



**Asia-Pacific  
Economic Cooperation**

**Advancing** Free Trade  
for Asia-Pacific **Prosperity**

**Project Report:  
Capacity Building on Marine Debris Management and  
Monitoring from Source as River is the Major Transport  
Pathway**

**APEC Ocean and Fisheries Working Group**

**April 2023**





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APEC Project: OFWG 04 2021

Produced by  
Professor Dr Latifah Abd Manaf  
Ts Dr Irina Harun  
Dr Zufarzaana Zulkeflee  
Dr Ferdaus Mohamat Yusuff  
Faculty of Forestry and Environment,  
Universiti Putra Malaysia,  
Malaysia

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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APEC#223-OF-04.1

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## Summary of Event

Date : 17th to 20th October 2022  
Venue : Putrajaya Marriot Hotel, Malaysia  
Online Platform : Zoom Meetings  
Date and Duration: 4 days, 17<sup>th</sup>-20<sup>th</sup> October 2022, 2-5 pm (UTC+8.0)  
Organized by : Faculty of Forestry and Environment, Universiti Putra Malaysia

## List of Abbreviations

<b>AIT RRC.AP.</b>	Asian Institute of Technology, Regional Resource Centre for Asia and Pacific
<b>AMR</b>	Antimicrobial Resistance
<b>APEC</b>	Asia Pacific Economic Cooperation
<b>ASEAN</b>	The Association of Southeast Asian Nations
<b>ASF</b>	Apec Support Fund
<b>FGD</b>	Focus Group Discussion
<b>KDEBWM</b>	KDEB Waste Management's
<b>MRF</b>	Material Recovery Facility
<b>OFWG</b>	Ocean and Fisheries Working Group
<b>PCB</b>	Polychlorinated Biphenyls
<b>STEM</b>	Science, Technology, Engineering and Mathematics
<b>UPM</b>	Universiti Putra Malaysia

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## 1. Executive Summary

The project is designed to develop a capacity building on marine debris management and monitoring from the source as the river is the major transport pathway for all member economies. The project meets the eligibility criteria under APEC Support Fund (ASF) – Sub-Fund on Marine Debris Management and Innovation. The project also supports APEC’s objectives, in line with one of the seven priority areas in Ocean and Fisheries Working Group (OFWG) Strategic Plan (2019-2021) on promoting capacity building for sustainable development and protection of the marine environment. The capacity building among government officers from various relevant agencies is very important and may lead to development of specific programs or policies tailored to their own economies, focused on managing land and sea-based waste, and reducing the impacts of marine debris.

## 2. Introduction to the Project

Marine debris is a global problem that has threatened the environment and food security. As rivers are the main transport pathway to the oceans, they will be the marine debris' main movers. Experts have agreed that an estimated 80% of these come from land-based sources and as most member economies are surrounded by oceans, the danger factors are increased. Marine debris is a global pollution concern many local communities in member economies face. As rivers are major pathways for the transportation of marine litter from land to the marine environment, this project will be focusing on capacity building on marine debris management and monitoring from source as the river is the major transport pathway. Capacity building through the empowerment of the community particularly government officers is an important component in reducing, managing, and monitoring marine debris to promote sustainable development. The online webinar and focus group discussions are targeted to government officers from various relevant agencies as well as academicians, NGOs and private sectors who are actively involved in solid waste/ marine debris, fisheries, and environmental field to support the development of the capacity building. This approach is expected to be useful and beneficial to all member economies.

This project also addresses the issue of marine debris and the associated environmental and economic loss. Through this project, member economies will be encouraged to share their marine debris issue, including policies and management practices. This will foster awareness among member economies and enable direct comparisons to be made between different management practices leading to innovative approaches that are regionally applicable. Similar policies across member economies are also discussed, further highlighting the challenges and key indicators in marine debris management and monitoring from source. Besides, this project will develop a regional network and create a long-term impact among member economies. Specifically, this project focuses on the needs of member economies in tackling the issues of marine debris, which is highly relevant as most member economies are socioeconomically dependent on rivers and the marine ecosystem. The intervention through this project is believed to become an enabler for member economies to make a change while assisting knowledge transfer towards those directly impacted by marine debris, either socially, environmentally, or economically. This project is designed to be inclusive and collaborative-based, to sustain the capacities built in achieving the objective of this project and supporting the four major aims of APEC in capacity building.

### 3. Project Objectives

The main aim of this project is to develop the capacity building on marine debris management and monitoring from the source as the river is the major transport pathway among member economies.

This project is expected to achieve the following objectives:

1. To create awareness on marine debris management and monitoring from the source as the river is the major transport pathway.
2. To share and compare marine debris management practices and experiences from member economies.
3. To strengthen the network for monitoring, prevention and reduction of marine debris as addressed in the vision of APEC Roadmap on Marine Debris 2019.

### 4. Program Overview

The 4-day hybrid webinar and focus group discussions on Capacity Building on Marine Debris Management and Monitoring from Source as River is the Major Transport Pathway involved various nominated government officers from relevant agencies of 10 member economies, as well as endorsed participants from non-governmental organizations, private companies, and universities. The program was held from the 17th to the 20th of October 2022, at the Pahang Room, Putrajaya Marriott Hotel, Malaysia, with online participants participating via the Zoom platform. The Hybrid Webinar and Focus Group Discussions on Marine Debris began with the Master of Ceremony, Dr. Saiful Amin Jalun welcoming all speakers and participants, and officially starting the event.

