Data Collection Survey on the Marine Plastic Litter and Application of Japanese Technologies for Resource Circulation

Final Report

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Japan International Cooperation Agency(JICA)

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Acronyms

ADB	Asian Development Bank
AFD	Agence Française de Développement
APEC	Asia Pacific Economic Cooperation
BtoB	Bottle to Bottle
CLOMA	Clean Ocean Material Alliance
CMMA	Coordinating Ministry of Maritime Affairs (I)
COBSEA	Coordinating Body on the Seas of East Asia
DCMR	Department of Coastal and Marine Resources (T)
DENR	Department of Environment and Natural Resources (P)
DEQP	Department of Environmental Quality and Promotion (T)
EIB	European Investment Bank
EPR	Extended Producer Responsibility
ESG	Environmental, Social and Corporate Governance
ERIA	Economic Research Institute for ASEAN and East Asia
FIT	Feed in Tariff
GEF	Global Environment Facility
GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection
GIZ	Gesellschaft für Internationale Zusammenarbeit
GPA	Global Programme of Action for the Protection of the Marine Environment from Land-based Activities
ICC	International Cleanup Campaign
IMO	International Maritime Organization
IUCN	International Union for Conservation of Nature
JAIF	Japan-ASEAN Integration Fund
JaIME	Japan Initiative for Marine Environment
JEAN	Japan Environmental Action Network
JICA	Japan International Cooperation Agency
KFW	Kreditanstalt für Wiederaufbau
MOC	Ministry of Construction (V)
MOEF	Ministry of Environment and Forestry (I)
MONRE	Ministry of Natural Resources and Environment (T)(V)
NSWMC	National Solid Waste Management Committee (P)
NOAA	National Oceanic and Atmospheric Administration
NORAD	Norwegian Agency for Development Cooperation
NOWPAP	The Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific region
OECD	Organization for Economic Co-operation and Development
PCD	Pollution Control Department (T)
POPs	Persistent Organic Pollutants
PPP	Public Private Partnership
RAP MALI	Regional Action Plans on Marine Litter
RC3S	Regional Capacity Center For Clean Seas
RDF	Refuse Derived Fuel
RPF	Refuse Plastic & Paper Fuel
SATREPS	Science and Technology Research Partnership for Sustainable Development
SDGs	Sustainable Development Goals
SIDA	Sweden International Development Agency
UNEA	United Nations Environment Assembly
UNEP	United Nations Environment Programme
UNGA	United Nations General Assembly
UNICPOLOS	United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea

USAID	United States Agency for International Development
VASI	Vietnam Administration of Seas and Islands (V)
VEA	Vietnam Environment Administration (V)
WEF	World Economic Forum
WtE	Waste to Energy
WWF	World Wildlife Fund

(I) Indonesia (P) the Philippines (T) Thailand (V) Vietnam

Chapter 1 Outline of the Survey

1.1 Background

The main cause of marine plastic litter is thought to be the release of waste in coastal areas or into the ocean, due to improper solid waste management (SWM) on land. Major concerns include (i) the degradation of the marine environment and its ecosystem, (ii) impaired ship navigation, (iii) the impact on tourism and fisheries, and (iv) a degraded coastal living environment. The amount of marine plastic litter that reaches the ocean in one year is estimated to be about eight million tons (Jambeck, et al. 2015). As plastic remains undecomposed and keeps accumulating for a substantially long period, worldwide countermeasures need to be promoted and assistance is urgently required, in particular for developing countries that do not have sufficient experience in environmental measures.

In the international arena, the 2017 G20 Hamburg Summit clearly addressed the issue of marine litter and launched an initiative called the "G20 Action Plan on Marine Litter", covering such necessary actions as waste reduction. At the G7 Summit in Charlevoix, Canada, held in June 2018, G7 leaders agreed on the "Charlevoix Blueprint for Healthy Oceans, Seas and Resilient Coastal Communities". This was followed by the adoption of the "G7 Innovation Challenge to Address Marine Plastic Litter" in September of that year. All of these measures signify an accelerated response to the problem. Furthermore, countermeasures against marine plastic litter through the promotion of circular economy, such as banning or charging for plastic grocery bags, have been adopted in a growing number of countries. Such actions are also expected to stimulate a new industry, related to resource circulation, for example the development of plastic-replacing materials in the private sector.

Under such circumstances, the government of Japan has promoted, in the "Fourth Fundamental Plan for Establishing a Sound Material-Cycle Society" (June 2018), the comprehensive pursuit of plastic material circulation, and in May 2019, formulated a new "Resource Circulation Strategy for Plastics". This addresses the promotion of international cooperation for developing countries to reduce marine plastic litter, as well as the further enforcement of 3R (Reduce, Reuse and Recycle) activities in Japan. Specifically, the draft Strategy states that Japan will share its knowledge, experience, and expertise in waste management, including its technological innovations and the application of Japanese advanced environmental infrastructure, with countries in the Asia-Pacific and other regions by providing assistance that is appropriate to the local needs and development stages of recipient countries.

The Japan International Cooperation Agency (JICA), which has mainly been implementing assistance projects to achieve appropriate land-based SWM, intends to extend its operations to include the management of marine plastic litter. It will do so by such means as starting new training programs and promoting the overseas application of technologies developed by Japanese firms. It also needs to collect and confirm information that is useful for the examination of future assistance policy.

1.2 Survey Objectives

The objective of this survey is to collect data and information necessary for the examination of future assistance policy on the marine plastic litter issue. This includes: international trends related to the issue; challenges and the current situation of marine plastic litter, and countermeasures implemented in Japan and other countries; the assistance needs of developing countries; and the applicability of relevant Japanese technologies. In this survey, in order to increase the understanding of efforts made by Japan and of its technologies, an invitation program on marine plastic litter in Japan will be planned for Asian

countries which are considered responsible for much of the world's marine plastic litter. The survey team will then support JICA to implement the invitation program.

1.3 Survey Team

The consulting firm, Kokusai Kogyo Co., Ltd. (KKC), was responsible for the survey under contract with JICA. KKC's survey team consists of five members, as shown below.

1.	Team Leader/SWM 1	Ichiro Kono
2.	SWM 2/Publicity	Noriko Otsuki
3.	Waste Data Analysis	Ai Akami
4.	Invitation Programs 1	Yoshikazu Miwa
5.	Invitation Programs 2	Yume Mori

The team was also advised by Prof. Atsuhiko Isobe (Research Institute for Applied Mechanics, Kyushu University) and Mr. Michikazu Kojima (Institute of Developing Economies, Japan External Trade Organization (temporarily assigned to Economic Research Institute for ASEAN and East Asia)).

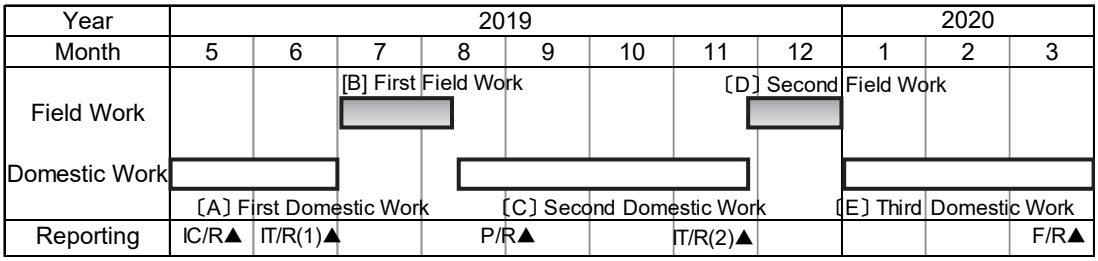
1.4 Structure of This Report

The final report consists of the following chapters.

Chapter 1. Background and Objectives of the Survey
Chapter 2. Challenges and Current Situation of Marine Plastic Litter
Chapter 3. Organization and Integration of Information for the Examination of JICA Assistance Policies for the Marine Plastic Litter Issue
Chapter 4. Organization of Information for the Examination of Assistance for Priority Countries
Chapter 5. Result Analysis of Invitation Program and Recommendations
Chapter 6. Implementation of Seminars and Publications

1.5 Survey Procedure

The following shows the survey procedure.



Note) IC/R: Inception Report, P/R: PR Material, IT/R: Interim Report, F/R: Final Report

Chapter 2 Understanding of the Current Status of Marine Plastic Litter Issue

2.1 Current Situation and Future Prospects of the Marine Plastic Litter Issue

2.1.1 Generation Amount of Marine Plastic Litter

There are several research studies on the amount of marine plastic litter generated. Because not much is well understood about how marine plastic litter is generated, research methodologies and results vary depending on what the release pathways of such litter are assumed to be.

The figure most frequently cited in the literature for generation amount is eight million tons/year, estimated in Jambeck, et al. 2015. For this estimation, they first calculated the waste amount generated by populations living in coastal areas within 50 km of shorelines in 192 coastal countries. Using data such as urban waste generation rates, the composition ratio of plastic to total waste, and the methodology applied to waste disposal by Hoornweg and Bhada-Tata 2012, the researchers estimated the amount of mismanaged plastic waste out of total waste. Further, based on research findings about waste behavior in the watershed that flows into San Francisco Bay, they assumed a rate of 15% to 40% for plastic waste released into the ocean relative to total mismanaged plastic waste and estimated a generation amount of marine plastic litter between 4.8 to 12.7 million tons/year (for an average of 8.76 million tons/year). The country that generates the most marine plastic litter is China, contributing 28%, followed by other Asian countries such as Indonesia and the Philippines (Table 2-1).

Table 2-1 Amount of Marine Plastic Waste Generated by Country

Country	Urban Waste Generation Rate (kg/day/capita)	Middle* (million tons/year in 2010)	Share
China	1.1	2.43	28%
Indonesia	0.52	0.88	10%
Philippines	0.5	0.52	6%
Vietnam	0.79	0.50	6%
Sri Lanka	5.1	0.44	5%
Thailand	1.2	0.28	3%
Egypt	1.37	0.27	3%
Malaysia	1.52	0.26	3%
Nigeria	0.79	0.23	3%
Bangladesh	0.43	0.22	2%
World Total		8.76	100%

* This study assumes a release rate of mismanaged plastic litter at 15% to 40%, and "middle" in this table is the middle value between the lowest (at 15%) and the highest (at 40%).
Source: Jambeck, et al., 2015

Furthermore, based on estimates of future population and future plastic waste composition rates, derived from trends in the plastic composition rate in the United States from 1960 to 2012, the generation of marine plastic litter will reach between 10.4 and 27.7 million tons/year (assuming the aforementioned plastic litter release rate of 15% to 40%) if waste management practices are not changed.

It should be mentioned that the waste generation rate of 5.1 kg/day/capita for Sri Lanka — which was used for the calculation ranking it fifth — is abnormally high. This value is reported in Hoornweg and Bhada-Tata 2012, which also includes the waste generation rates of two cities in Sri Lanka, Dehiwala-Mount Lavinia and Moratuwa, whose averages are 0.70 kg/day/capita. If this lower value is used, Sri

Lanka's marine plastic litter generation is calculated at 0.06 million tons/year, which would put it at 23rd in the ranking.

The research by Jambeck, et al. 2015 assumed that waste generated near the coast and inappropriately managed will partly find its way into the ocean in some way. There are also, however, a number of studies that show evidence of plastic pollution in rivers, and if we consider rivers to be the pathway for plastic litter to the ocean, inland areas can also be considered the generation source. Lebreton, et al. 2017 is one instance of research done from this point of view to estimate the plastic litter amount delivered by rivers. They constructed a computation model using such information as waste management status, population density, river flow volume and seasonal fluctuations, and estimated that the total plastic litter amount delivered by rivers is between 1.15 and 2.41 million tons/year. Asian rivers contribute as much as 86% of total plastic litter discharge. The researchers attribute this to high population density, a high rate of mismanaged waste, and a large amount of rainfall in most Asian countries, and pointed out the importance of monitoring and reducing marine plastic litter in Asia. In addition, plastic litter delivered by the top twenty rivers (Table 2-2) accounts for 67% of the total. It should be mentioned that the model used was calibrated against plastic litter concentration measured in rivers by other research. Because of the nature of sampling devices, which typically had 0.3 mm of mesh size and 0.5 m of aperture, only plastic litter within a size range of 0.3 mm to 0.5 m is taken into account.

Table 2-2 Top 20 Rivers Discharging Largest Amounts of Plastic Litter into the Ocean

River	Country	Midpoint mass input estimate* (x10,000 ton/year)
Yangtze	China	33.3
Ganges	India, Bangladesh	11.5
Xi	China	7.39
Huangpu	China	4.08
Cross	Nigeria, Cameroon	4.03
Brantas	Indonesia	3.89
Amazon	Brazil, Peru, Columbia, Ecuador	3.89
Pasig	Philippines	3.88
Irrawaddy	Myanmar	3.53
Solo	Indonesia	3.25
Mekong	Thailand, Cambodia, Laos, China, Myanmar, Vietnam	2.28
Imo	Nigeria	2.15
Dong	China	1.91
Serayu	Indonesia	1.71
Magdalena	Colombia	1.67
Tamsui	Taiwan	1.47
Zhujiang	China	1.36
Hanjiang	China	1.29
Progo	Indonesia	1.28
Kwa Ibo	Nigeria	1.19

* Middle value of the results from three regression analyses applied in the model.
Source: Lebreton et al., 2017

Lebreton, et al. 2017 also estimated the amount of plastic litter generated within 50 km of coasts and discharged into the sea through rivers. Comparing these results with those of Jambeck, et al. 2015, they estimated that 2.8% to 18.6% of mismanaged plastic waste ends up in the ocean via rivers.

Another paper regarding marine litter that flows through rivers (Schmidt, Krauth and Wagner 2017) calculates the volume of plastic litter discharged through rivers into the ocean based on the estimated

amount of mismanaged plastic waste in watersheds. This study concluded that marine plastic litter from rivers amounts to 0.41 to four million tons/year, of which 88-95% flows through the top ten rivers. If compared with the results from Lebreton, et al. 2017, the Yangtze River in China is at the top in both studies, but other rivers are ranked in a completely different order.

Research by Boucher and Friot 2017 focuses on microplastics[1] under 5 mm in diameter. Thoroughly reviewing the existing literature regarding microplastics, they identified seven types of microplastics according to material or source, as shown in the table below, with total discharge of microplastics into the ocean estimated at 1.5 million tons/year. The largest contribution is from the erosion of synthetic textiles, accounting for 35%.

Table 2-3 Types of Microplastics and Their Contribution to Total Discharge

Types of Microplastics	Description	Pathway to the Ocean	Contribution
Synthetic textiles	Abrasion of synthetic textiles while washing	Wastewater	35%
Tires	Abrasion of tires while driving	Wind and rain	28%
City dust	Loss from the abrasion of synthetic soles of footwear, cooking utensils, building coatings, etc.	Wind and rain	24%
Road markings	Weathering or abrasion of road markings by vehicles	Wind and rain	7%
Marine coatings	Release of marine coatings applied to vessels due to cleaning for maintenance, pre-treatment, weathering, etc.	Direct	3.7%
Microbeads in products	Spillage during the use of personal care products and cosmetics.	Wastewater	2%
Plastic pellets	Pellets spilled by accident during manufacturing, processing, transport and recycling.	Rain or direct	0.3%
			Total 1.5 million tons/year

Source: Boucher and Friot 2017

A recent study (UN Environment 2018) attempted to understand the whole picture of plastic waste discharge by integrating all of the existing information, including from the research introduced above, and by examining how plastic is released into the environment and eventually into the ocean at all stages of the plastic value chain, from production to disposal. This study took into account the results of past studies, including those by Jambeck, et al. 2015 and Boucher and Friot 2017, making appropriate modifications when reasonable[2]. Their findings are shown in Table 2-4.

In this table, plastic particles smaller than 5 mm are called microplastics, while larger particles are macroplastics. Please note that the numbers listed in the “Environmental Compartments” column refer to the following.

- Types A and H are wastes generated in the ocean and discharged into the ocean.

[1] When microplastics are generated as they are, they are called primary microplastics, while microplastics which are the result of fragmentation of large plastics are called secondary plastics.

