• Symposium introduction</li><li>• Safety Induction</li><li>• Bali Dance Performance and Group Photo Session</li></ul>
10:15 - 10:30	<b>Coffee Break</b>
10:30 - 11:00	<b>SESSION 1:</b> Marine Debris Sources, Mitigations, and Solutions.
11:00 - 11:45	<b>SESSION 2:</b> Philosophical Aspects in Designing Innovative Vessel to Combat Marine Debris.
11:45 - 12:00	<b>QUESTION AND ANSWERS</b>
12:00 - 13:30	<b>Lunch Break</b>
13:30 - 15:30	<b>SESSION 3:</b> <b>Sharing Session of Debris Carrier/Collecting Vessel implementation in APEC Economies</b>
15:30 - 15:45	<b>Coffee Break</b>
15:45-17:00	<b>DISCUSSION</b>

### Day 2 – Thursday, 19 October 2023

08:00-09:00 (Local Time / WITA)	<b>REGISTRATION</b>
09.00-10.30	<b>SESSION 4:</b> Discussion for Draft Document: Guidelines and Recommendation Document for marine debris countermeasures on the sea, coastal and small islands with vessel innovation, fleet management and collaboration in international waters.
10:30-10:45	<b>Coffee Break</b>

<b>10.45 – 11.45</b>	<b>SESSION 4 (Cont'd):</b> Discussion for Draft Document : Guidelines and Recommendation Document for marine debris countermeasures on the sea, coastal and small islands with vessel innovation, fleet management and collaboration in international waters.
<b>11.45 – 12.00</b>	<b>Short Introduction About Marine Debris Waste Management and Vessel Operation</b>
<b>12.00-13:30</b>	<b>Lunch Break</b>
<b>13:30-17.00</b>	<b>SESSION 5</b> <b>Field Trip : The SeaCleaners</b>

### Day 3 – Friday 20 October 2023

<b>08:00-10:00</b>	<b>SESSION 6:</b> Symposium's Final Document: Guidelines and Recommendation Document for marine debris countermeasures on the sea, coastal and small islands with vessel innovation, fleet management and collaboration in international waters.
<b>10.00-10.30</b>	<b>SESSION 7:</b> Future Collaboration Opportunity in Managing Marine Debris.
<b>10:30-10:45</b>	<b>Coffee Break</b>
<b>10:45-11:30</b>	<b>SESSION 8:</b> <b>APEC recommendation</b>
<b>11.30-12.00</b>	<b>WORKSHOP EVALUATION</b> <a href="https://bit.ly/EvaluationsurveyAPEC">https://bit.ly/EvaluationsurveyAPEC</a>
<b>12:00 - 13:30</b>	<b>Lunch Break</b>
<b>13:30-14:00</b>	<b>CLOSURE OF SYMPOSIUM</b>

## Appendix II: Documentation

### DAY 1 (One)



Photo group session



Session 1 session



Session 2



Session 3

**DAY 2 (Two)**



Session 4



Session 4



Session 5- Field Trip: The Seacleaner



Session 5- Trip: The Seacleaner



Session 5- Field Trip: The Seacleaner



Session 5- Field Trip: The Seacleaner

**DAY 3 (Three)**



Session 6 & 7



Symposium Closing Group Photo