In total there were 36 attendees (6 speakers, 3 moderators and 27 participants) both online and physical, comprising of 17 and 19 male and female participants, respectively. Two speakers out of six were women, meeting the set target goal of 30% of the experts are females. The female participants were around 53% of the total participants which exceeded the original target goal of 40%.

#### i. **Opening remarks by Professor Dr. Hazandy Abdul Hamid, Dean of the Faculty of Forestry and Environment at Universiti Putra Malaysia (UPM)**

Prof. Dr. Hazandy Abdul Hamid, Dean of the Faculty of Forestry and Environment at Universiti Putra Malaysia (UPM), warmly welcomed all distinguished guest and speakers present at the Marriott Hotel Putrajaya and those on the Zoom session. He explained that this is an excellent continuation of APEC's vision and that the Faculty of Forestry and Environment and UPM will be fully supportive in ensuring that the many lessons and action plans learned are discussed and shared with relevant stakeholders. He went on to say that the spirit of this webinar is clearly aligned with APEC's initiatives, which strive to ensure the protection of our environment.



**ii. Professor Dr. Latifah Abd Manaf, Project Overseer and Deputy Dean, Faculty of Forestry and Environment, UPM**

Prof. Dr. Latifah Abd Manaf, Project Overseer and Deputy Dean, Faculty of Forestry and Environment, UPM, briefly introduced the four days Webinar and two Focus Group Discussions on Marine Debris. The project is aimed as a catalyst for more discussions, discoveries, and collaborations, which will not only benefit marine debris management and monitoring, but also the opening of more resources in networking, research collaborations, policy, and technology transfer and sharing between member economies. The project focuses on the capacity building on marine debris management and monitoring from source as river is the major transport pathway. Capacity building through the empowerment of community particularly the government officer is an important component in reducing, managing and monitoring marine debris to promote sustainable development. The online webinar and a focus group discussion were targeted to government officers from various relevant agencies who are actively involved in solid waste/ marine debris, fisheries, and environmental fields to support the development of capacity building. This approach is expected to be useful and beneficial to all member economies.



## 5. Hybrid Webinar and Focus Group Discussion (FGD)

The four-day program featured distinguished speakers from four APEC member economies on a wide range of topics, including marine debris research findings, government policies, non-governmental and private sector involvement, and sustainable technologies. On the second and fourth day of the program, a focus group discussion involving all online and in-person participants was held to discuss the topics presented by the respective speakers, also serving as a platform for participants to share their experiences from the perspective of their own member economy.

### a. Hybrid Webinar Summaries

**i. Mr. Ramli Mohd Tahir, Managing Director and Board Member of KDEB Waste Management Sdn. Bhd. MALAYSIA**

Mr. Ramli delivered his speech via Zoom platform on **Solid Waste Management and Issues** with wide-ranging views from policies, economics, and challenges from the community. He explained and posited the challenges KDEBWM is facing, shared challenges and resolves, methods, and tips as well as reminders on what need to be done in managing waste. In detail, he explained that KDEBWM is a leading Waste Management Company in Malaysia and is the largest waste collector.. KDEBWM manages 7000 tons of waste daily, keeping the cleanliness, health, and safety of 6.5 million customers. KDEBWM has also set a target to establish five (5) more Recycling Centres in 2023 to help the state government achieve the target of 15% recycling rate in the state as stated in the Selangor Plan (RS-1) as it is a believed that recycling is the way to go, in line with the aspirations of the Malaysian Government to have a 40% increase in recycling by 2025.

KDEB Waste Management's (KDEBWM) Material Recovery Facility (MRF) is also in place as one of the strategies to achieve the fourth core of the 2022 budget which is to create a green environment and sustainable development. It is extremely important to have a standard policy for all with clear implementation guidelines, as well as the rebranding of the waste management services with more mechanized and tech-based solutions.

It is recommended that the waste management industry be rebranded with sensible reward package to attract local workers. There must be a concerted drive to mechanize the process so as not to be dependent on landfills. Rate review and other stricter policy implementation must be done quickly especially on illegal dumping. Ideally member economies must have clear and workable SOPs and continuous campaigns and education on waste management.

In addressing these issues all parties must be involved including the government, waste collectors and the community. It must be reminded that waste issue is significant and is a global concern, thus must be managed effectively across political and ideological differences. There already successful models and solutions from developed member economies which can be assessed and replicated.

**ii. Mr. Yulianto Suteja, Lecturer, Marine Science Department Faculty of Marine and Fisheries, Udayana University, INDONESIA**

Mr. Yulianto Suteja, a lecturer from the Marine Science Department, Faculty of Marine and Fisheries, Udayana University Jl. Kampus Universitas Udayana, Bukit Jimbaran, Bali, Indonesia delivered his speech on **River as Transport Pathway** via Zoom platform.

He presented on the issues of pollutants travelling through rivers to the oceans, its impacts and gravity of the situations through graphic examples and modelling data. This includes the explanation on macroplastic release of toxic substances causing pollution, producing microplastic that could end up in fish and other organisms. He added that there are studies revealing that traces of microplastics can now be found in human lung tissues and placentas. In particular, Mr Suteja explained the marine debris is defined as any persistent solid material that is manufactured or processed and directly or indirectly, intentionally, or unintentionally, disposed of or abandoned in the marine environment or the great lakes. The debris can be categorized as plastic, metals, glass, wood/paper, fiber/cloth, and other unwanted items from the anesthetic, ethical, economic, and ecological points of view.