[2] For example, Jambeck, et al. 2015 assumed that 15-40% of mismanaged plastic waste will reach the ocean, but this rate seemed to be high and was replaced with 10% in UN Environment 2018. The rate of mismanged waste to total waste in China was 74% in Jambeck, et al. 2015, but this was changed to 32%, in reference to other literature. Also, the amount of mismanaged plastic waste in India was 0.6 million tons/year in Jambeck, et al. 2015, while it was 3.87 million tons/year in UN Environment 2018. The reason for this was not described, but it can be pointed out that the plastic composition rate of India used in Jambeck, et al. 2015, which was 3%, was too low.

- Types B and C are discharged into household wastewater and eventually reach waterbodies. Some will remain in freshwater and some will reach the ocean, but this ratio is not shown.
- Types D through G, I and J are wastes that are generated on land, with some remaining in soil, some flowing into drains and rivers, and some reaching the ocean. How much goes to where is not known.

Table 2-4 Types and Volume of Plastics and Environmental Compartments to Which They are Released

(million tons/year)

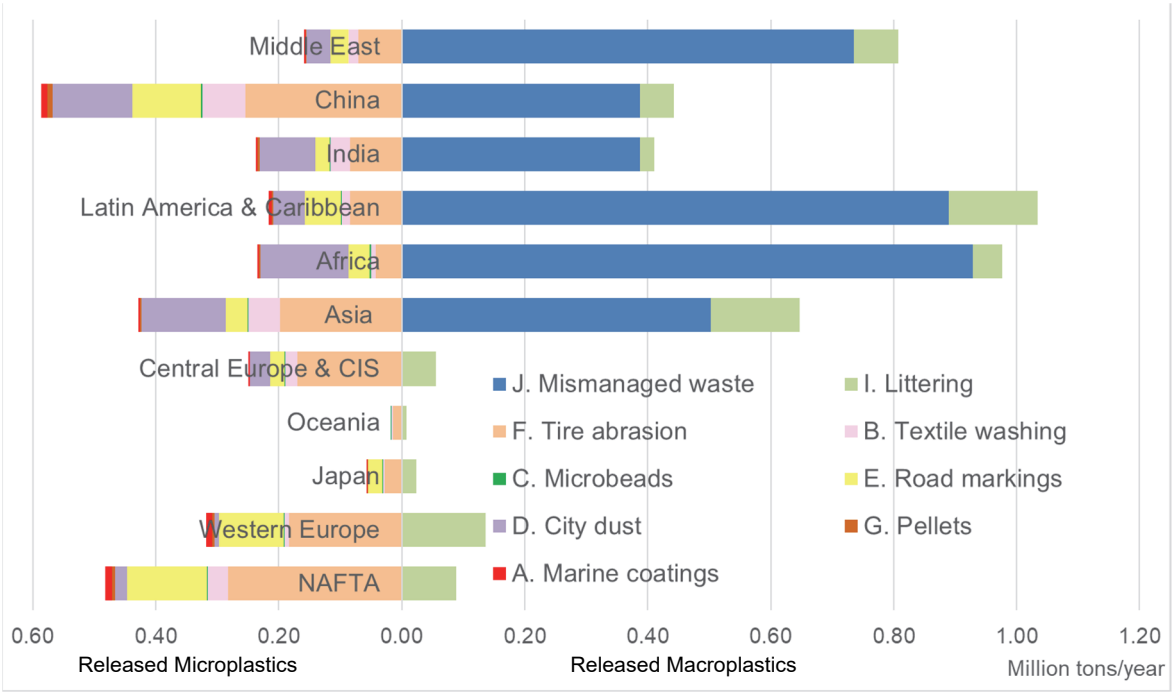
	Volume	Types		Environmental Compartments			Total
				Ocean	Freshwater	Soil	
Microplastics	3.01	A	Marine coating weathering	0.05			
		B	Microfibers, textile washing		0.26		
		C	Microbeads		0.01		
		D	City dust			0.65	
		E	Road marking			0.59	
		F	Tire abrasion			1.41	
		G	Plastic production and handling			0.03	
Macro-plastics	5.27	H	Fishing nets & related losses	0.60			
		I	Littering			0.80	
		J	Mismanaged waste treatment			3.87	
Total	8.28		Ocean	0.65			0.65
			Freshwater/Ocean	0.65	+ 0.28		0.93
			Soil/Freshwater/Ocean	0.65	+ 0.28	+ 7.36	8.28

Source: UN Environment 2018

As shown in the table above, the total amount of plastic released into the environment is estimated at 8.28 million tons/year. Of this, 0.65 million tons/year reach the ocean, another 0.28 million tons/year is released into waterbodies (including the ocean, although as noted above the freshwater/ocean ratio is not shown), and 7.36 million tons/year is released into the ocean, freshwater, or soil (with these ratios likewise unspecified).

The amounts of these kinds of plastic litter generation are influenced by various factors, which include plastic production activities for the estimation of Type G above, traffic volume for Type F, and waste management practices and sewerage network coverage for post-discharge pathways to the environmental compartments. Taking these factors into account, the plastic litter released into the environmental compartments is estimated by region, as shown below in Figure 2-1. Roughly, non-OECD countries are placed in the upper part of the figure and OECD countries in the lower part. There is a tendency for the former countries to generate far more macroplastics than microplastics, probably due to insufficient waste management, while the latter countries generate more microplastics than macroplastics. In addition, with regard to microplastics, tire abrasion is the major source in OECD countries, while city dust as well as tire abrasion are the top two sources in non-OECD countries.

As shown above, a number of studies have been carried out to estimate the generation amount of marine plastic litter. It should be recognized that their results are based on different restrictions or conditions.



*1. Asia excluding Japan, China and India.
*2. "H. Fishing nets & related losses" (0.6 million tons/year) is not included in this figure as their sources are not well understood.
Source: UN Environment 2018 (Table S2)

Figure 2-1 Plastic Litter Release by Region

2.1.2 Marine Plastic Litter Amount

The generation amount of marine plastic litter is discussed in the previous section. In other words, its flow. Given the longevity of plastics — the length of time it lasts without biodegrading — research about stock, i.e. how much plastic litter there is in the ocean, is another important area.

According to the cumulative data analysis (Geyer, Jambeck and Law 2017) of global production and disposal of plastic from 1950 to 2015, total production is 8.3 billion tons and total disposal into the environment in any form is 4.9 billion tons. This includes 150 million tons of plastic in the ocean (McKinsey & Company and Ocean Conservancy 2015).

Based on the annual generation of marine plastic litter estimated by Jambeck, et al. 2015 as shown earlier and assuming an increase in accordance with future global GDP growth, the World Economic Forum 2016 calculated that total marine plastic litter in 2050 could exceed the total weight of fish, 812 million tons, if no countermeasures were taken.

There is another type of research methodology for estimating marine litter volume: simulation modelling where the marine litter volume is computed taking into account sea currents, wind, waves and the vertical mixing process caused by these, and by referring to real data taken in the ocean worldwide. In spite of difficulties such as limited measured data, the inconsistency of past data in terms of units, and the restriction of the aperture size or mesh size of sampling nets, the following results are reported by this modelling approach.

- The amount of plastic litter on the ocean surface is 7,000 to 35,000 tons (Cózar, et al. 2014). Because this value has not changed much since the 1980s, the researchers consider the ocean surface not to be the final destination for plastic and propose possible mechanisms working to

remove plastic from the surface, such as nano-fragmentation, ingestion, biofouling, and shore deposition.

- The total particle count of plastic marine litter in the world's oceans is estimated to be over five trillion. This is about 268,940 tons in mass, of which 36% is in the North Pacific and 75% is larger than 200 mm in size (Eriksen, et al. 2014).
- The amount of ocean microplastic is estimated to be from 15 to 51 trillion particles globally, which is from 93,000 to 236,000 tons (van Sebille, et al. 2015).

As shown above, estimates of the amount of marine plastic litter vary significantly. Compared with the annual generation rate (on the order of eight million tons/year) or cumulative generation amount (150 million tons), they imply a missing sink for a large proportion of marine plastics. The following are thought to possible causes of this missing sink: that the plastic has been deposited on the beach; that sampling nets, such as Manta nets and Neuston nets whose typical mesh size is several hundred micrometers, cannot capture smaller plastic fragments; that biofouling micro-organisms have become attached and have made the plastic litter sink to the sea floor; and that the plastic has been ingested by marine organisms. Such causes are implied by research that shows a repository of microplastics in the form of fibers in deep-sea sediments (Woodall, et al. 2014) and by research that revealed microplastics ingested by deep-sea organisms at depths of over 10,000 m (Jamieson, et al. 2019). The "Deep-Sea Debris Database" website (http://www.godac.jamstec.go.jp/catalog/dsdebris/j/), run by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC), presents a collection of photos of marine litter in the deep seas taken by its submersible vessels.

When considering the worrisome influence of plastic litter on marine organisms, however, plastic concentration should be looked at more carefully than total volume. Plastic litter concentration in the world's oceans is not homogeneous; it varies due to currents, wind, and other factors. Regardless of the volume of plastic, the higher it is concentrated, the more likely that it seriously affects marine organisms.

The term "gyre" is used to refer to five ocean areas where ocean currents converge and circulate (Figure 2-2). Pelagic plastics are thought to concentrate in those five gyres (van Sebille, England and Froyland 2012). One of these is located in the North Pacific Gyre, the so-called Greater Pacific Garbage Patch, which is an ocean area with a particularly high concentration of pelagic plastic. It is estimated that the Greater Pacific Garbage Patch contains a total of 1.8 trillion plastic pieces weighing about 80,000 tons (Lebreton, et al. 2018).

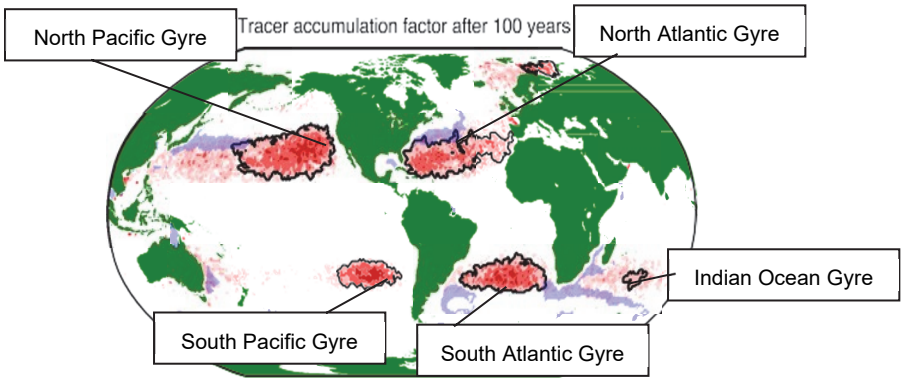
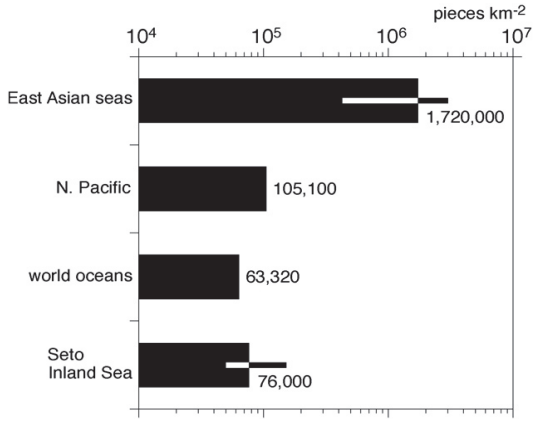


Figure 2-2 Names and Locations of Five Gyres

Source: Figure 1 from van Sebille, England and Froyland 2012. Tracers, the amount of which was determined by coastal population, were

released and their accumulation after 100 years was simulated.

Even though they are not called gyres, enclosed sea areas, the Mediterranean Sea in particular (Cózar, et al. 2015), are regarded as areas polluted with plastic. The East Asian seas around Japan are another example (Isobe, et al. 2015). Compared with other sea areas (reported in Eriksen, et al. 2014), the East Asian seas can be called hot spots, as shown in Figure 2-3.



Superimposed on the bars of the East Asian seas and the Seto Inland Sea is the margin of error evaluated by a t-test with a 95% confidence interval.

Source: Figure 4 from Isobe, et al. 2015.

Figure 2-3 Microplastic Count Density in Three Sea Areas and World Average

Further, a numerical simulation model was developed taking into account a set of previously measured data on marine plastic litter, plastic waste generation estimates (Jambeck, et al. 2015), and a timescale for the removal of plastic from the ocean surface. This model showed that there is an ocean area around 30°N in the Pacific Ocean where plastic concentration is in the range of 100 to 500 mg/m3, and estimates that this value will increase approximately fourfold (more than 1,000 mg/m3) by 2060 (Isobe, Iwasaki, Uchida, and Tokai 2019).

Last but not least, the results of an attempt to integrate existing available data and draw the whole picture of the flow and stock of marine plastic litter are shown below (Eunomia Research & Consulting 2016).

Table 2-5 Flow and Stock of Marine Plastic Litter

Flow		Stock		
Source and Pathway	Million tons/year	Place	kg/km^2	Million tons
Land-based coastal	9	Beach	2,000	1.4
Land-based inland	0.50			
Microplastics in surface runoff, wastewater, etc.	0.95	Ocean surface	0.74	0.27
At sea sources	1.75	Sea floor	70	25.3-65
Total	12.2	Total		27-66.7

Source: Eunomia Research & Consulting 2016

This table shows that marine plastic waste generation is 12.2 million tons/year, while the ocean stock is 27 to 66.7 million tons, of which 94% is lying on the sea floor. The study also states that considerable amounts of plastic (microplastics in particular) may be contained in Arctic sea ice and deep sea sediments, although such stocks are not considered in the study, with data being insufficient.

2.1.3 Impacts by Marine Plastic Litter

(1) Impacts on Marine Life

Cases in which marine animals ingested or were entangled with plastic litter started to be widely reported in the 1970s, as striking examples of the influence of marine plastic litter on marine life. It has been shown that the number of species affected by plastic entanglement or ingestion has doubled since 1997 (Kühn, Rebolledo and van Franeker 2015). There are also a number of cases where microplastics were found in marine organisms, one of which (Tanaka and Takada 2016) detected plastic in 49 out of 64 Japanese anchovies sampled in Tokyo Bay and implied that “microplastics have infiltrated the marine ecosystem” in a particular ocean area “and that humans may be exposed to them” by eating fish.

The ingestion of plastic by marine organisms, firstly in physical terms, causes a blockage in the digestive system or physical injury, and due to insufficient nutrient intake leads to inhibited growth. Although plastic itself is not considered toxic, it has been pointed out that additives in polymers can be released from plastic products into the environment in due course of fragmentation and/or from the influence of ultraviolet light (Teuten, et al. 2009). Further, being hydrophobic, plastics easily adsorb persistent organic pollutants (POPs). It has been pointed out that microplastics may efficiently transport POPs, whose concentration in the ocean is rather low, into organisms (Mato, et al. 2001).

It is to be noted, however, that marine organisms and human beings are affected by other toxic substances and not only by microplastics. The extent to which microplastics are the sole influence is not known. There is also another difficulty in understanding the effects of microplastics, in that there is a mismatch between the types and concentrations of plastics used in experiments and those actually observed in the ocean, as well as a mismatch between species used in laboratory experiments and those for which plastic ingestion is a concern (de Sa, et al. 2018). Further, the particle size of the microplastics in experiments is smaller than those measured in situ or those in modelling by one to four orders of magnitude, which is another obstacle to proper understanding (Isobe, Iwasaki, Uchida and Tokai, 2019).

(2) Impacts on Vessels

The impacts made by marine plastic litter on vessels are reported to include the entanglement of plastics in propellers or anchors and the blockage of seawater inlets for cooling. These often necessitate rescue dispatches or entail economic loss due to the need for repairs to be made (Lee 2015) (Hermawan, Damar and Hariyadi 2017) (Mouat, Lozano and Bateson 2010).