Mr Suteja also explained the thread of micro and macroplastic along with their dangers and the potential risks of debris towards human health and the environment. Floating macro plastics impacts marine megafauna through ingestion or entanglement, release of toxic substances that causes pollution and produces microplastics. Microplastic can then enter the food system, causing disease in humans: short-term health effects (eye, nose, throat, and lung irritation, coughing, sneezing, runny nose, and shortness of breath), affect lung function and worsen medical conditions such as asthma and heart disease.

He added, the sources of plastic in the environment are identified from 5 sources:

- improper disposal
- direct dumping
- leaking from waste infrastructure or industry
- sewage discharge
- hydrometeorological variables such as wind and surface runoff, and disasters including floods, storms, or landslides

It is posited that plastic fragmentation drives an exponential increase in the interfacial area and changes in the surface chemistry. It causes microplastic to interact or adsorb other chemicals in water. It is also a certainty that microplastics is a detriment to human health.

The relations between estimated based on population density, mismanagement plastic waste (per member economies), topographic elevation and artificial barrier were explicitly expounded on. It was also found that more accurate data is needed as direct observation conclude that 5 rivers in Jakarta release 8-16 times lower than previous studies (based on modelling technique). In the end it is clearly stressed that river is the major source of marine debris and single use and other forms of plastic dominate the aquatic/marine environment. It is also realized that local and international collaborations are needed to fill the gap of in observation data.

**iii. Mr. Huno Solomon Kofi Mensah, Senior Program Officer of the Waste and Resource Management Cluster, Regional Resource Centre for Asia and the Pacific, Asian Institute of Technology, THAILAND**

Solomon Huno delivered his speech on **Policies and Regulations on Waste and the Environment: River and Marine**. In his speech, the key policies in place were explained as he listed the policy practices and recommendations based on APEC High Level Meeting on Overcoming Barriers to Financing Waste Management Systems to Prevent Marine Litter and 10 examples of local and national level legislations and policies from member economies to regulate plastic. It was explained that material consumption and economic development is creating stress on municipalities and cities. The explanation posits the need for planning and expansion to meet current growth on governance, regulations, and policies. Waste management challenges are expanding in the region due to the lack of segregation at source, open burning, low collection fees and coverage, illegal dumping, waste mismanagement and the COVID-19 pandemic.

There are many established policies in the member economies, but it was found that they were unable to cater the complex fast-evolving nature of waste and its link to the environment. Marine debris in the ocean may originate from unmanaged waste and from fishing, shipping, and other industrial activities which would then spread further from its origin and is transboundary in nature. This is expounded due to a lack of international arrangements and collaboration. Hence, the coordination at national and local levels are highly imperative to manage multi-sectoral mechanisms, capacity needs, and management mechanisms, reduce overlapping in tasks and increase awareness.

It is also posited that policies and regulations must involve diverse stakeholders. In the end, it was suggested that the waste management solution approach must include:

1. market forces to drive business towards scalable investments that simultaneously generate sustainable solutions to development challenges;
2. creating more data from more sources with more disaggregation and making these more easily transparent and accessible to drive towards evidence-based reforms and accountability;



3. more encouragement of innovations (technical, organizational, and business model) to drive the world away from business-as-usual

This is in line with APEC's policies and recommendations on setting ambitious attainable targets, measuring, and rewarding progress, determining shared terms, streamlining decision-making and increasing funding, and improving outcomes by financing all phases of the integrated waste management systems (APEC High Level Meeting on Overcoming Barriers to Financing Waste Management Systems to Prevent Marine Litter, 28-29 September 2016 in Tokyo, Japan).

#### **iv. Professor Kahoko Nishikawa, Faculty of Commerce, Chuo University, JAPAN**

Prof. Dr. Kahoko Nishikawa delivered her speech on the **Study of Riverine Litter: Composition and Generation** via the Zoom platform. She explained that 400 million tonnes of plastic are produced annually. This is increasingly untenable, and new methods need to be found to manage this. She added that plastic waste is now everywhere within and thereabout the marine ecosystem. It is on coastal trees, birds, fish, and other life forms. It is a huge dangerous issue as plastic and microplastics contain harmful additives such as benzotriazole, ultraviolet (UV) stabilizers, and brominated flame retardants, to name a few.

In general, Prof. Nishikawa elaborated that plastic and microplastics have been found to create new health issues. It was shown that plastics and microplastics included harmful additives such as benzotriazole UV stabilizers - brominated flame retardants - Polychlorinated biphenyls (PCBs). It was also explained that marine animals have ingested these elements and there is evidence that they will travel into other life forms including humans.

Furthermore, about 50 percent of the birds in the world are impacted by the additives of microplastic. Consequently, it was discussed how microplastics could be accumulating in human bodies. The case study of Tama river showed that the number of microplastics were increased from upstream to downstream in various shapes and sizes, and can be found in the marine life.

The surge of plastic waste is a serious threat to ocean and coastal ecosystems, including marine biota conservation, which will subsequently endanger human health and other marine life forms. Marine plastic sources come from a variety of household items found in the trash especially personal care products. Though the long-term effects of plastic ingestion on the human body are not yet well documented, studies are underway. However, results from case studies are already pointing out that pathogenic risk is already evident in environmental waters. The source was explained as possible runoff from the hospital and residential house pathogenic bacteria, antimicrobial resistant bacteria, and its antimicrobial (AMR) resistant genes.

It is also highlighted that a high share of the world's marine litter and plastic pollution has its origin in Asia and this is compounded by the realization back in 2010 that many member economies contributed to the estimated mass of mismanaged plastic waste in millions of metric tonnes. Other than awareness and education, data sharing is proposed as one of the very pertinent solutions for these issues especially as the health concerns are serious and growing.

**v. Mr. Norshahrizal Nordin, President, Malaysian Association of Design and Innovation, MALAYSIA**

Mr. Norshahrizal Nordin delivered his speech on **Technologies: Automatic Log Boom system**. In his speech, Mr. Norshahrizal explained a key trend is the development of technology that uses minimal manpower and can substantially protect and improve waste management. The Log Boom technology that has been gaining attraction in Malaysia is precisely the required solution. This is shown through a comparative analysis fashion in terms of the ability and suitability to remove waste and garbage from rivers. The many types of mechanisms that have multiple areas of failure chances in comparison to his design which is relatively cost-effective, were expounded on. The Automatic Log Boom technology is shown to work better and is less harmful to water-based life forms.

The comparative analysis started with the current standard and mechanisms, and technologies in practice. There are many issues that must be tackled including cost, practicality, types of waste, health concerns, and flooding due to the increase in sediments as the by-product of the mechanism. Thus, design of the log boom is very important to manage issues of waste in rivers. Suitability of a design must include design and failure analysis, financial and cost implications, prototyping, and proof of concept to final design.

The discussion included the danger and safety level of the water in class 3 and 4 (by Malaysian standards), which is not safe for human contact. Facts were also highlighted on issues of mosquito breeding grounds and other dangerous animals that may feed off the waste, especially animal carcasses. The speech posited clear reasons for the need for log boom technology and add to it the cost explanation.



It was concluded that cost-effective solutions require automation and smart technologies. It was also suggested that a locally produced system support the local economy and provide more job opportunities. It also recommended government tenders and projects in river cleaning activities follow specific Standard Operating Procedures that focus on cost efficiency, workers and community safety, environmental sustainability, and following Immigration and Local Council rules and regulation. Finally, the setting up of an Environmental Maintenance and Service Act, Regulation, and Policies for APEC Economy to agree upon initiatives are more effective and measurable results in riverine litter and debris management services.

**vi. Ms. Sofea Farida, Co-founder and Director of Planning and Development, EcoGarage Sdn. Bhd., MALAYSIA**

Ms. Sofea Farida delivered her speech on **Recovery Potential: Upcycling and Other Alternatives**. She explained what we can and should do with waste and went on to list what can be done with waste that we now have. Her best term was 'value unlocked' from waste which would have gone unnoticed and become part of a bigger problem of waste. Her session was moderated by Azhanni Muhammad.

The increase in plastic waste is considered a serious threat to our environment which includes ocean and coastal ecosystems, which will subsequently endanger human health. Thus, it is apt that we look for more alternatives to manage and reduce waste. As major cities, which are hotspots of unmanaged waste, are grappling with these problems, the best alternative seems to point to the viewpoint towards waste as not just waste by something with value attached to it.

In 2019, USD 234 million is the unlocked annual value of waste, and if we know what to do with them. It is realized that in all actuality, more could be gotten from waste as a total of over USD 1 Billion is lost due to several reasons. The loss is mainly due to loss in price, resin loss in the recycling process and simply not being collected. Technologies and innovations such as novel collection systems, recycling, and other means are required and would be more supported if the waste is seen more as an item of possible value.

Managing at source is cheaper and wholesomely better through the concept of 'easier' recycling. There were many recycling examples shared that can be implemented and will unlock values of the waste. As 75% of the trash collected is essentially plastic (Reef Check Malaysia 2020), the need to enhance efforts on recovery potential and upcycling the waste is ever-increasing.

In general, there are two main methods used for plastic recycling which are mechanical and chemical recycling. Both methods have specific requirements and results, further highlighting the need for this approach to be improved. Therefore, more value is anticipated for waste to be segregated at source with various ways to unlock their potentials are found, rather than conventional ways to manage the waste.

## **b. Focus Group Discussion (FGD)**

The first FGD (designated as FGD1) was conducted on the 18<sup>th</sup> of October, addressing each topic from the first three speakers as follows:

Topic 1 - Solid Waste Management and Issues

Topic 2 - River as Transport Pathway

Topic 3 - Policies and Regulations in Waste and Environment: River and Marine

Meanwhile, the second FGD (designated as FGD2) was conducted on the 20<sup>th</sup> of October addressing each topic delivered by the last three speakers as follows:

Topic 4 - Study of Riverine Litter: Composition and Generation

Topic 5 - Technology – Automatic Log Boom System

Topic 6 - Recovery Potentials: Upcycling and Other Alternatives

In both FGD sessions, participants were divided into groups. In FGD1, there were 3 groups where one is physical, while the other two were online groups conducted through Zoom breakout rooms. In FGD2, two groups were organized; one physical while the other is online. Each group has its own moderator. The moderator started each session with questions about issues based on the topic, followed by recommendations and solutions.