(3) Impacts on Fishery

The impacts made by marine plastic litter on fishery include those on vessels as mentioned above, the entanglement of plastics in fishery apparatuses such as nets and aquaculture equipment and damage to them. The impacts are not only physical; there is also economic loss or a loss of time for the removal of plastic and equipment repair. According to statistics from the government of Scotland in 2009, marine litter including plastic litter costs the Scottish fishery fleet EUR 11.7 to 13 million a year, which is equivalent to 5% of landings (Mouat, Lozano and Bateson 2010). In the APEC region, the economic impact of marine litter including plastic litter on fishery is estimated to reach USD 364 million (McIlgorm, Campbell and Rule 2009). The impact of marine plastic litter on fishery and aquaculture

worldwide is estimated to have been USD 801 million in 2012 (UNEP 2014).

(4) Impacts on Tourism

The presence of marine plastic litter can impair the landscape and detract from tourism value. It is estimated that the cost associated with the impact of marine litter including plastics on tourism in the Asia-Pacific region is USD 622 million a year (McIlgorm, Campbell and Rule 2009). A study on marine litter at UNESCO World Heritage Marine Sites finds impacts that are detrimental aesthetically at more than 70% of 49 sites (Mannaart, et al. 2019). UNEP 2014 estimates that the total economic loss in 2012 to the worldwide tourism sector due to marine plastic litter amounted to USD 4 million.

(5) Cost for Clean Up

The cost of cleaning up marine litter to prevent the aforementioned impacts is substantial. The annual clean-up costs for local governments were EUR 18 million in the UK and EUR 10.4 million in the Netherlands and Belgium (equivalent to USD 23.94 million and USD 13.83 million, respectively, at the average exchange rate in 2010) (Mouat, Lozano and Bateson 2010). In the Hudson-Raritan Estuary in the United States, a study concluded that the annual clean-up cost per resident was USD 6.16 (Columbia Marine Debris Research Team, Colombia University 2015). It should be noted, however, that the figures must be interpreted carefully, as items covered by the clean-up cost can differ in each calculation.

In Japan, municipal governments carry out clean-up by themselves or with subsidies from the central government. The total cost of these clean-up activities was JPY 4.4 billion in FY 2016, whereby 40,000 tons of waste was collected and disposed of (Ministry of the Environment, Japan, 2016). The unit cost is calculated at JPY 110,000 /ton, while average cost of municipal waste management is JPY 35,000/ton[3]. This implies that the clean-up of marine litter costs a significant amount.

2.1.4 Issues Requiring Further Research

Vigorous studies are still required to understand the real picture of marine plastic litter. A number of studies have been introduced in this chapter so far regarding generation rate, total volume, concentration in the ocean, and impacts on the eco-system and society, but much still needs to be explored regarding all of these themes. In addition, the following can be listed as the main areas of concern.

Release Pathway to the Ocean. One of the key assumptions in estimating the generation of marine plastic litter is about its release pathway to the ocean. What kinds of plastic waste are transported, the distance they are transported, and the route through which they are transported to the ocean — all of these can yield different estimations. Therefore, it is necessary to understand how mismanaged plastic waste finds its way into the ocean in order to improve the accuracy of generation estimates.

Behavior of Plastic Litter and its Fragmentation Process in the Ocean. As stated earlier, a certain proportion of marine plastic litter is thought to sink to the ocean floor. At the same time, it undergoes a deterioration and fragmentation process due to physical forces and ultraviolet light, becoming microplastics. The mechanism and speed of this process and the size distribution that results from it is

[3] The generation amount for municipal solid waste was 43.17 million tons and the operation and maintenance cost of waste management was JPY 1,507.8 billion (Ministry of the Environment, Japan, "The Status of Generation, Treatment and Disposal of Municipal Solid Waste in FY 2016" (Japanese)).

thought to be determined by polymer types, the shape of plastics, density, water temperature, pH, depth and other factors, but these are not yet well known. Considering that plastic litter will remain in the ocean for a significantly long time and that a substantial amount of plastics will keep entering the ocean in the coming years, figuring out the behavior of plastic litter and its fragmentation process is essential for understanding the impacts of plastic litter (microplastics in particular).

Standardization of Study and Monitoring Method. Many attempts that reference past study results and integrate or compare existing data and information are found in the literature, as shown in this chapter. However, it has been pointed out that such data utilization is not simple, as the study methods and units used are not uniform. In the present survey, plastics smaller than 5 mm are called microplastics, but this is not the universal definition of the term (Law 2017). Research on nano-plastics (plastic particles at nm size) has recently been started, but the detection methodology has yet to be developed (Koelmans, Besseling and Shim 2015). Meanwhile, in a project financed by the Ministry of the Environment, Japan, floating microplastics in the seas around Japan have been continuously studied based on samples taken by the training ships of Tokyo Marine University, Hokkaido University, Nagasaki University and Kagoshima University, and the analysis of Kyushu University. The measuring technique has been improved through this project, and the data on the concentration of floating plastics is open to access (Isobe 2017). Japan has also taken the lead in the international standardization of microplastics monitoring methods, while a Japanese researcher took part in the development of the plastic litter assessment guideline (GESAMP 2019). Furthermore, the Ministry of the Environment, Japan developed guidelines for surface microplastics monitoring methods, aiming at producing horizontal distribution maps of microplastics at the ocean surface (Michida Y., et al. 2019), based on discussions with researchers invited from different countries.

2.2 Implementation of Countermeasures

2.2.1 Discussion Trends in International Society of Marine Plastic Litter Issue

The following section summarizes how the marine plastic litter issue has been taken up by the international community. For the main trends regarding the issue, see also the timeline on the following page.

(1) Discussion Trends of Marine Litter and Plastic Waste

1) Recognition of Marine Litter Issue

Marine pollution caused by marine litter, especially plastic waste, has been reported since around 1960. Including a report by Japanese researcers that plastic objects were found in the stomach of lancetfish (Kubota and Uyeno 1970), ingestion of plastic litter by seabirds and the entanglement of marine animals in plastic litter have been reported worldwide. In the 1970s, results were widely reported of an assessment of the concentration of plastic resin pellets floating in the ocean and cases of such pellets being ingested by organisms (Ryan 2015).

In response to this situation, in 1982 the US Marine Mammal Commission[4] asked the National Marine Fisheries Service (NMFS) to organize a workshop to address the marine debris issue. “The Workshop

[4] MMC is the governmental advisory organization that execute Marine mammal Protection Act. (https://www.mmc.gov/)

on the Fate and Impact of Marine Debris" (later called "The First International Marine Debris Conference") took place in November 1984, and has continued to be held by the National Oceanic and Atmospheric Administration (NOAA) since then, co-sponsered by UNEP since the Fifth Conference (Richard S. Shomura, Howard O. Yoshida (NMFS, NOAA) 1985).

The "Honolulu Strategy" was adopted at the "Fifth International Marine Debris International Conference" in 2011. This has become an important opportunity to tackle the marine plastic litter issue, appealing to the international community about the necessity of reducing and managing marine litter and curtailing the effects of land-based and sea-based plastic waste.

Table 2-6 Timeline of Discussion of Marine Plastic Litter Issue in International Society

Year	International Conferences, Adopted Documents, etc.
1972	Adoption of London Convention ("Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972") (entered into force in 1975)
1978	MARPOL 73/78 ("International Convention for the Prevention of Pollution from Ships, 1973" as modified by the "Protocol of 1978") (entered into force in 1983)
1984	The "First International Marine Debris Conference"（sponsored by NOAA)
1986	The "Second International Marine Debris Conference"（sponsored by NOAA)
1988	Annex V of MARPOL 73/78 entered into force (prevention of pollution from ships)
1989	Basel Convention（"Controlling Transboundary Movements of Hazardous Wastes and Their Disposal"）(entered into force in 1992)
1994	The "Third International Marine Debris Conference"（sponsored by NOAA)
	Adoption of "The Action Plan for the Protection, Management and Development of the Marine and Coastal Environment of the Northwest Pacific Region" (NOWPAP)
1995	Adoption of "The Global Programme of Action for the Protection of the Marine Environment from Land-based Activities"
1999	Establishment of United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea
2000	The "Fourth International Marine Debris Conference"（sponsored by NOAA)
2002	Agreement for implementation of the "Regular Process for Global Reporting and Assessment of the State of the Marine Environment"
2005	UNGA Resolution A/RES/60/30 on "Oceans and the Law of the Sea"
2011	The "Fifth International Marine Debris Conference" (co-sponsored by NOAA and UNEP), Adoption of the "Honolulu Strategy"
2012	United Nations "Conference on Sustainable Development" (Rio+20)
2013	Amendment of Annex V of MARPOL 73/78 based on UNGA Resolution A/RES/60/30 (Prohibits discharge of all types of garbage into the sea)
2014	The First United Nations Environment Assembly (UNEA-1)
2015	Adoption of SDGs in UNGA, including Goal 14 ("Conserve and sustainably use the oceans, seas and marine resources for sustainable development")
	Implementation of the "First World Ocean Assessment" by UN
	Adoption of "Action Plan to Combat Marine Litter" at G7 Summit 2015 in Schloss Elmau
2016	"The New Plastics Economy: Rethinking the Future of Plastics" released by World Economic Forum
	Publication of UNEP Report, *Marine Plastics Debris and Microplastics*
	Expression of Commitment from G7 for implementation of priority measures in G7 Toyama Environment Ministers' Meeting based on the Action Plan in G7 Summit 2015 in Schloss Elmau
	The Second United Nations Environment Assembly (UNEA-2)
	Reconfirming contribution of efforts on resource efficiency and 3R to the control and reduction of marine litter and plastic waste, and measurement for marine waste in G7 Ise-Shima Summit
2017	Expression of determination for further implementation of "G7 Action Plan to Combat Marine Litter" in G7 Bologna Environment Ministers' Meeting

	Adoption of “Call for Action” in UN Ocean Conference
	Agreement for issuing an initiative of “G20 Marine Litter Action Plan, G20” in G20 Hamburg Summit
	Adoption of “Resolution for Marine Litter and Microplastic”, decision to convene Ad-hoc Technical Expert Meeting
2018	The “Sixth International Marine Debris Conference” (co-sponsored by NOAA and UNEP)
	Adoption of “Charlevoix Blueprint for Healthy Oceans, Seas and Resilient Coastal Communities” and “Marine Plastic Charter”
	Adoption of “G7 Innovation Challenge to Address Marine Plastic Litter” in G7 Environment, Oceans and Energy Ministers Meeting in Halifax
	Adoption of “Action Plan to Address Marine Plastic Litter from Ships” by the Marine Environment Protection Committee (MEPC), including system for marking fishing gear and garbage record-keeping
2019	Adoption of Ministerial Declaration, “Innovative Solutions for Environmental Challenges and Sustainable Consumption and Production” and other 23 resolutions at UNEA-4
	Adoption of amendment to Basel Convention to include contaminated, mixed, or unrecyclable plastics
	“24th Intergovernmental Meeting of the Coordinating Body on the Seas of East Asia” (COBSEA) in Bali (June 2019), discussing revision of the COBSEA Regional Action Plan
	At the ASEAN Summit, the “Bangkok Declaration” was adopted to promote regional cooperation to reduce marine debris and welcomed the ASEAN framework of action, which lists actions and activities to be carried out by the member states.

2) Activities by UN Agencies

- United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea

Marine issues are discussed at the United Nations Open-ended Informal Process on Oceans and the Law of the Sea (UNICPOLOS), which was established in 1999. A different topic is discussed at each meeting, with marine litter being the focus at the Sixth UNICPOLOS in 2005. The agreement made at this meeting was adopted that same year by the UN General Assembly as UNGA Resolution A/RES/60/30, “Oceans and the Law of the Sea” (November 29, 2005).

This resolution called for observance of the United Nations Convention on the Law of the Sea (the Convention) and asked for cooperation among all nations toward it. The request made by the Convention for the review of Annex V of MARPOL 73/78 (see below) is noteworthy. In response to this, the International Maritime Organization (IMO) amended Annex V, as a general rule prohibiting the discharge of all types of garbage into the sea from ships (entered into force in 2013).

More recently, the topic of “Marine Debris, Plastics and Microplastics” was chosen as a theme at the Seventeenth UNICPOLOS in 2016. The meeting confirmed the impact of marine debris, plastics and microplastics on marine organisms and human health. Moreover, as most of it is land-based, the importance of preventing the inflow of marine litter, including measures from upstream (manufacturers) to downstream (consumers) was also confirmed, while each country was asked to take immediate political/legal/social actions.

- Regional Seas Programme

The Regional Seas Programme is a UNEP program that divides the world’s oceans into several sea areas, with neighboring countries facing the same sea area formulating Regional Action Plans on Marine Litter (RAP MALI) and mutually cooperating to deal primarily with the issue of land-based marine pollution. The action plan works as a moderate framework to coordinate concerned countries in each area, but it does not have any legal binding force in the way a convention does. Instead, it asks that

concerned countries cooperate regionally through such actions as entering into agreements to prevent marine pollution and for the conservation of the marine environment. Action Plans have already been adopted by eighteen regional sea areas (including the Mediterranean Region, Caribbean Region, Black Sea Region, East Asian Seas, and Southeast Pacific Region) since 1973. Among these eighteen plans, seven are directly administered by UNEP; one of these is the Northwest Pacific Action Plan (NOWPAP), which Japan has joined. Through NOWPAP, Japan promotes environmental cooperation together with neighboring countries (Russia, South Korea and China) in the Northwest Pacific Region.

In 2006, NOWPAP started "Marine Litter Activity" (MALITA). A variety of activities in the Sea of Japan, the Yellow Sea, and their surrounding coastal areas have been implemented by MALITA. Namely, existing marine litter data and information has been collected and reviewed, meetings and workshops for the purpose of information sharing and common understanding on marine litter have been held, a long-term monitoring program has been developed and put into practice, guidelines have been created on the management of marine litter for the fishery, shipping, and tourism industries, and awareness raising has been conducted. Through the implementation of MALITA, the "Regional Action Plan on Marine Litter" (RAP MALI) was developed. Its main activities are: 1) preventing the inflow of marine litter into the marine and coastal environments; 2) monitoring marine litter quantities and distribution; and 3) the removal and disposal of existing marine litter. Based on this Action Plan, various activities such as the sharing of information on marine litter among regional governments have been implemented.

Likewise, regarding the Southeast Asian Region targeted by this survey, the "East Asian Seas Action Plan" was approved in 1981. Upon adoption, five countries were involved in this Action Plan, namely Indonesia, Malaysia, the Philippines, Singapore and Thailand. In 1994, Australia, Cambodia, China, South Korea and Vietnam joined. Currently, nine countries participate (as Australia is not a participating country any longer). The "East Asian Seas Action Plan" is steered by the Coordinating Body on the Seas of East Asia (COBSEA), which in 2008 formulated "Marine Litter in the East Asian Seas Region". In "Part 2: COBSEA RAP-MALI (Regional Action Plan on Marine Litter)" of this document, activities to be implemented over a five-year period and a working plan for six major actions are stated. These actions are:

Action 1: Preventing and reducing marine litter from land-based sources
Action 2: Preventing and reducing marine litter from sea-based sources
Action 3: Preventing and reducing Lost and Abandoned Fishing Gear (LAFG)
Action 4: Mitigating the impacts of marine litter
Action 5: Raising awareness on marine litter
Action 6: Monitoring and assessing marine litter

Currently, COBSEA, participating countries and related international agencies have been cooperating, and these actions are being implemented. At the 24th Intergovernmental Meeting of COBSEA in June 2019, in order to respond to the current situation, there was a discussion about revising RAP-MALI and they adopted the revised one[5]. Member states agreed to implement technical training, capacity building for governments and other stakeholders, awareness raising and the management of information and knowledge.

[5] https://www.unenvironment.org/cobsea/resources/policy-and-strategy/cobsea-regional-action-plan-marine-litter-2019

- Global Partnership on Marine Litter (GPML)

The Global Partnership on Marine Litter (GPML) was launched at a side event during the United Nations "Conference on Sustainable Development" (Rio+20) in June 2012, in Rio de Janeiro. It follows recommendations made at a UN meeting held in Manila earlier that year. For GPML, the secretariat is provided by UNEP and is joined by international agencies, national governments, companies, NGOs, academic organizations and institutions, local governments, and individuals. GPML follows the "Honolulu Strategy" and promotes activities like the development of an online portal site for marine litter (the "Marine Litter Network").