## i. Discussion Summary of FGD 1

This summary frames the issues and recommendations on all 3 topics discussed by the groups on similarity and/or connectivity. The finding was grouped into 3 main sub-classes: policy, technology, and cooperation.

**Table 1: Summary of the issues and recommendations generated in FGD 1**

No	Items	Issues	Recommendations/Solutions
1	Policy	Insufficient and not fully encompassing, and some outdated ones.	<ul style="list-style-type: none"> <li>i. Review and upgrade based on shared data from other member economies.</li> <li>ii. Ensure clear demarcation and instruction and implementation level.</li> <li>iii. Add new policies and incentives so that the 'managing at source' mantra can be fully supported. <ul style="list-style-type: none"> <li>- Reduce single-use plastic</li> <li>- Support a sustainable design</li> <li>- Support collection fees through new funding (federal or private)</li> </ul> </li> <li>iv. Reduce riverbank merchants</li> </ul>
2	Technology	<ul style="list-style-type: none"> <li>i. High Cost</li> <li>ii. Lack of usage of new technology, and most are not based on IoT</li> <li>ii. Landfill is still the predominant choice</li> </ul>	<ul style="list-style-type: none"> <li>i. Encouraging reusable designs</li> <li>ii. An incentive for sustainable design</li> <li>iii. Moving fast toward IoT design</li> </ul>
3	Cooperation	Predominantly localized efforts either at district, state, or member economy	Networking and sharing of local, national, and international data, funding, and other resources.

## ii. Discussion Summary of FGD 2

This summary frames the issues and recommendations on all 3 topics discussed by the groups on similarity and/or connectivity. Similarly, the findings were grouped into 3 main sub-classes: policy, technology, and cooperation.

**Table 2: Summary of the issues and recommendations generated in FGD 2**

No	Items	Issues	Recommendations/Solutions
1	Policy	<ul style="list-style-type: none"> <li>i. Lack of clear regulations and enforcement that allows polluters to continue polluting.</li> <li>ii. Lack of awareness and actual numbers of recycling and recycling centers</li> <li>iii. Lack of awareness in the collection and segregating</li> </ul>	<ul style="list-style-type: none"> <li>i. Improve government policies, rules, and regulations to implement clearer and stricter rules</li> <li>ii. More waste centers near residential areas</li> <li>iii. More campaigns and significant educational sections on the environment</li> </ul>
2	Technology	<ul style="list-style-type: none"> <li>i. The data received and actual happenings are conflicting and inconsistent</li> <li>ii. Difficulties in collecting and segregating plastics</li> <li>iii. High cost of upcycled products sometimes more than new ones)</li> <li>iv. Degraded and contaminated plastic or other waste materials</li> <li>v. Financial issues to make and install technologies such as log boom</li> <li>vi. Unproven Technology at all areas, for Log Boom, only in Klang valley with the prototype in Perak</li> <li>vii. Lack of Awareness of the advantages of technology.</li> </ul>	<ul style="list-style-type: none"> <li>i. More engagement with stakeholders for funding and awareness</li> <li>ii. Promote the concept of a circular economy for a technology-driven mechanism</li> <li>iii. More support for the technology, especially local ones like the log boom that was explained</li> </ul>
3	Cooperation	<ul style="list-style-type: none"> <li>i. Lack of awareness among economies on the impact of this problem on them and on how to manage or minimize the problem due to their surrounding</li> </ul>	<ul style="list-style-type: none"> <li>Start having plans and implementation guides on all of these issues</li> </ul>

localities or economy.

- ii. Lack of data exchange with other sources or economy
- iii. Near zero integrated approach that connects the health of animals, environment, and humans

Based on the two FGD sessions, the assessment of new skills and knowledge gained by the participants from this event found that the skills acquired are explicit but are interrelated which was identified especially in the discussion section. The knowledge identified by the participants is grouped into three categories; policy, technology, and cooperation. The frequency of the responses based on these 3 categories were recorded. The frequency is calculated on the meaning of the responses in connection to the categories by applying linguistic and contextual values. It was found that approximately 50% of the skills area improvement is in the cooperation theme, 31% on technology, and 19% on the policy.

## 5. COLLECTIVE FEEDBACK

This section presents the results from the knowledge evaluation and feedback surveys conducted regarding the level of knowledge, awareness, and practices (past, present, and future) gained from the hybrid webinar and FGDs and for the overall program among the participants. Respondents from 8 member economies were categorized as nominated participants and two endorsed participants from member economies were not able to attend after registering. Slightly more than half of the respondents were males, and 48% are female. Thus, with only a 2% difference, the results of the collective survey are considered to be gender-neutral.

### a) Hybrid Webinar - Evaluation of Knowledge Gained by Participants

It is reported that very positive responses were received addressing the topics being presented in the webinar. Below is the specific explanation of the responses based on the topics.