- SDG 14 and the Ocean Conference

At the 70th Session of the United Nations General Assembly in September 2015, the 2030 Agenda for Sustainable Development and seventeen Sustainable Development Goals were adopted. Of these, marine litter is included in Goal 14 — "Conserve and sustainably use the oceans, seas and marine resources for sustainable development" — in Target 14.1, which calls for the prevention of marine pollution caused by, among other things, marine litter: "By 2025, prevent and significantly reduce marine pollution of all kinds, in particular from land-based activities, including marine debris and nutrient pollution."[6]

In response to Goal 14, the high-level United Nations Conference to Support the Implementation of Sustainable Development Goal 14 (informally, "The Ocean Conference") was convened in June 2017 at the headquarters of the United Nations, under the title of "Our Oceans, Our Future: Partnering for the Implementation of Sustainable Development Goal 14". In the agreed upon declaration — "Our Oceans, Our Future: Call for Action" — the commitment of participants to the conservation and sustainable use of marine resources was clearly stated.

- The World Ocean Assessment

The "First World Ocean Assessment"[7] was prepared as an outcome of the "Regular Process for Global Reporting and Assessment of the State of the Marine Environment", the implementation of which was agreed to at the World Summit on Sustainable Development (Johannesburg Summit) in 2002. This assessment aimed to study the current state of the marine environment on a global scale. The study results were expected to be utilized by decision makers at national, regional, and global levels. The assessment prepared by the Group of Experts of the Regular Process, which was appointed through regional groups within the General Assembly, was divided into seven parts, such as ecosystems, cross-cutting issues of food security and food safety, the impact of human activities, and marine biological diversity. Marine debris is the focus of Chapter 25 in Part V, "Assessment of Other Human Activities and the Marine Environment". In this chapter, the types of marine debris were defined and their impacts summarized — such as entanglement and ingestion by organisms, habitat destruction, impacts on beach communities, beach use, coastal tourism, and commercial fishing. In addition, the densities of floating and benthic marine debris, and the status of the accumulation of marine debris on beaches, were summarized from past studies and the results of international coastal clean-ups, respectively. On the other hand, the assessment stated that there was a gap in the information needed to evaluate the impacts of marine debris. Moreover, it stated that the ways of implementing waste management at the local level

[6] https://www.un.org/sustainabledevelopment/oceans/
[7] https://www.un.org/regularprocess/content/first-world-ocean-assessment

would be a barrier to solving the issues and that biodegradable biopolymers as alternatives to plastic were needed.

- United Nations Environment Assembly (UNEA)

The United Nations Environment Assembly (UNEA) was created in accordance with Rio+20 and the declaration from the conference, "The Future We Want". The objective was to put the declaration's proposal into practice. The UNEA became the decision-making body for this, composed of all 193 Member States.

The overall theme selected for the fourth session (UNEA-4) held in March 2019 was "Innovative Solutions for Environmental Challenges and Sustainable Consumption and Production". In response to growing international concern, marine plastic litter was the main agenda item of the session. The final outcome adopted by UNEA-4 was the Ministerial Declaration, which stated that innovative solutions would be promoted to deal with environmental issues and that transition to a sustainable consumption and production pattern would be accelerated. In addition, 23 resolutions were adopted, including one regarding "Marine Plastic Litter and Microplastics", co-proposed by Japan, Norway, and Sri Lanka, "Addressing Single-Use Plastic Products Pollution", and one on "Innovative Pathways to Achieve Sustainable Consumption and Production"[8].

Regarding the resolution on "Marine Plastic Litter and Microplastics", the following three points are mentioned as the primary items.

- The strengthening of scientific infrastructure, such as with a new scientific and technical advisory mechanism through the utilization of existing institutions
- The creation of a multi-stakeholder platform to strengthen the activities of various actors
- The analysis of international response options and implementation progress with a view toward the Fifth United Nations Environment Assembly (UNEA-5), to be done by the ad-hoc open-ended expert group on marine litter and microplastics

Regarding the resolution on "Addressing Single-Use Plastic Products Pollution", the following three points are mentioned as the prime items.

- Encourages Member States to develop and implement national or regional actions, as appropriate to address the environmental impact of single-use plastic products
- Invites Member States to work together with industry to encourage the private sector to innovate and find affordable and environmentally friendly alternatives to single-use plastic products and to promote business models that take into account the full environmental impact of their products
- Encourages Governments and the private sector to promote the more resource-efficient design, production, use and sound management of plastics across their life cycle

However, the US disassociated itself from the Ministerial Declaration in regards to the part about "significantly reducing the manufacturing and use of single-use plastic products by 2030", expressing that:

- The majority of marine plastic discharges come from only six countries in Asia;

[8] https://un-spbf.org/unea-4-resolutions/

- Accordingly, by improving waste management in these six countries, these discharges could be radically decreased;
- Believing there are numerous ways to achieve solutions to marine plastic litter issues, the language "significantly reduce single-use plastic products by 2030" is "too prescriptive".

3) Activities for Marine Litter by G7 and G20

- G7 Action Plan to Combat Marine Litter

Marine litter appeared in a G7 Leader's Declaration for the first time at the G7 Schloss Elmau Summit in June 2015. In this Leader's Declaration, marine litter was acknowledged as a global challenge; in addition, the need to address land- and sea-based sources, removal actions, as well as education, research and outreach, are stressed. A commitment to priority actions and solutions was agreed to, with the "G7 Action Plan to Combat Marine Litter" being added to the Annex of the declaration[9]. In this Action Plan, it is recognized that, "Prevention is key to long-term success in addressing and combating marine litter and that industries and consumers have an important role to play in reducing waste". This shows a commitment to taking necessary actions (such as reducing waste, removing marine litter, and encouraging industry to play a role). Subsequently, this commitment to addressing marine litter has been reaffirmed by the entire international community, including at the G7 Ise-Shima Summit in 2016.

- G20 Action Plan on Marine Litter

Marine litter issues were first taken up by the G20 at the G20 Hamburg Summit in July 2017. Based on the 2016 UNEP report entitled *Marine Plastic Debris and Microplastics*, the GESAMP report, *Sources, Fate and Effects of Microplastics*, and G7 activities, the "G20 Action Plan on Marine Litter" initiative was launched[10]. This includes activities for reducing the generation of waste, sustainable waste management, education and research.

In this Action Plan, promoting the establishment of policies to prevent marine litter, waste prevention, and resource efficiency were recognized as priority areas in developing policy measures. Moreover, to strengthen the global network, the G20 launched the Global Network of the Committed (GNC) as a platform to exchange information, standards, experience and knowledge.

- Charlevoix Blueprint for Healthy Oceans, Seas and Resilient Coastal Communities

At the G7 Charlevoix Summit held in June 2018 in Canada, the "Charlevoix Blueprint for Healthy Oceans, Seas and Resilient Coastal Communities" was adopted by all G7 member countries in response to marine plastic litter issues, encouraging the international community to take concrete measures.

The Blueprint recognized the urgency of the threat posed by marine plastic litter to biological diversity, confirmed the commitment to transitioning to a more resource-efficient and sustainable approach to the management of plastics, and indicated the direction for promoting coordination with UNEP and other agencies on monitoring methodologies and research.

- Ocean Plastics Charter

[9] https://www.env.go.jp/water/marine_litter/07_mat13_2_%EF%BC%93-2ALD.pdf
[10] https://www.mofa.go.jp/mofaj/files/000272290.pdf

At the G7 Charlevoix Summit, the "Ocean Plastics Charter" was also adopted by five countries — Canada, France, Germany, Italy, and the United Kingdom — and the European Union. With the Charter, the strengthening of regulations on plastics in each country is promoted, while a significant reduction is sought in the usage of single-use plastics and microbeads, as is the development of a system and infrastructure for the collection and management of plastic packages. The government of Japan has not signed the Charter, citing the need for careful consideration of its impact on national life and economy and the necessity of action by developing countries. However, the Japanese Ministry of the Environment has decided to reflect the numerical targets adopted in the Charter in the "Resource Circulation Strategy for Plastics", prepared by the Ministry.

4) Activities of Scientific and Technical Advisory Panel, Global Environment Facility (GEF-STAP)

The Scientific and Technical Advisory Panel of the Global Environmental Panel (GEF-STAP) held a workshop titled "Seeking Global and Regional Solutions to Marine Debris Problem", in order to consider the role of GEF in marine litter countermeasures. This was a side event carried out together with UNEP and NOAA at the Fifth International Marine Debris Conference in March 2011 in Honolulu. That same year, STAP prepared an advisory document for GEF, *Marine Debris: Defining a Global Environment Challenge*[11]. In this document, the following items were proposed:

i) The mainstreaming of interventions addressing marine plastic debris into existing and planned GEF projects and programs;
ii) GEF investment in a pilot project or programme on plastic debris prevention, reduction, and management in areas covered by the Regional Seas Conventions and Action Plans, as a catalyst in mobilizing public and private sector dialogue and resources for market transformation in the production, consumption, and utilization of sources of marine debris such as plastics;
iii) The promotion, facilitation, or establishment of a global public-private partnership to encourage innovation and to expand assistance to developing countries to transform their use of single-use plastic packaging.

This document was also submitted to eleventh meeting of the Conference of the Parties to the Convention on Biological Diversity in 2012. Decision XI/18 of the conference requests the Executive Secretary to invite the parties to submit information on the impacts of marine debris on marine and coastal biodiversity and habitats.

5) ASEAN

The ASEAN Conference on Reducing Marine Debris in ASEAN Region was held for information exchange, knowledge sharing and constructive discussion in adressing the marine plastic issue in ASEAN region, organized by the Department of Marine and Coastal Resources of the Ministry of Natural Resources and Environment (MONRE) of Thailand in coordination with the ASEAN Secretariat and IUCN, in November 2017 in Phuket of Thailand.

[11] https://www.thegef.org/council-meeting-documents/marine-debris-defining-global-environmental-challenge

At the 21st ASEAN Plus Three (Japan-China-Republic of Korea) Summit Meeting on November in the following year, "Marine Plastic Debris Cooperation Action Initiative" was proposed by Japanese Prime Minister Abe, in which regional cooperation promotion on infrastructure development for 3R and waste management, and capacity building was endorsed in collaboration among three countries. This initiative lead to the establishment of the regional knowledge centre mentioned in 2.2.7 (10).

In June 2019, the following policy papers were adopted at the 34th ASEAN Summit in Bangkok.

- "Bangkok Declaration on Combating Marine Debris in ASEAN Region"[12]
  The declaration included strengthening collaborative actions among the ASEAN member states, strengthening national laws and regulations, enhancing the multi-stakeholder coordination and cooperation, promoting research capacity and application of scientific knowledge and others.
- "ASEAN Framework of Action on Marine Debris"[13]
  The framework comprises four priority areas namely; (i) Policy Support and Planning, (ii) Research Innovation and Capacity Building, (iii)Public Awareness, Education and Outreach, and (iv) Private Sector Engagement.

The ASEAN Working Group on Coastal and Marine Environment (AWGCME), organized to ensure the sustainable management of coastal and marine environment, functions as a consultative forum to promote coordination and collaboration among various relevant projects or initiatives. The working group sets seven priority programmes, one of which is the mitigation of coastal and marine pollution including marine debris. In January 2019, the current progress of activities in each country or region was shared among member states at the 20th Meeting of AWGCME in Phuket of Thailand.

(2) Global Conventions, Pledges and Strategies Related to Marine Litter

1) London Convention and London Protocol

The "Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972", the "London Convention" for short, was established by the IMO with the objective of preventing marine pollution caused by the dumping of land-based waste into the sea and the incineration of waste at sea. Even though the London Convention does not address marine litter, it regulates activities that could generate marine litter. At the outset, the London Convention adopted a "list" method, which put highly hazardous materials into a list and then prohibited or strictly limited the dumping of those materials. Subsequently, because of the increasing recognition of the necessity of protecting the marine environment, the "1996 Protocol to the Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972" (the "London Protocol") was adopted in November 1996 and entered into force in March 2006 (Japan entered into the London Protocol in October 2007). In the London Protocol, a "reverse list" method was adopted, which implies that all dumping of wastes into the sea is prohibited unless explicitly permitted on the list.

The World Ocean Assessment, mentioned earlier, takes up solid waste disposal in Chapter 24 and reports the condition of the London Convention and the London Protocol. It states that as of October 2014, there are 87 parties to the London Convention, 45 parties to the London Protocol and 34 to both. It also says

[12] https://asean.org/bangkok-declaration-combating-marine-debris-asean-region
[13] https://asean.org/asean-framework-action-marine-debris/

there are many countries which are the parties to other regional agreements which have similar provisions to the London Convention or London Protocol.

It further points out that reporting under the London Convention and the London Protocol is not consistent enough to well understand the situation of waste dumping, but also that the overwhelming type of dumping is of dredged material for navigational purposes.

2) MARPOL 73/78 Convention

While the London Convention and London Protocol regulate the dumping of land-based wastes into the sea and ocean incineration, the "International Convention for the Prevention of Pollution from Ships" (the "MARPOL 73/78 Convention") is a regulation concerned with the prevention of discharge oil, hazardous matter and waste from ships. The MARPOL 73/78 Convention is composed of the main body and six Annexes, and as previously mentiond, Annex V bans the disposal of wastes such as cargo residues (wastes generated by a ship) into the sea. The wastes regulated in the MARPOL 73/78 Convention are those considered Harmful to the Marine Environment (HME). Except for certain wastes recognised as being unharmful, the discharge of wastes from ships into the sea is generally prohibited.

3) Basel Convention

"The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal" (the "Basel Convention") was adopted in 1989 and entered into force in 1992. It regulates transboundary movements of hazardous waste.

A draft amendment to the Basel Convention was adopted in May 2019, having been jointly proposed by Norway, Japan, and other countries. It included mixed, unrecyclable and contaminated plastic waste in the regulation. Following its enforcement from January 2021 onward, consent is required for exporting countries before exporting contaminated plastic waste. In response, the establishment of a partnership on plastic waste was decided upon at the Fourteenth Meeting of the Conference of the Parties to the Basel Convention (COP-14). Further, the provision of technical and financial support, collection of information on the status of efforts to reduce plastic waste in each country and area, and public awareness raising are planned.

4) Convention of Biological Diversity

The Convention was opened for signature in Rio de Janeiro on 5th June 1992 and entered into force on 29 December 1993.

In the 13th ordinary meeting of the parties to the Convention took place in December 2016, resolution No. 10 "Addressing Impacts of Marine Debris and Anthropogenic Underwater Noise on Marine and Coastal Biodiversity"[14] was adopted. In the 14th ordinal meeting of the parties to the Convention took place in November 2018 in Egypt, resolution No. 10 " Other Matters Related to Marine and Coastal Biodiversity"[15] which urges Parties to avoiding, minimizing and mitigating the impacts of marine debris, in particular plastic pollution, on marine and coastal biodiversity and habitats was adopted.

[14] https://www.cbd.int/doc/decisions/cop-13/cop-13-dec-10-en.pdf
[15] https://www.cbd.int/doc/decisions/cop-14/cop-14-dec-10-en.pdf

Regarding the above conventions, the status of ratification by the top countries for generating plastic litter based on the estimation of Jambeck, et al. 2015 is shown in the following list.

Table 2-7 Ratification Status of Top Marine Plastic Litter Generating Countries

Country	London Convention	London Protocol	Annex V, MARPOL 73/78	Basel Convention	Convention on Biological Diversity
China	x	x	x	x	x
Indonesia	-	-	x	x	x
Philippines	x	x	x	x	x
Vietnam	-	-	x	x	x
Sri Lanka	-	-	x	x	x
Thailand	-	-	-	x	x

As of 2019, the Phillippines and China have signed the London Convention and London Protocol, while five of the countries (excluding Thailand) have ratified MARPOL73/78 Annex V. All six countries have ratified the Basel Convention and the Convention on Biological Diversity. .

The government of Indonesia has not ratified either the London Convention or the London Protocol, while dumping into the ocean is regulated by the Government Regulation of the Republic of Indonesia No. 19 of 1999 Concerning Control of Pollution and/or Sea Destruction, in Chapter 8 (BAB VIII) . There it is stated that:

i) Every person or person in charge of a business and/or activity that dumps into the sea must obtain the Minister's permission.
ii) The dumping procedure is further stipulated by the Minister.

For the Vietnamese government, it is stated in Decree No. 25/2009/ND-CP, on integrated management of natural resources and environmental protection of the sea and islands, that owners of vessels at sea shall report on the volume of waste and waste treatment plans to environment state management agencies, that is, the Ministry of Natural Resources and Environment.

The government of Thailand has also not ratified the London Convention and Protocol, or MARPOL 73/78 Annex V regarding the prevention of pollution by waste from ships (it has already ratified MARPOL Annex I and II). The law of Thailand related to waste dumping from ships is “The Act on Navigation in Thai Waters”, B.E. 2456 (1913). It is prohibited by Section 119 of this law to pour, throw, or by any means whatsoever engage in the dumping of rocks, pebbles, sand, earth, mud, ballast, or any waste substance into Thai waters that may pollute them.

The government of Sri Lanka has also not ratified the London Convention and Protocol. For this country, the relevant law is the “Marine Pollution Prevention Act No. 35 of 2008”[16]. Regarding waste management, the law stipulates in Part VI, Article 21, that the Marine Environment Protection Authority (MEPA) exercises the power “to provide reception facilities within or outside any port in Sri Lanka” for “any ship using these ports or traversing Sri Lankan waters or any other maritime zone”, and “to direct the person in charge of all ports, harbours, terminals repair yards of ships, dry docks or any other marine related facility used by ships which have any residue of oil to discharge to provide adequate reception facilities for the purpose of discharge”. However, MEPA has stated that the law does not recognise a

[16] http://www.mepa.gov.lk/web/images/pdf/acts/act-mepa.pdf

layered system of fines, ranging from the average individual polluter to large industries; therefore, MEPA has proposed amendments to the Act to fill this lacuna in the law.[17]

As mentioned below, with funding from the Norwegian Agency for Development Cooperation (NORAD), IMO is currently implementing the "Marine Environment Protection of the South-East Asian Seas" (MEPSEAS) project (2018-2021), which supports Southeast Asian countries (Cambodia, Indonesia, Malaysia, Myanmar, the Philippines, Thailand, and Vietnam) in preparing national legislation, policy, strategy and the ratification of IMO Conventions. Support for the ratification of the London Convention, London Protocol and MARPOL 73/78 Annex V is included in activity in Thailand.[18]

2.2.2 Overview of Regulatory Approaches Controlling Marine Plastic Pollution at the National Level

The number of countries enforcing laws to control marine plastic waste is gradually increasing in response to international discussion on this urgent issue, although the detailed mechanisms of marine plastic pollution are still unclear. These laws are classified into three main categories in accordance with these purposes:

- Controlling the discharge amount of plastic waste
- Promoting appropriate disposal and/or recycling of plastic waste
- Reducing and/or recovering marine debris

Each component is described in more detail in the following sections, which basically refer to UNEP 2019, including regulatory trends at the national level as of July 2018. Relevant legal approaches in the EU are shown in Box 2-1.

(1) Controlling Discharge Amount of Plastic Waste

Regulatory approaches for controlling the discharge amount of plastic waste are categorized into three main types: 1) for plastic bags, 2) for single-use plastics, and 3) for microbeads.

1) Controlling Plastic Bags

Although plastics contribute roughly 10% by mass to all man-made garbage, it is estimated that plastic debris accounts for 60-80% of marine litter, reaching 90–95% in some areas (Xanthos and Walker 2017). About 300 million tons/year of plastic are produced across the world, half of which are disposable plastics such as containers and packaging (UNEP 2018). Therefore some countries have instituted regulations on specific items that contribute as marine plastic litter. In particular, restrictions on plastic bags have been introduced in many countries, since they get easily scattered to the outside environment and adversely affect wildlife because they are light.

The number of countries with regulatory measures targeting plastic bags is 127 out of 192 reviewed (66%) as of July 2018, a number that has been gradually increasing since the early 2000s. Regionally,

[17] http://www.sundaytimes.lk/180211/news/sea-of-trash-inland-and-overseas-garbage-washes-up-on-lankas-beaches-281482.html

[18] https://mepseas.imo.org/

44 countries in Europe (82%) lead the way in having enacted some form of legislation, which all EU member states except Belgium have transposed into domestic law based on EU Directive 94/62/EC on packaging and packaging waste and Directive 2015/720 on the consumption of lightweight carrier bags. In contrast, there are some countries which have no national laws on plastic bags, but do have local laws, such as the United States, Canada and Belgium.

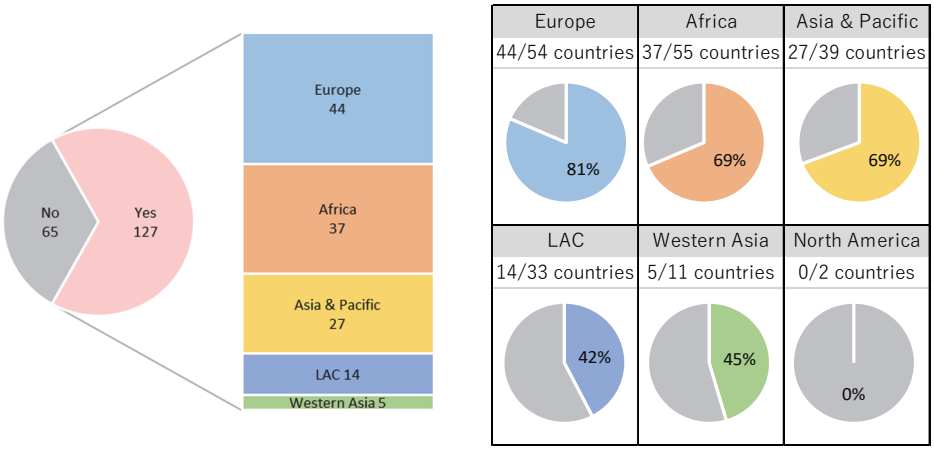
Box 2-1 Regulatory Approaches on Marine Plastic Litter in EU

As legal regulations related to the marine plastic litter, the European Union (EU) has issued two directives regarding plastic waste and one concerning marine debris.

1. EU Directive 94/62/EC on packaging and packaging waste (https://eur-lex.europa.eu/eli/dir/1994/62/oj)
This directive aims at reducing packaging waste and promoting recycling. As amended by directive 2015/720, plastic bags were added in 2015 as an item for reduction, while the recycling target was revised in 2018 by Directive 2018/852 in accordance with the European Commission's Circular Economy Package.

2. EU Directive 2019/904 on the reduction of the impact of certain plastic products on the environment (https://eur-lex.europa.eu/eli/dir/2019/904/oj)
This directive was adopted in May 2019 to implement practical approaches on the reduction of the impact of specific plastic products, in accordance with the EU Plastics Strategy, unveiled in January 2018 in response to the Circular Economy Action Plan, which places top priority on the plastic issue. The directive bans the selling of single-use plastic products which have alternatives (e.g. forks, spoons and straws), regulates the reduction of consuming plastic containers for food and beverages, and sets specific targets for the recovery and recycling rate. Member states have to introduce domestic laws related to this directive within two years.

3. Marine Strategy Framework Directive 2008/56/EC (http://data.europa.eu/eli/dir/2008/56/oj)
This directive aims at protecting and conserving the marine environment, preventing its deterioration and, where practicable, restoring marine ecosystems in areas where they have been adversely affected. As a way of determining effective and appropriate management of marine litter, one of the descriptors listed in Annex I is that "Properties and quantities of marine litter do not cause harm to the coastal and marine environment". The target marine areas under the sovereignty and jurisdiction of member states of the EU include waters in the Mediterranean Sea, the Baltic Sea, the Black Sea and the Northeast Atlantic Ocean. The member states have to develop and implement a strategy to maintain a favourable marine environment by 2020 in line with this directive.

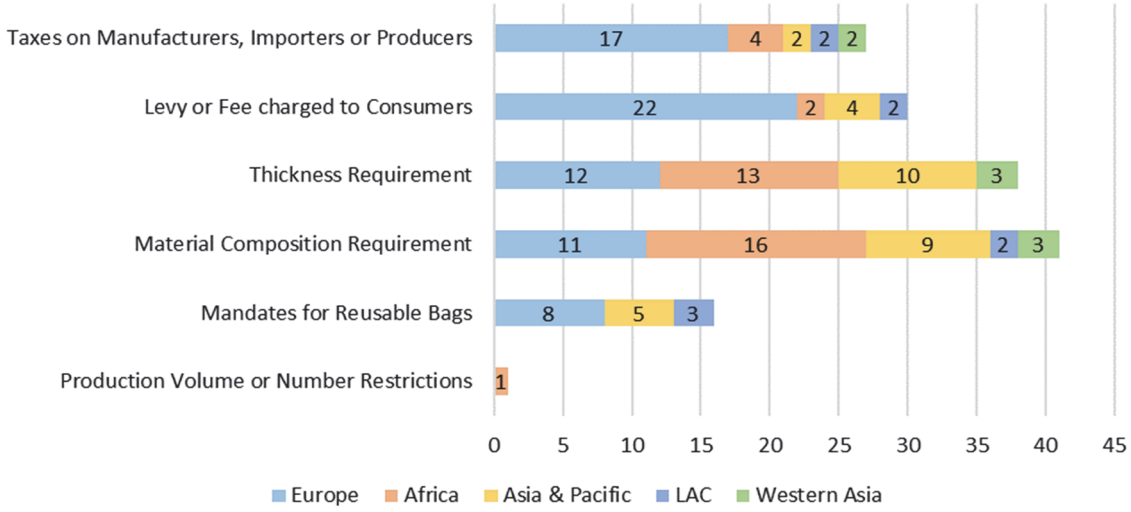


Source: UNEP 2019

Figure 2-4 Regional Distribution of Countries with Plastic Bag Regulations

The regulations introduced in each country are categorized into the five following types. A breakdown of the regulations is shown in Figure 2-5.

- Taxes on manufacturers, importers or producers
- Levies or fees charged to consumers
- Thickness or material composition requirements
- Mandates for reusable bags
- Production volume or number restrictions



Source: UNEP 2019

Figure 2-5 Breakdown of Regulations on Plastic Bags

- Taxes on Manufacturers, Importers or Producers

Twenty-seven countries have instituted taxes on the manufacture, import or production of plastic bags. Taxation methods are, for instance, a specific levy on carrier bags and flat bags (e.g. Lesotho) and an environmental levy on all locally manufactured items including plastic bags (e.g. Jamaica).

- Levy or Fee Charged to Consumers

Thirty countries have imposed a levy or fee charged to consumers; most of the amounts charged are defined based on the thickness or material composition of plastic bags, although criteria vary in each

country. Different approaches include countries which charge fees based on material, as with lower fees for plastic bags that have a specific amount of recycled content (e.g. Andorra), the adoption of limits on consumption rates per customer (e.g. Luxemburg), or prohibitions on plastic bags being sold for less than their actual cost (e.g. China and Estonia).

- Thickness or Material Composition Requirement

Thirty-eight countries regulate the thickness of plastic bags in the range of 15 to 100 microns, of which 32, or 80%, ban or impose a levy on lightweight or thin plastic bags with a thickness of 15 to 50 microns.

Forty-one countries have instituted some type of regulation on the material composition of plastic bags. Of these countries, 38 imposed bans or phase-outs of non-biodegradable plastic bags, or incentivized the production, import, or use of biodegradable and/or compostable bags, two countries require bags to have recycled material, and one country requires plastic bags to contain a certain amount of recyclable materials.

- Mandates for Reusable Bags

There are 16 countries that have explicitly promoted reusable plastic bags. Of these countries, 6 have mandated that reusable bags be provided to consumers or end-users, either free of charge or for a fee, 4 promote reusable bags by explicitly exempting them from the ban on plastic bags, 2 exempt reusable bags from the plastic bag tax, and 4 require retailers and/or consumers to opt for reusable bags.

- Production Volume or Number Restrictions

Only Cape Verde has imposed a production volume restriction on conventional plastic bags. As a result of applying a ban on all conventional plastic bags in July 2016, only biodegradable and compostable plastic bags are distributed in this country. In the EU, Directive 94/62/EC mandates that packaging must be manufactured so as to limit packaging volume and weight to the minimum necessary to maintain the required safety and hygiene of the packaged product, but while this provision has been transposed into domestic law by most member states, in general explicit numerical targets have not been created.

Table 2-8 Examples of the Regulation of Plastic Bags

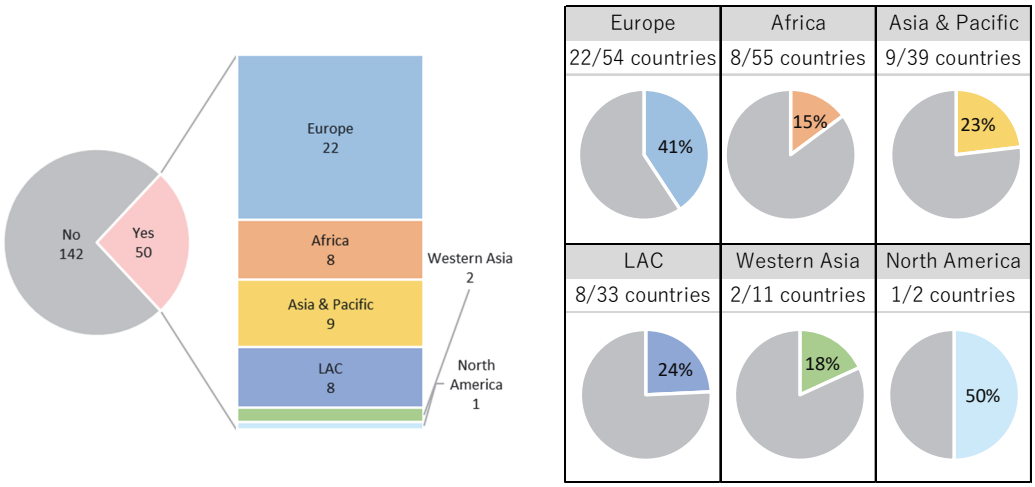
Taxes on Manufacturers, Importers or Producers	
South Africa	- Levy on the manufacture of plastic bags: 12 cents per bag is payable to the South African Revenue Authority.
Malta	- Tax on imports: Charges are placed on any goods of a certain class or description on plastic sacks and bags, which further delineates excise duty rates.
Latvia	- Tax on plastic bags: The law provides for a tax specifically on plastic bags, EUR 4.80/kg for lightweight plastic bags, EUR 1.50/kg for plastic bags with a thickness of material more than fifty microns and a weight of one bag more than three grams
Levy or Fee Charged to Consumers	
Fiji	- Levy paid by consumer: A levy is charged on plastic bags distributed by businesses prescribed by regulations. The Environment and Climate Adaptation Levy charged on plastic bags is $0.10 cents per plastic bag. The levy on plastic bags is payable by the person to whom a plastic bag is provided.
Ireland	- Levy paid by retailer on plastic bags: Supply to customers of plastic bags will be charged, levied at the point of sale of goods or products to be placed in the bags, or otherwise of plastic bags in or at any shop, supermarket, service station or other sales outlet. The amount of the levy is 22 cents for each plastic bag.
Thickness or Material Composition Requirement	
Botswana	Ban on plastic bags thinner than 24 microns
Vanuatu	Ban on plastic bags less than 35 microns thick
Palau	Retail establishments shall not provide plastic bags except those that are biodegradable or compostable to their customers
Yemen	Ban on the manufacture and use of non-biodegradable plastic bags
Mandates for Reusable Bags	

Italy	Provide to consumers or end-users free of charge
Nepal	Obligation of retailers and/or consumers to opt for reusable bags
Paraguay	Exemption from the plastic bag ban
Production Volume or Number Restrictions	
Cape Verde	Prohibition of production, importation, distribution into the market and use of conventional plastic bags for packaging. (100% by July 1, 2016.)