Based on the feedback from the survey, all respondents agree that the objectives of the project were clearly defined, with 61% strongly agreeing and 39% agreeing. All respondents agree that the project achieved its intended objectives, with 65% of the respondents strongly agreeing and 35% agreeing. The agenda items and topics were relevant, with 70% of the respondents strongly agreeing and 30% agreeing. All respondents agreed that the content was well organized and easy to follow, with 61% strongly agreeing and 39% agreeing. All except one respondent agreed that the content was well organized and easy to follow, with 61% strongly agreeing and 30% choosing the agree option. All agree that experts/speakers were well prepared and knowledgeable about the topic. Around 74% of the respondents strongly agreed, and 26% chose the option 'agree'. All agree that the materials distributed were useful, with 61% of the respondents strongly agreeing and 39% agreeing. All agree that the time allocated for the training was sufficient. About 65% of the respondents strongly

agreed, and 35% agreed.

In assessing how the project is relevant to the participant and their economy, it is reported that 78.2% categorically agreed that the project is relevant. Only 2 (8.6%) reported otherwise. It is thus comfortably stated that the project is of high relevance to them and their economy. Around 3 respondents reported their view on relevance as neutral, 1 respondent reported them as not relevant, and 1 reported it as very not relevant.

Evaluation of the project's results/achievements was divided into positive, neutral, and negative responses to ensure that the data could be interpreted meaningfully by the audience. From the initial data, it was found that 22 out of 23 responses were clearly positive. Only one was categorized under neutral, and none was in the negative category. This indicates that the program improved the understanding of challenges and practical solutions in the waste management landscape. The program also increased awareness of the challenges, risks, and impacts of marine debris in the Asia Pacific region and managed to increase knowledge of best practices on riverine transport mechanisms and monitoring technologies/ best practices in member economies. The positive responses were gained from 95.7% of the respondents, it can be concluded that there is no significant difference in the views between gender. The same can be concluded for the views of member economies as the positive view is in the majority.

It is reported that 30.4% of the respondents claim that their level of knowledge and skills prior to the event is from the low to very low category. Significantly, 43.5% of the respondents rated themselves in the unsure category, whilst 26% that their knowledge and skills are quite high. Conclusively, 74% of the respondents rated themselves at the high and very high increase category after the event, with 13% at the unsure level. This positive could also be added as one of the respondents though giving a positive written response to the increase in knowledge and skills and rating the score in contradiction. It can be concluded that the knowledge levels of the respondents have increased significantly with also considerations that there was not a single respondent who chose strongly to disagree and disagree descriptor.

In terms of gender distribution, it is positively reported that 85% of the female respondents claimed that they had increased their knowledge and skills after the event. Around 60% of the male respondents reported that their knowledge and skills had increased after the event.

Evaluation of the participant's view on the next step by APEC, whether there are plans to link the project's outcomes to subsequent collective actions by fora or individual actions by economies, 87% of the participants are favourable towards linking the projects' outcomes (data, findings, and methodology) to future actions and steps by APEC. Among the significant selected statements inserted as responses by the respondents are:

- i. Its better if the result of this event goes public through the article that could be read by other persons
- ii. APEC must discuss and comes up with policies and regulations, including incentives to the economy for debris management and waste recycling
- iii. Conduct a project that includes people with different educational backgrounds and social classes
- iv. Encourage people to do more recycling and upcycling
- v. Government intervention with the private sector to empower sustainability outcomes

Respondents' views on how to improve the project:

- i. the project shall be continuously conducted to generate knowledge that the world needs to know, by choosing the right relevant and practical topics
- ii. avoid choosing none related speakers for certain topics and more consideration to the time difference
- iii. to create collaboration among APEC members, promote more people, more engagement with policymakers
- iv. increase the number of participants, more physical collaborations, involve more types of companies
- v. present a guideline on debris management from developed member economies
- vi. associate more corporate environmental protection income-generating projects, more activities, involving more researchers and industries to share new technologies and knowledge, involve more authorities or expertise in that particular area.

### **b) FGD – Knowledge Evaluation Gained through Practices Evaluation – CSS (Continue-Stop-Start) Action Plan**

The CSS (Continue-Stop-Start) Action Plan is a tool to identify and evaluate the next plan of action after the program. It is divided into these 3 actions:

**'Continue'** – actions that have been implemented and are beneficial in achieving the objectives

**'Stop'** - actions that have been implemented and are NOT beneficial in achieving the objectives

**'Start'** - actions which have NOT been implemented but they realized to be beneficial in achieving the objectives

# Items that are similar are grouped together

**Table 3: Actions that should be continued**

<b>CATEGORIES</b>	<b>POLICIES</b>	<b>TECHNOLOGY</b>	<b>COOPERATION</b>
<b>CONTINUE</b>	<ul style="list-style-type: none"> <li>• Waste separation at the source</li> <li>• Monitoring of microplastics</li> </ul>	<ul style="list-style-type: none"> <li>• Recycling</li> <li>• Innovation to reduce and manage garbage</li> <li>• Works being done on log boom systems and educational works for the economy</li> </ul>	<ul style="list-style-type: none"> <li>• Reduce the amount of Marine Debris</li> <li>• Educating the masses on general waste and microplastics</li> <li>• Educate stakeholders and communication with more organizations</li> <li>• Including more participants</li> </ul>
<b>DISCUSSION</b>	In the views collected from the FGDs and speeches, these actions	The discussion in FGD 2 and the responses from the 5 <sup>th</sup> speaker	Both FGDs and all the speeches supported the need for more to be done

	were also posited. Participants from member economies Peru and Thailand added that giving incentives to those already at the separation work may lead to more separation done.	concluded that more must be done in terms of educational awareness and technological research and advancement to enable technology to be more prominent in tackling waste and marine debris issues.	through collaboration and cooperation in terms of awareness enhancement and educational strategies for managing waste and marine debris issues.
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**Table 4: Actions that should be stopped**

<b>CATEGORIES</b>	<b>POLICIES</b>	<b>TECHNOLOGY</b>	<b>COOPERATION</b>
<b>STOP</b>	<ul style="list-style-type: none"> <li>• Using single-use plastic</li> <li>• Illegal dumping</li> <li>• Disposal of the garbage directly into the river</li> </ul>	<ul style="list-style-type: none"> <li>• Release the waste in an open landfill</li> <li>• Public acceptance of recycling practice</li> <li>• Create a more sustainable system to collect debris from household</li> </ul>	<ul style="list-style-type: none"> <li>• Throwing culture that endlessly leads to the accumulation of plastic waste into the river.</li> <li>• Reduce the use of plastic bags and use canvas bags</li> <li>• Use of single-use plastics</li> <li>• Reduce the use of plastic bags and use canvas bags</li> <li>• Direct debris disposal to the river by increasing public awareness about marine debris</li> <li>• Consuming and buying too many products</li> </ul>
<b>DISCUSSION</b>	<ul style="list-style-type: none"> <li>• The FGDs and the speeches are not only in agreement but point that both policymakers and social consciousness do not contribute more in terms of waste and wasteful behaviors.</li> </ul>	<ul style="list-style-type: none"> <li>• The discussion in FGD 1 and 2 and the responses from the 5<sup>th</sup> and 6<sup>th</sup> speakers concurred that more must be done in terms of educational awareness and technological research and advancement to enable technology to be more prominent in tackling waste and marine debris issues.</li> </ul>	<ul style="list-style-type: none"> <li>• Similar to the view under policy discussion.</li> </ul>

**Table 5: Actions that should be started**

CATEGORIES	POLICIES	TECHNOLOGY	COORPERATION
<p><b>START</b></p>	<ul style="list-style-type: none"> <li>• Consider the environment the of the ocean with energy</li> <li>• unplanned development of coastal areas.</li> <li>• Educate people (especially the young generation, lecturers, and people in charge) to add more wariness to all communities.</li> <li>• provide climate education to the general public</li> <li>• Conduct research on ocean energy</li> <li>• Imposing hefty fines.</li> <li>• Sorting waste at sources.</li> <li>• Exchange technologies and knowledge with other member economies for a win-win situation.</li> <li>• Combine this issue with climate change for carbon reduction.</li> </ul>	<ul style="list-style-type: none"> <li>• Research about the marine debris in rivers against model data.</li> <li>• Upcycling.</li> <li>• Recycling plastic products.</li> <li>• Advanced technology to reduce current plastic waste and education syllabus.</li> <li>• Create revenue generating project</li> <li>• systematic study and planning for combating marine debris</li> <li>• Upcycling and repurposing my plastics.</li> </ul>	<ul style="list-style-type: none"> <li>• Raise awareness through education and stricter law implementation.</li> <li>• More research of the area conduct research about debris emission from the river.</li> <li>• Use of sustainable, Reusable products and packaging</li> <li>• Education and awareness on household waste recycling,</li> <li>• The culture of waste segregation must be from an educational platform</li> <li>• Start using natural materials.</li> <li>• Pay more attention to all aspects of environmental protection.</li> <li>• Focus on daily sustainable leaving, beach cleaning, mechanical coastal cleaning.</li> <li>• Creating awareness among family &amp; friends</li> </ul>
<p><b>DISCUSSION</b></p>	<p>The FGDs and speeches, especially in the responses, concurred with all the statements. It is</p>	<p>Both FGDs concurred on this, with participants from member economies Thailand and</p>	<p>All the views from the speeches and FGDs categorically are in agreement with all the statements.</p>

	highlighted that oftentimes it is just based on public and government awareness to help implement the policies better and add the final 5%, such as the hefty fines and the giving of incentives to help manage the waste better.	Indonesia adding that data combination and collection from different sources may enable a better plotting of the happenings or phenomena to be implemented.	
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## 7. Conclusion and Recommendations

The 4-day hybrid webinar and FGD managed to build capacities of participants from 8 member economies, including China, Indonesia, Japan, Malaysia, Peru, Chinese Taipei, Thailand, and Viet Nam as well as non-member economies, including Iraq and Nigeria.

Insightful talks from experts covered the topics on solid waste management and issues, the composition and generation of riverine litter, the river as the major transport pathway for marine debris, regional policies and regulations on riverine litter, and marine debris technologies available to help mitigate riverine litters problems as well as waste recovery potentials.

The FGD sessions provided the platform for all participants to share their waste management-related issues, experiences, and practices from different member economies, and practical strategies that should be focused on have been discussed.