Source: UNEP 2019

2) Controlling Single-Use Plastic Items

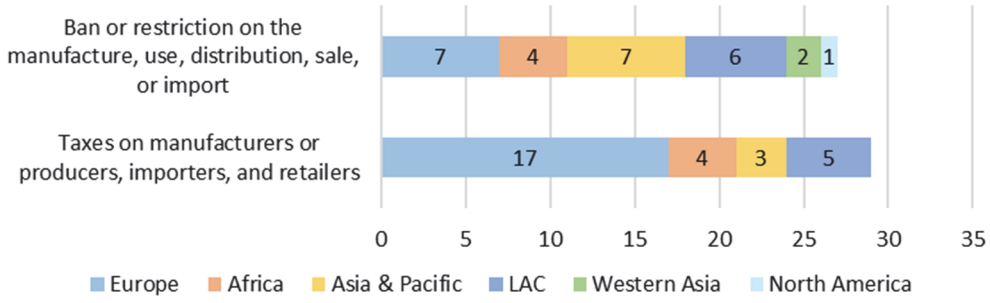
Only 50 out of the 192 countries reviewed (26%) have introduced regulations on single-use plastics. Compared with plastic bags, measures that control single-use plastic items have not progressed. Most legal approaches are recent, having been enacted since 2012 in response to the plastics issue.



Source: UNEP 2019

Figure 2-6 Regional Distribution of Countries with Single-Use Plastic Regulations

The two main mechanisms for addressing this kind of pollution are bans or restrictions on the manufacture, use, distribution, sale, or import of single-use plastics; and market-based instruments such as taxes or levies. All countries with these regulations have some exceptions, such as the acceptance of biodegradable plastic. In other words, there are no bans applied to all disposable plastic items.



Source: UNEP 2019

Figure 2-7 Breakdown of Regulations on Single-Use Plastic Items

Overviews of each mechanism are as follows;

- Ban or restriction on the manufacture, use, distribution, sale, or import

Twenty-seven countries have instituted some form of ban or restriction on the manufacture, distribution, use, sale, and/or import of single-use plastics, which target either specific products (e.g. plates, cups, straws, packaging), items for specific purposes (e.g. to-go boxes), material composition (e.g. polystyrene), production volume, or thickness. It is notable that 10 of these countries are small island states (37%) and that they have been more likely to institute such bans. The factors contributing to this trend are thought to be that tourism in island countries is adversely affected by plastic pollution and, furthermore, the fact that such countries depend heavily on marine ecosystems.

- Taxes on manufacturers or producers, importers, and retailers

Twenty-nine countries have enacted some type of tax on single-use plastics, either as a special environmental tax, waste disposal fees or charges, or in the form of higher excise taxes. The main purpose of these taxes is to reduce single-use plastics as a type of waste, manage plastic waste or increase the rate of postconsumer recovery or recycling, or as motivation in environmental and circular economy initiatives.

Table 2-9 Examples of Regulations on Single-Use Plastic

Ban or Restriction on the Manufacture, Use, Distribution, Sale, or Import	
Antigua and Barbuda	Material and product ban: Ban on expanded polystyrene products in the food service industry
Malta	Product restrictions: Packaging, plates, cups, and some beverage containers must be designed, manufactured, and sold in such a way as to permit their reuse or recyclability
Saudi Arabia	Material and product ban: Prohibited to manufacture, advertise, sell, import, or use polypropylene and polyethylene plastics intended for one-time use, including personal care products, plastic bags intended for one-time use, and disposable products such as spoons, plates, and cups
Tuvalu	Material/product ban: The manufacture, sale, distribution of plastic foam products (including polystyrene foam, board stock, egg cartons, food containers, disposable plates and cups, and horticulture netting) is banned.
Zimbabwe	Material ban: The manufacture, distribution, use, and import of plastic packaging of a thickness of greater than thirty micrometers and polystyrene is prohibited
Taxes on Manufacturers or Producers, Importers, and Retailers	
Benin	Eco-taxes on disposable plastic packaging
Marshall Is.	Deposit beverage container fee on each deposit beverage container manufactured or imported into the country
Albania	Excise tax for plastic packaging at higher rates than glass and other packaging
Estonia	Packaging excise duty for plastic packages
Jamaica	Environmental protection levy on plastic goods manufactured or imported into the country

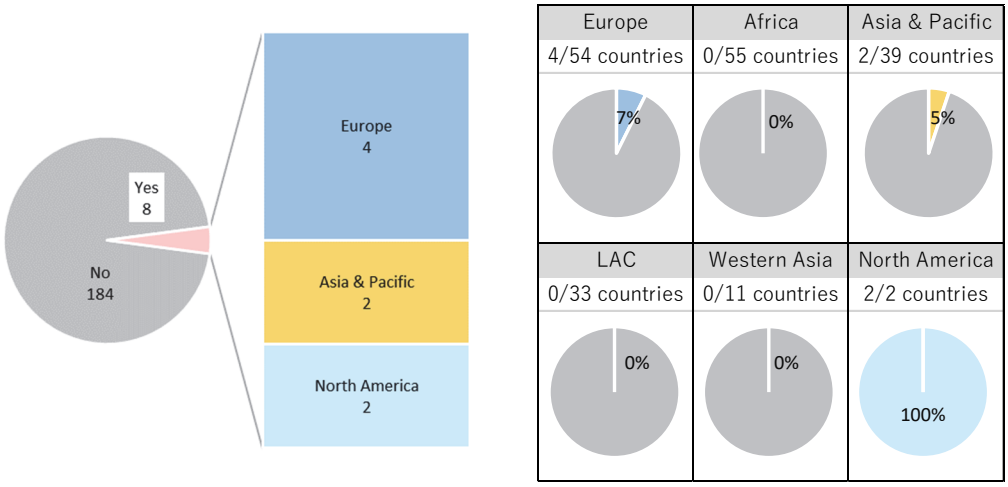
Source: UNEP 2019

3) Controlling Microbeads

Microbeads are mainly added to personal care products such as facial wash and toothpaste. They adversely affect marine ecosystems by flowing out to the ocean from household effluents. Only 8 (4%) out of the 192 countries have enacted national-level regulations on the use, sale, and/or manufacture of microbeads in personal care products — which means that most countries have not taken such action.

Seven of the countries with these regulations focus only on controlling personal care products containing microbeads. In contrast, New Zealand regulates household, automotive, and industrial products in addition to personal care products. These types of regulations are classified into two categories: a ban on the manufacture, import, and sale in two countries; and a ban on only some part of these activities in six countries.

Countries with proposed laws are Belgium, Brazil, India, and Ireland. Enactment of these regulations is expected to gradually become more common in the years to come. Regionally, the EU has started the process to ban intentionally-added microplastics to personal care products for both household and professional use.



Source: UNEP 2019

Figure 2-8 Regional Distribution of Countries with Microbead Regulations

Voluntary measures on microbeads are being more actively introduced by private companies or organizations, as mentioned in another chapter.

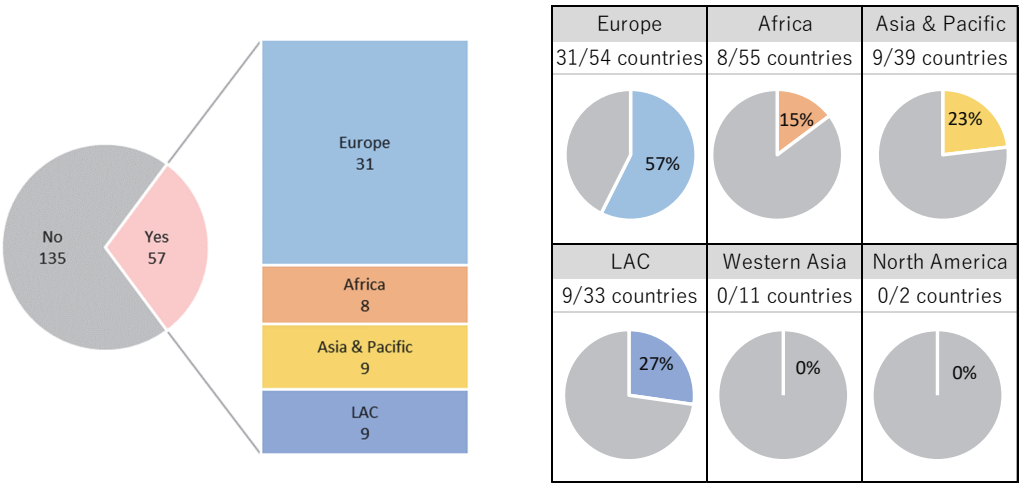
Table 2-10 Types of Prohibitions in Countries with Microbeads Regulations

Type of Prohibition	Country
Manufacture, import, or sale	US, Canada
Manufacture or sale	Republic of Korea, New Zealand, UK
Sale	France, Italy, Sweden

Source: UNEP 2019

(2) Promoting Appropriate Disposal and/or Recycling of Plastic Waste

Regulatory approaches to promoting the proper disposal and/or recycling of plastic waste are also of significant importance in addition to the measures on controlling plastic amount as described above, in particular regulations on recycling and/or proper recovery mandates, and general requirements in solid waste management laws. 57 of the 192 countries (30%) have introduced some form of these regulations.

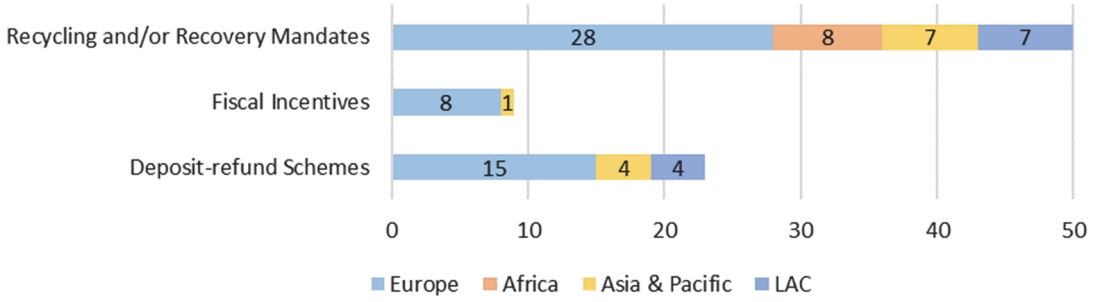


Source: UNEP 2019

Figure 2-9 Regional Distribution of Countries that Regulate Recycling and/or Proper Disposal of Plastics

The contents of the regulations are as follows:

- Recycling and/or recovery mandates
- Fiscal incentives
- Deposit-refund schemes



Source: UNEP 2019

Figure 2-10 Breakdown of Regulations on Recycling and/or Proper Disposal

- Recycling and/or Recovery Mandates

Fifty (50) countries have explicit regulatory mandates on recycling and/or recovery beyond general policy objectives, of which 26 countries (52%) include specific recycling targets. Regionally, many countries in Europe have enacted national laws in compliance with the EU Directives on packing and packing waste, stipulating the reduction, reuse and recycling of plastic containers and packaging waste. As many as 19 of these countries have numerical targets.

The targets of these regulations are mainly categorized into two types: business operators such as manufacturers and retailers, based on the concept of Extended Producer Responsibility (EPR) (e.g. Mali); and public institutions (e.g. Panama). (See Box 2-2 for EPR.)

The content of these regulations includes not only the clarification of responsibility for the implementation of recovery and/or recycling, but also obligations concerning green purchasing (the

procurement of environmentally-friendly products, such as recycled materials) and prohibitions on the manufacture and/or use of nonrecyclable products.

Box 2-2 Extended Producer Responsibility（EPR）

"Extended Producer Responsibility" (EPR) is a concept propounded by the Organization for Economic Co-operation and Development (OECD), which aims to make producers responsible for the environmental impacts of their products throughout the product chain, from design to the post-consumer phase. It has become an established principle of environmental policy in an increasing range of countries since the late 1980s. The main purposes of this concept are to alleviate the burden on municipalities and taxpayers for managing end-of-life products, reduce the amount of waste destined for final disposal, and increase rates of recycling. More than 400 EPR systems were currently in operation as of 2015, of which 70% or more have been implemented as legal obligations since the year 2001. Various forms of take-back requirements are the most commonly used instruments, accounting for nearly three-quarters of those surveyed. Advance disposal fees and deposit-refund schemes account for most of the rest. About 17% of the mandates are subject to packaging mainly made of plastic.

In connection with marine plastic litter issues, 63 countries (33%) of the 192 countries reviewed, have EPR mandates for post-use of plastic packaging and other single-use items. Many countries extend this obligation to both producers and retailers or distributors, but a few countries impose it on only distributors or retailers (e.g. Barbados). Examples of EPR are shown as follows.

Single-use Plastics	
Belgium	Responsibility to take back packaging 300 kg or greater (annually) that is placed on the market, which may be contracted out to a public or private contractor
Brazil	Responsibility to collect end-of-life packaging; implement sectoral agreement to reduce 22% of packaging waste being sent to landfills by 2017
Senegal	Plastics operators are required to offer households and other users a system for the collection or recovery of plastic waste for recovery, recycling or disposal; duty to reduce the amount of plastic waste that results from activities or production processes and develop waste recovery activities
Barbados	Distributors and dealers of beverages in containers may not operate without a system of recycling of beverage containers in place
General Waste Management	
Zimbabwe	The agency responsible for plastic waste shall set prevention targets including (a) the disposal of plastic waste by the responsible person in designated receptacles or sites; or (b) the design of plastics containing few pollutants, are recyclable and durable when put to their intended use; or (c) the use of biodegradable plastics; or (d) the creation of the mode of distribution and return systems, that reduce residual plastic waste to a minimum.
Vanuatu	The Minister may by regulation impose requirements in relation to certain wastes that have adverse impacts on the environment or human health by imposing obligations on persons importing, exporting, using or manufacturing certain objects, substances or things which may become waste in relation to their eventual disposal.
Bhutan	With the aim of achieving a more sustainable approach to resource use and a reduction in the quantity of waste going to disposal, the National Environment Commission may require producers to take responsibility for the costs of the management of their products when they become waste, by diverting end-of-life products to reuse, recycling or other forms of recovery and safe disposal. The law indicates that producers/industries shall be fully responsible for safe and proper disposal of their waste.
Finland	It is the responsibility of the producer to manage waste management and associated costs related to products it has brought to the market. The producer's responsibility applies to discarded products delivered to reception points or for transportation.

Source: UNEP 2019

Table 2-11 Countries with Mandated Recycling and/or Recovery Regulations

Recycling Mandate Without Target	
Mali	"Any producer and distributor who markets or uses in its activities plastics or other non-biodegradable packaging, and any responsible person for first time on the market, if the producer and the distributor are unknown, is obliged to proceed [*sic*] the recovery of its plastics and packaging used for recycling."
India	"Responsibility of producers, Importers and Brand Owners. - xxx (3) manufacture and use of non-recyclable multilayered plastic if any should be phased out in two years' time."
Lithuania	"Producers and importers must take the necessary measures to ensure that empty transport, grouped and sales packaging as well as its waste are managed xxx and that targets for collection, recycling and reuse of packaging and packaging waste set by the Government or an institution authorized by it are attained. xxx Producers and importers who do not meet the objectives provided xxx relating to collection, recycling and reuse of packaging and packaging waste, must, pursuant to the law, pay a tax for pollution of the environment with product waste."
Panama	Law No. 6 of February 6th, 2018, "Which establishes integrated waste management in public institutions", orders public institutions to sort their waste and undertake recycling schemes for paper, plastic bottles, Tetrapak containers and aluminum cans.
Recycling Mandate With Target	
Macedonia	A minimum target of 55% to a maximum of 80% of plastic packaging must be recycled by 2020
Republic of Korea	Mandatory Recycling Ratio applied to manufacturers, ranging from 0.442 (single-material polystyrene paper) to 0.830 (PET complex materials). Recycling due is 30/100 of the sum of expenses to be incurred in recycling non-recycled wastes out of the mandatory recycling quantity.
Peru	Public sector entities must use plastics with a minimum of 80% recycled content
Slovakia	At least 45% by weight of plastic packaging must be recycled

Source: UNEP 2019

- Fiscal Incentives

Fiscal incentives are provided in nine countries to promote the recovery or recycling of plastic waste. Specifically, mechanisms such as tax exemptions or subsidies have been adopted for activities related to the recovery of recycling of plastic products.