The key recommendations gathered from the talks, FGD sessions, as well as feedback surveys for the way forward in marine debris management and monitoring, as the river is the major transport pathways are as follows:

- i. Continuous awareness and education programs are needed to build the capacity of society and officials within and across member economies in waste management;
- ii. Advancement in research and development, incentives from relevant parties, and technology transfer cooperations are needed to enable a more efficient solution in tackling waste and marine debris issues;
- iii. Development and implementation of waste-related policies integrated at local, national, and regional levels are needed for better waste management strategies;
- iv. Establishment of a data collection, storing, and sharing platform from different sources and economies may enable a better integrated strategy; and
- v. Capacity buildings on waste recovery potentials (recycling, upcycling, waste to energy) are also needed for long term sustainable waste management solutions.

## WEBINAR AND FOCUS GROUP DISCUSSION AGENDA



	Time	Topic	Speaker
<b>Day ONE (17<sup>th</sup> Oct)</b>	2.00-2.15pm	Opening Address	
	2.15-3.45pm	Solid Waste Management and Issues	<b>Mr. Ramli Mohd Tahir</b> KDEB Waste Management Sdn Bhd, MALAYSIA
	3.45-5.15pm	River as Transport Pathway	<b>Mr. Yulianto Suteja</b> Marine Science Department Faculty of Marine and Fisheries Udayana University, INDONESIA
Moderator	Mr. Raimizar Rahim		
<b>Day TWO (18<sup>th</sup> Oct)</b>	2.00-3.30pm	Policies and Regulations on Waste and the Environment: River and Marine	<b>Mr. Huno Solomon Kofi Mensah</b> Regional Resource Centre for Asia and the Pacific Asian Institute of Technology THAILAND
	3.30-5.00pm	Focus Group Discussion 1	
	Moderator	Mr. Ahmad Syihan Fadzli	
<b>Day THREE (19<sup>th</sup> Oct)</b>	2.00-3.30pm	Study of Riverine Litter: Composition and Generation	<b>Professor Kahoko Nishikawa</b> Faculty of Commerce, Chuo University, JAPAN
	3.30-5.00pm	Technologies: Automatic Log Boom system	<b>Mr. Norshahrizal Nordin</b> Malaysian Association of Design and Innovation, MALAYSIA
	Moderator	Mr. Ahmad Syihan Fadzli	
<b>Day FOUR (20<sup>th</sup> Oct)</b>	2.00-3.30pm	Recovery Potential: Upcycling and Other Alternatives	<b>Ms. Sofea Farida Mohd Shukri</b> EcoGarage Sdn. Bhd. MALAYSIA
	3.30-5.00pm	Focus Group Discussion 2	
	5.00-5.15pm	Closing Address	
Moderator	Ms. Azhanni Muhammad		

Annex 2: List of Participants

No	Name	Member Economy	Gender	Participation
<b>SPEAKERS</b>				
1	Yulianto Suteja	Indonesia	M	Speaker
2	Kahoko Nishikawa	Japan	F	Speaker
3	Ramli Mohd Tahir	Malaysia	M	Speaker
4	Norshahrizal Nordin	Malaysia	M	Speaker
5	Sofea Farida Mohd Shukri	Malaysia	F	Speaker
6	Huno Solomon Kofi Mensah	Thailand	M	Speaker
<b>MODERATORS</b>				
7	Azhanni Muhammad	Malaysia	F	Moderator
8	Raimizar Rahim	Malaysia	M	Moderator
9	Ahmad Syihan Fadzli	Malaysia	M	Moderator
<b>PARTICIPANTS</b>				
10	Yin Beilei	PRC	F	Participant
11	Li Yang	PRC	F	Participant
12	Mashashi Nakayama	Japan	F	Participant
13	Abu Hanifah Mohammad Ramli	Malaysia	M	Participant
14	Nuraini Daud	Malaysia	F	Participant
15	Sharmaine Xinhui Kaur	Malaysia	F	Participant
16	Farah Ayuni Shafie	Malaysia	F	Participant
17	Siti Rohana Mohd Yatim	Malaysia	F	Participant
18	Binyamin Yusoff	Malaysia	M	Participant
19	Sara Purca	Peru	F	Participant
20	Adriana Ghersi	Peru	F	Participant
21	Leonela Valdivia	Peru	F	Participant
22	Hsin-Chen Sung	Chinese Taipei	F	Participant
23	Yi-Bei Liang	Chinese Taipei	F	Participant
24	Chun-Hao Jung	Chinese Taipei	M	Participant
25	Chalatip Junchompoo	Thailand	F	Participant
26	Ratchanee Puttapreecha	Thailand	F	Participant
27	Jenwit Thammavichan	Thailand	M	Participant
28	Kongkiat Kiitiwattanawong	Thailand	M	Participant
29	Apaporn Siripornprasarn	Thailand	F	Participant
30	Nakhorn Pila	Thailand	M	Participant
31	Wiparat Thong-Ngok	Thailand	F	Participant
32	Kajitpan Jarernnate	Thailand	F	Participant
33	Quang Dung Le	Viet Nam	M	Participant
34	Qusay Luay Doorri	Iraq (Non-Member)	M	Participant
35	Rukayya Mohammed	Nigeria (Non-Member)	F	Participant
36	Halima Mohamed	Nigeria (Non-Member)	F	Participant

### Annex 3: Event Photographs

	<p><i>Participants asking questions</i></p>
	<p><i>Group Photo</i></p>
	<p><i>Group Photo of the organizers and moderators</i></p>
	<p><i>Closing speech and Appreciation</i></p>
	<p><i>Secretariat Teams</i></p>