Table 2-12 Countries with Fiscal Incentives for Single-Use Plastics Recycling

Fiscal Incentives	
Malaysia	Manufacture of biodegradable disposable packaging and household wares and waste recycling activities are listed as promoted products and activities under the Promotion of Investments Act which are eligible for pioneer status and investment tax allowance.
Finland	Exemption from excise duty under the Act on Excise Duty on Certain Beverage Containers for containers which are included in a deposit-based, functional return system and which can be refilled or used for the recovery of raw material.
Norway	Under tax regulations, an environmental tax is imposed on plastic PET bottles, set at NOK 3.44 for recyclable bottles. The environmental tax lessens in line with the return rate, starting with a 25% return rate. At a 95% return rate, the environmental tax ceases completely.

Source: UNEP 2019

- Deposit-refund Schemes

Twenty-three countries have requirements for taking back single-use plastic products through deposit-refund schemes which are mainly introduced as a part of EPR. This kind of system is one of the effective measures leading to appropriate waste management, including recycling. It generally covers the recovery of beverage containers, whereas some countries regulate inclusive plastic products.

Table 2-13 Countries with Mandated Deposit-Refund Schemes

Beverage Containers	
Fiji	Plastic bottle permit holders obligated, in conjunction with the government authority, to establish a system of cash payments for the return of bottles for recycling, including collection centers.
Austria	Compulsory deposit of €0.29 for refillable plastic beverage containers
Belize	Distributors and dealers must collect a deposit on beverage containers at the time of sale or distribution, and upon proof of purchase accept at the place of business from a redeemer, any empty beverage containers and refund its value.
Plastic Products	
Romania	Economic operators marketing packaged products in reusable primary packaging shall be obliged to receive the reusable packaging at the exchange or to repay, at the consumer's request, the value of the deposit
Uruguay	Merchants, retail shops, and other intermediaries in the chain of distribution and marketing of packaged products are obliged to receive and accept the return of the packaging of products they have placed on the market.
Venezuela	Manufacturers, distributors and importers of goods or consumer products that generate solid waste must have return programs for the recovery of their waste, including the mechanisms of return or deposit refund.

Source: UNEP 2019

In the past, most plastic waste has in fact been exported overseas to be recycled. However, this trade structure is being forced to change since China, which had received about 45% of exported global plastic waste (Brooks, Wang and Jambeck 2018), enacted a ban on the import of plastic waste in December 2017. In Southeast Asian countries which have been getting attention as alternative sites to China, regulations on importing plastic waste have also become stricter (Table 2-14).

Moreover, because the Basel Convention set rules to control the plastic waste trade in May 2019, each country has to strengthen its domestic recycling system for plastic waste.

Table 2-14 Examples of Regulations on Import of Plastic Waste in Asian Countries

Country	Regulation
China	Import of resource waste with environmental burdens was banned in 2017.
Malaysia	Provision of import permission (AP) was suspended for three months in July 2018. The criteria for this permit has been tightened (e.g. certification of storage capacity, taxation based on import amount), after reactivation in October 2018.
Thailand	In some ports, the unloading of containers carrying plastic waste, e-waste, etc, were prohibited in 2018. All ports will introduce the import ban in stages by 2021
Vietnam	Inspection control on waste import, including plastic waste, was strengthened and the criteria for import permits was tightened in 2018. The ban on renewal and issuance of permits without import quotas is under consideration.
Laos	Under consideration for import restrictions or prohibitions (e.g. stop providing permits to establish plastic recycling facilities, prohibit the import of plastic waste).
Cambodia	Designated as an import restricted item.
Bangladesh	Designated as an import restricted item.
India	Designated as an import restricted item.
Indonesia	Designated as an import restricted item.
Philippines	Designated as an import restricted item.

(3) Reducing and/or Recovery of Marine Debris

Regulatory approaches to reducing and/or the recovery of marine debris are also important as means of preventing plastic waste from being discharged into the ocean. International regulations (e.g. MARPOL Annex V, the London Convention and Protocol, and the Basel Convention) and frameworks for marine conservation (e.g. A/RES/60/30 and A/RES/63/111) have been transposed into domestic laws in each country. Moreover, international and regional institutions have been tireless promoters of efforts to handle this issue.

An overview of the national approaches in the United States, Republic of Korea, the United Kingdom, and Australia are given hereinafter.

1) The United States

In the US, since 1998 public institutions such as the NOAA, United States Coast Guard (USCG) and Environmental Protection Agency (EPA) have implemented the recovery and disposal of ghost fishing gear that adversely affects coral reefs in the northern Pacific Ocean. The results of these activities are classified and analyzed by the government and utilized as basic information for necessary measures. The NOAA is also collaborating with related organizations to implement overall projects on marine debris, as described above. In addition, the EPA supports International Coastal Cleanup (ICC), the National Marine Debris Monitoring Program (NMDMP), and the formulation of regional marine monitoring programs with UNEP. The national regulations are described as follows.

- Marine Debris Research, Prevention, and Reduction Act of 2006 (MDRPRA)

This was enacted for the purpose of identifying, determining the sources of, assessing, reducing, and preventing marine debris and its adverse impacts on the marine environment and navigational safety. On the basis of this act, the NOAA implements the “Marine Debris Prevention and Removal Program” to research, monitor, reduce or recover marine debris.

- Coral Reef Conservation Act of 2000

For the purpose of conserving marine life resources, this act supports the NOAA in subsidizing state activities on eliminating marine litter, ghost fishing gear and waste vessels.

- Coastal Zone Management Act of 1972

The act regulates the National Coastal Management Program, the National Estuarine Research Reserve System, and the Coastal and Estuarine Land Conservation Program for the management of the nation’s coastal resources. It also allows states to provide subsidies for expenses to reduce waste in coastal and estuarine environments.

2) Republic of Korea

- Marine Environment Management Act

This was enacted in 2007, thoroughly ammending the “Marine Pollution Prevention Act”, including the overall control of the marine environment, tightening of criteria for waste discharge into the ocean,

formulation of a national emergency conservation plan and establishment of a public corporation for marine environment management.

The “Marine Debris Management Plan” was formulated based on this law for the reduction and/or minimization of waste, enhancement of recovery and disposal capacity, establishment of a management system, and promotion of civic participation and international cooperation. In particular, the introduction of responsibility for watershed management, the operation of a management system for waste fishing gear, the installation of a registration system for fishing gear, management of a marine debris center, and the institution of regulations on recycling are being implemented in each responsible organization.

3) The United Kingdom

- Environment Act 1990

This act stipulates that the relevant authorities are responsible for removing waste within their jurisdiction. As part of this, local governments are obligated to clean up waste from public seashores from May to September. Moreover, discharging waste in public areas, including on the coast, is prohibited as an illegal action.

- Merchant Shipping and Maritime Security Act 1997

This act stipulates that foreign ships which have carried out illegal acts leading to marine pollution within 200 nautical miles from the UK coast face prosecution. It requires all domestic ports and terminals to establish proper reception facilities for dry waste and waste that contains oil, to formulate a waste management plan and acquire the endorsement of this plan from the Secretary of State. In addition, with the exception of food, the marine discharge of any waste including plastics, is prohibited by this act.

4) Australia

- Environment Protection and Biodiversity Conservation Act 1999/Amendment on 2007

This act defines the role of the federal government in environmental conservation, streamlining protocol for environmental assessment and development restriction, and mandating that decision-making be in line with the principle of ecologically sustainable development. It also regulates genetic recombination, assessments of natural resources, and the conservation of threatened species. Furthermore, based on this law, a Threat Abatement Plan on “the impacts of marine debris on the vertebrate marine life of Australia’s coasts and oceans” was formulated, as marine debris adversely affects threatened species. Specifically, countermeasures include the improvement of waste management in drainage canals, plans for a reception facility for marine debris, and regulations on vessel waste including fishing gear.

2.2.3 Voluntary Approaches in Private Companies and Organizations Worldwide

(1) Private Companies

In response to growing interest in the global issue of marine plastic and momentum for the promotion of the circular economy, some private companies in each country have begun to implement voluntary measures. These approaches are being promoted not only in EU countries that are leading the way with

national regulations, but also by companies in countries that do not have such regulations, such as the US and in developing countries. Efforts are being made in a variety of industries — from packaging companies to retailers — to reduce plastic products, use recycled materials, and ban disposable straws.

As described below, the activities of private companies (e.g. signing up for the "New Plastics Economy Global Commitment", led by the Ellen MacArthur Foundation, or the establishment of international organizations such as one called the "Alliance to End Plastic Waste") are expected to reach global proportions in the years to come.

Table 2-15 Examples of Voluntary Approaches at Private Companies

Packaged Goods Companies		
Danone S.A.	France	・To convert materials, utilize recycled materials, and establish recycling system by 2025 ・To introduce recyclables into packaging film
Unilever	U.K. and Netherlands	・To reduce weight of packaging, convert to easily recyclable and recoverable items, sell refillable and condensed products ・All plastic containers will be converted into reusable, recyclable, and compostable items by 2025
Retail & Hospitality Companies		
Starbucks	U.S.	・To eliminate all plastic disposable straws by 2020 ・To provide plastic covers without straws for containers and introduce paper or compostable plastic straws
McDonalds	U.S.	・To convert to renewable, recycled, or certified resources for 100% of packaging for customers, particularly products certified by the Forest Stewardship Council ・To recycle all plastic packaging for customers at all outlets
Packaging Producers		
Constantia Flexibles	Austria	・New innovations to overcome the challenges of problematic (plastic) packaging and aim to eliminate materials such as PVC and flexible PET. ・100% of its consumer and pharma packaging will be recycled by 2025.
Dynapack Asia	Indonesia	・To eliminate unnecessary plastic packaging and, in case packaging is still required, use 100% recyclable or compostable products ・Targets for the use of recycled content: PET to 25%, rHDPE to 5% and rPP to 5% by 2020
Raw Material Producers		
Indorama Ventures PLC	Thailand	・By 2025, to recover a minimum of 750,000 tons of PET from the market and utilize recycled material in several facets, as products to be returned as plastic packaging material with recycled content.
Finance		
Circulate Capital	U.S.	・To incentivize private capital investment and advance development objectives to reduce marine plastic litter, with private sector support of USD 100 million committed by PepsiCo, Procter & Gamble, Dow, Danone, Unilever and The Coca-Cola Company, a loan-portfolio guarantee of up to USD 35 million by USAID, and cooperation from Ocean Conservancy.

Source: Spring 2019 report by Ellen MacArthur Foundation and HP in each company

(2) Organizations

Some private companies that are highly concerned about the marine plastic issue have formed international cooperative alliances. Movements such as these are expected to accelerate global activities, with synergy generated by cooperation with each resulting measure.

Table 2-16 Examples of Voluntary Approaches in Cooperative Organization

Cooperative Organizations	
Alliance to End Plastic Waste (AEPW)	AEPW, an international alliance for the reduction of marine plastic litter, was established through the cooperation of thirty (30) global companies that engage in business related to plastics or consumer appliances, including the Japanese companies Sumitomo Chemical, Mitsubishi Chemical Holdings, and Mitsui Chemical. AEPW has committed over USD 1.0 billion, with the goal of investing USD 1.5 billion over the next five years, to help end plastic waste in the environment.
Global Plastics Alliance	The website "Marine Litter Solutions" integrates the activities of eighteen countries and 74 plastics associations from forty countries which have signed the Global Declaration of 2011. It had a total of 355 projects by the end of 2017 (completed/on-going/planned) in the areas of education, research, public policy, sharing best practices, recycling, and the recovery of plastics and plastic pellet containment. The Japan Plastics Industry Federation is the member from Japan.

Source; AEPW HP etc.

2.2.4 Related Legislation and Policies in Japan

(1) Plastic Resource Recycling

1) Legislation and Policies

Legal measures for plastic resources recycling in Japan started with "Effective Resource Utilization Promotion Act", which was enacted in 1991. The act encouraged manufacturers to produce their products with their recyclability in mind even from the designing stage and to utilize recycled materials in the production lines. "Basic Act for Establishing a Sound Material-Cycle Society" was put in force in January 2001 and the Effective Resource Utilization Promotion Act was amended in 2001. Furthermore, in order to promote a material cycle society, the "Containers and Packaging Recycling Law", "Home Appliance Recycling Law", "End-of-Life Vehicle Recycling Law" and the "Act on Promotion of Green Purchasing" have been enacted, while circular economy is promoted in Japan.

Table 2-17 Recycling-related Laws in Japan and Plastic Resource Recycling

Law（Put in Force）	Relation to Plastic Resource Recycling
Containers and Packaging Recycling Law (2000)	An obligation to recycle plastic containers and packaging has been placed on businesses that manufacture and/or use them. The recycling rate as of 2016 was 83.9% for PET bottles and 46.6% for other plastic packaging and containers.
Home Appliance Recycling Law (2001)	Home appliances discharged from household and business entities, such as air conditioners, televisions, refrigerators and washing machines, are recycled. Consumers bear the cost, retailers take back discharged appliances, and manufacturers recycle used home appliances. There is no specific requirement on plastics, but they are recycled as road base materials or blast furnace reductant, or thermal recycled in incineration plants. Types of plastics used are clearly indicated in order to promote their utilization as recycled resources.
End-of-Life Vehicle Recycling Law (2005)	Manufactures shall take back and recycle the air bags and shredder dust of end-of-life vehicles. Shredder dust contains a lot of plastics. The recycling rate of shredder dust reaches 98% if thermal recycling is included.
Small Household Appliance Recycling Law (2013)	The amount of small household appliances collected in 2017 was 65,750 tons, with 2,304 tons of plastics being material recycled and 14,063 tons thermal recycled.

In order to further enhance the comprehensive policy to achieve a material-cycle and low carbon society, the "Fourth Fundamental Plan for Establishing a Sound Material-Cycle Society" was decided upon by the Cabinet in June 2018. Specifically, the purpose of the plan is 1) to reduce the degree of dependence on non-renewable resources; 2) to replace them with renewable resources; and 3) to use renewable

resources repeatedly through the recovery of used resources. Based on the contents of this plan, the "Resource Circulation Strategy for Plastics" was formulated in May 2019.

This strategy aims for the following:

1) To reduce the usage of plastics, which contributes to the reduction of negative environmental impact.
2) The thorough, effective and efficient collection and recycling of used plastic resources.
3) To improve the practicality of bioplastics and promote alternatives to fossil fuel-derived plastics

Japan's measures will be disseminated to other countries at international conferences, such as G20 meetings, and Japan aims to lead discussions in order to promote globally effective efforts involving developing countries.

2) Industry-Government-Academia Collaboration

In order to solve the marine plastic problem, it is essential that a wide range of actors such as ministries, local governments, companies, NGOs, and research institutes collaborate and cooperate to promote measures.

In Japan, the "Plastic Smart" program of the Ministry of the Environment and the "Clean Ocean Material Alliance" program of the Ministry of Economy, Trade and Industry have been organized in order to stimulate dialogue and exchange between main actors. Furthermore, the collection of various types of information and information dissemination are being implemented, and events held.

Platforms for Industry-Government-Academia Collaboration		
Ministry of Environment	Plastic Smart	Started in January 2019 with 48 companies and organizations participating. The purpose is to promote measures by collecting and sharing information related to plastic waste reduction. A large number of efforts are currently being consolidated and will be internationally disseminated at meetings such as G20 gatherings. [Examples of participating companies/groups] Aeon, Coca-Cola Japan, McDonald's Japan, Kanagawa Prefecture, Japan Marine Research and Development Organization, and National Institute for Environmental Studies.
Ministry of Economy, Trade and Industry	Clean Ocean Material Alliance	Started in January 2019 with 159 companies and organizations participating. In order to reduce the use of plastic waste and accelerate the sustainable use of plastic products and the development and diffusion of alternative materials such as biodegradable plastics, this program was established with the aim of strengthening collaboration among related businesses. In future, technology dissemination and the promotion of cooperation will be implemented through the Dissemination Promotion Working Group and the International Working Group. [Examples of participating companies/groups] Kao, Kaneka, Asahi Kasei, Japan Packaging Technology Association, and Japan Plastics Industry Federation.

(2) Countermeasures Against Drifting Waste/Waste That Has Drifted Ashore

1) Legislation and Policy

Japanese law related to countermeasures against drifting wastes and wastes that have drifted ashore includes the "Act on Promoting the Treatment of Marine Debris Affecting the Conservation of Good Coastal Landscapes and Environments to Protect Natural Beauty and Variety" (the "Act on Promoting the Treatment of Articles that Drift Ashore").

This law was executed in 2009 to deal with debris that drifts ashore on the Japanese coast and accompanying problems that had become serious — heavy deposits of drifting debris from both domestic sources and neighboring countries that had caused damage to the coastal environment — including the coastal ecosystem deterioration and impacts on fisheries among other problems.

The three countermeasures are: 1) the smooth processing and control of the generation of wastes that drift ashore; 2) securing of appropriate role-sharing and cooperation among various actors; and 3) the promotion of international cooperation. Responsibilities such as processing, the obligation of municipalities to cooperate, and the promotion of measures to recover debris drifting in the sea are clearly stated.

Subsequently, in order to promote the disposal of drifting waste and to cope with the problem of marine plastic waste, the "Act on Promoting the Treatment of Articles that Drift Ashore" was revised in 2018. Revisions dealt with following points.

- The addition of perspectives on the conservation of the marine environment.
- The addition of "drifting wastes" and the promotion of the smooth disposal of such wastes
- The reduction of wastes that have drifted ashore through the promotion of 3R, etc.
- Countermeasures on microplastics (restraints on the use and discharge of microplastics by business entities, the prompt examination of the state of policy for microplastics control by the government, and the stipulation that actions be taken based on this examination)
- The securing of international collaboration and promotion of international cooperation

In one of the projects supported by the Ministry of the Environment, "Regional Countermeasures Promoting Programs on Articles that Drift Ashore", subsidies have been issued based on Article 29 of the "Act on Promoting the Treatment of Articles that Drift Ashore", for the development of regional plans for marine waste to be implemented by prefectures and municipalities, the recovery and treatment of marine waste, and measures for the control of waste generation. This project has been implemented since 2009 and has contributed to the conservation of the marine environment in various places by supporting marine waste collection and disposal activities with heavy equipment and by volunteers.

In addition, various surveys are conducted every year to investigate measures to reduce the amount of drifting waste and waste that has drifted ashore in the coastal waters of Japan, to grasp the actual conditions, and to study international strategies and knowledge pertaining to the management of these types of waste. Consequently, general knowledge of drifting waste is being accumulated.

Subsidies have been provided for research on the elucidation of the actual situation of marine plastic pollution and to give predictions for the future on a global scale under the "Environment Research and Technology Development Fund (2018-2020)". It is expected that the dynamics and environmental impact of marine plastic waste will be systematically elucidated in the future.

2) Industry-Government-Academia Collaboration

As it is necessary for various actors to cooperate and promote the collection and disseminaton of information, a platform has been launched by the Ministry of the Environment and the Nippon

Foundation for countermeasures dealing with drifting waste. All-Japan initiatives such as “Sea Garbage Zero Week” are being implemented.

Platform for Industry-Government-Academia Collaboration		
Ministry of the Environment Nippon Foundation	CHANGE FOR THE BLUE	Launched in November 2018 as a project to create a marine waste reduction model and disseminate it domestically and internationally, with the collaboration of twelve organizations from industry, government, academia and the public. In cooperation with the Ministry of the Environment’s “Plastics Smart”, the “Sea Garbage Zero International Symposium” and “Sea Garbage Zero Week” were conducted, and the “Sea Garbage Zero Award” given out.

2.2.5 Efforts by Private Companies and Organizations in Japan

(1) Private Companies

In order to reduce the generation of waste plastics, Japanese companies have been rapidly implementing measures in recent years. An overview of such measures was already given in the previous section. The following are some examples of efforts taken by specific companies in the development of alternative materials, reduction of usage, and development of recycling technology.

Development of Alternative Materials		
Mitsubishi Chemical HD	Development of biodegradable plastics	Development of biodegradable plastic (BioPBS) with excellent heat resistance, etc. Manufactured and sold at an affiliated company in Thailand (2016-). In addition to for compost bags and agricultural multi-films, the development and sales for various applications such as coffee capsules, paper cups (inner surface laminate), and tableware related such as straw etc. were carried out.
KANEKA	Development of biodegradable plastics	A 100% plant-derived biodegradable polymer (PHBH) with excellent biodegradability in seawater was developed. Manufactured and sold as a raw material for fruit and vegetable bags and compost bags for use in Europe, where disposable plastic products and other regulations are being tightened (2011-).
Reduction of Amount Used		
Kao	Reduce the amount of plastic used for containers	A “refilling” system was developed, with the amount of plastic used 1/6 that of the main unit, for containers used for detergent and shampoos (since 1991, the current sales rate for the refill container is 84%). “Replacement” products were introduced, with compactification of containers (concentration of contents), weight reduction, and the use of renewable raw materials and recycled materials.
Aeon	Reusable shopping bag campaign, cancellation of free distribution of plastic bags cancellation, over-the-counter resource recovery	A campaign for customers to bring their own reusable shopping bags, in order to reduce plastic bags (1991-), the cancellation of free distribution of plastic bags (2007-), and collection boxes for food trays, paper packs, aluminum cans, etc. installed at stores (1991-)
Development of Recycling Technology.		
Showa Denko	Chemical recycling of used plastic	Gasification of used plastics collected by local governments, using the extracted components (hydrogen, carbon dioxide) to produce ammonia (raw materials such as plastics, synthetic fibers, chemical fertilizers) and carbonic acid products (2003-). In addition, an experiment in using the extracted hydrogen in nearby hotels etc. is also being conducted (2015-).
Japan Environmental Planning	Chemical recycling of clothing	Efforts to collect unnecessary clothing items in collaboration with each company are being implemented. Donate and reuse items that can be used and, for unusable items, dissolve and refine polyester fibers to manufacture polyester resin (raw material of polyester fibers) (2010-).

(2) Organizations

As an example of international efforts, an international alliance of global companies was introduced above. In Japan as well, for cooperation between relevant organizations, the following initiative on the marine environment has been organized. The results from the collection and dissemination of information in the collaborating organizations has also contributed to the formulation of the Japanese government's plastic recycling strategy.

Cooperative Organization	
Japan Initiative for Marine Environment	This was established in September 2018, with a joint secretariat of five chemical related organizations (the Japan Chemical Industry Association, Japan Plastics Industry Federation, Plastic Recycling Association, Petrochemical Industry Association, PVC Industry and Environment Association). The purpose of this initiative is to deliberate — as members of Japan's chemical industry, including the plastic industry — on measures that address marine plastic issues and to promote planning and implementation. Specifically, the initiative will carry out activities such as accumulation of scientific knowledge and for the improvement of waste management capacities in Asian countries.

2.2.6 Measures to Deal with Marine Plastic Litter in Japan

The overall measures taken in Japan to deal with marine plastic litter, which have been partly shown in the previous section, are summarized in the table below. The measures detailed here are those based on scientific or engineering technologies, excluding institutional or educational measures.

Table 2-18 Measures to Deal with Marine Plastic Litter in Japan

Types of Plastic		Macroplastics (called "plastic litter" when generated)		Microplastics (generated as small particles)
		Land origin	Marine origin	
Examples		Shopping bags, packages, electric and electronic apparatuses, construction material, transportation equipment, tableware, stationary, shoes, etc.	Fishery nets, ropes, buoys, floats, waste similar to that left from ships, etc.	Tires, coatings, road markings, shoe soles, micro beads, abrasive powders, resin pellets, etc.
Production	Material Substitution	・ Material development using paper and wood ・ Development of biomass plastic ・ Development of biodegradable plastic	・ Use of biodegradable plastic for products that does not particularly need to be very strong.	・ Avoidance of the use of plastic micro beads ・ Development of micro beads from biological material
	Reduction of Plastic Use/Design for Recycling	・ Weight minimization, development of refillable products, development of container-free products ・ Unification of material ・ Design for recycling	・ Floats that have covers	

After Use	Collection/ Segregation/ Shredding/ Compressing	・ Segregation of plastic ・ Increased portability by shredding and/or compressing	・ Increased portability by shredding and/or compressing	・ Collection at domestic wastewater treatment plant ・ Collection at wastewater treatment plant of factories/waste final disposal site
	Recycling/ Recovery*	・ Material recovery ・ Energy recovery		
	Collection from the environment	・ Collection of floating waste and/or waste that has drifted ashore	・ Collection from ocean	
Situation understanding		・ Measuring and Monitoring		

*) There is a case where thermal recovery is called "thermal recycling" and considered as part of recycling, but since the energy of waste is limited to one-time use, it is often regarded as “recovery”, not “recycling”. In Japan's “Resource Circulation Strategy for Plastics”, the recycling rate and the energy recovery rate are shown, both of which constitute the waste utilization rate. According to the EU Waste Framework Directive (2008/98/EC), recycling does not include energy recovery.

As this survey focuses on land-based litter, the technologies listed in the left column in the table above are further explained below.

(1) Material Substitution

This is a technology for using paper, wood, biomass plastic (plastic not made from petroleum but from plants) or biodegradable plastic to produce conventional plastic products. Applying special processing and coatings, paper for packaging that has high waterproofness and wooden straws have been developed. Biomass plastic, as it is made from renewable materials such as corn and oil palm, is carbon neutral and does not emit additional CO2 when it is incinerated. As for biodegradable plastic, the development of plastic[19] that is biodegradable in the sea is currently drawing attention.

For all of these materials, costs still have to be reduced and user-friendliness improved for them to become practical substitutes for plastic. It has also been argued that using these materials as substitutes for plastic may facilitate waste littering or detract from the importance of proper waste management.

(2) Reduction of Plastic Use/Design for Recycling

The technology to reduce plastic use includes the minimization of the weight of plastic packaging and the development of refillable products. For example, the weight of PET bottles has been reduced by making them thinner and rippled, while maintaining their strength, and by improving the screw threads used for caps. As for refillable products, packages that allow content to be transferred to containers easily without spillage have been developed. Recently products have been developed that do not require containers; such products are furnished with dedicated containers that hold only the products themselves, which can be used without being transferred to other containers.

[19] There is a certificate called “OK Biodegradable MARINE” which guarantees 90% biodegradability within six months in the sea at thirty degrees. This certificate guarantees decomposition under specific conditions and does not ensure biodegradability in all conditions.

Designs for recycling include material unification (e.g. development of food packages, which used to be a combination of plastic and aluminum, only from plastic), the improvement of part assemblage for electronic products so that it enables easy disassembly, and other designs.

The background to these efforts is that industrial groups have established voluntary guidelines to encourage product designs that are easy to recycle.

(3) Collection/Segregation/Shredding/Compression

For smooth recycling following usage, it is necessary to segregate plastic from other material and/or specific kinds of plastic from other kinds of plastic. Automatic segregation machines that employ wind, specific gravity variation, or a spectroscopic method that detects differences in molecular structure have been developed, but manual disassembling and segregation is also widely practiced.

In the shredding process, shredder dust is generated. Technology has been developed that can collect plastic from shredder dust by applying a material identification methodology that uses near-infrared rays.

Compression is particularly important to transport plastic to recycling facilities after collection and segregation, as most plastic products are light but bulky. A specific example is the compression machines that are installed at markets where a number of foamed polystyrene boxes for fish and vegetables are thrown away, or are used by municipalities that separately collect formed polystyrene trays. These machines transform foamed polystyrene into an ingot 1/50 in volume, improving transportation efficiency.

(4) Recycling and Recovery

Plastic recycling technologies in Japan can be categorized in the following ways. (The percentages shown below are the rates of plastic treated by each technology relative to the total amount of waste plastic in Japan in 2017.)

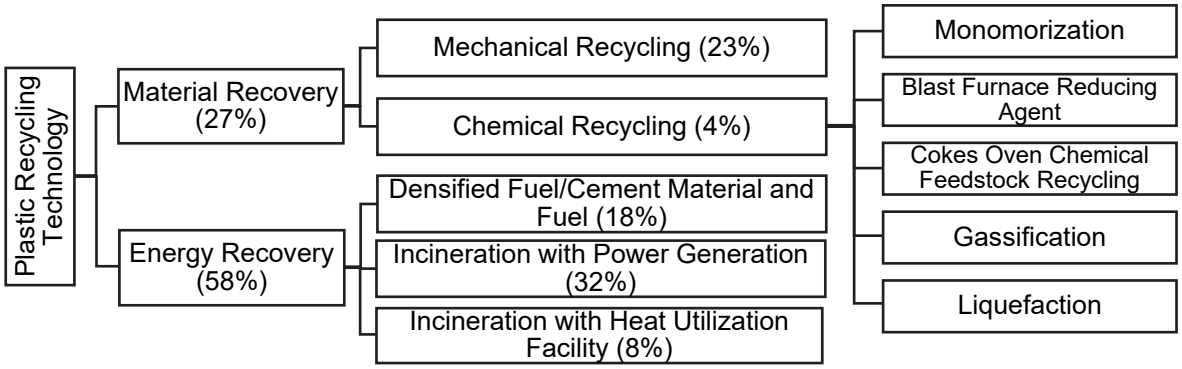


Figure 2-11 Plastic Recycling Technologies

The technologies[20] shown above are further explained below.

1) Mechanical Recycling

Mechanical recycling is the production of plastic material or plastic products from waste plastic without changing the chemical structure of the material. In Japan, it is often called material recycling. As it is important for mechanical recycling that waste plastic is homogeneous, pure and available in large quantities, industrial waste plastic and PET bottles from municipal waste usually undergo this process.
Chemical Recycling

Chemical recycling transforms waste plastic into monomers or new material with a chemical structure different from plastic. This further includes the following.

- Monomerization. This is to chemically decompose waste plastic into monomers and manufacture it into new products. The technology for producing new PET bottles from recycled PET bottles has been put to practical use.
- Blast Furnace Reducing Agent. Waste plastic is put into a blast furnace instead of coke, which is a reducing agent. Mixed plastic can be used, but foreign material other than plastic must be removed. In cases where waste plastic contains vinyl chloride, hydrogen chloride, which is corrosive to the facilities, will be generated and must be removed under high temperatures (350 degrees Celsius) without oxygen.
- Coke Oven Chemical Feedstock Recycling. Waste plastic is mixed with coal at a rate of 1-2% and put into the coke oven to produce hydrocarbon oil, coke, and coke oven gas, each of which is used as chemical material, a reducing agent for blast furnaces, and fuel for power generation. Mixed plastic can be used, but preprocessing, such as foreign material removal, vinyl chloride removal and granulation, is necessary.
- Gasification. In the gasification process, waste plastic undergoes high temperature with limited oxygen to generate compound gas (mainly consisting of carbon monoxide and hydrogen). It is used as raw material for chemical industry to produce hydrogen, methanol, ammonia, acetic acid, among other things. The residue including inert material and slag are also used as material for civil engineering and construction material.
- Liquefaction. This is a technology to turn waste plastic back into oil, its raw material. Since the practical use of this, however, necessitates the consumption of energy, a product-refining process, and strict control of the risks of ignition or explosion, it is difficult to ensure business feasibility.

It is to be noted that the mechanical recycling and chemical recycling described above are classified based on the material changes that take place at the molecular level during processing. There is another classification based on the types and quality of waste plastic and recycled plastic: cascade recycling and horizontal recycling.

Cascade recycling is a process in which the quality of the recycled plastic is lower grade than that of the waste plastic, whereas horizontal recycling is a process where the quality grade is the same for both.

[20] "Chemical recycling" in the figure above is called "feedstock recycling" in ISO 15270:2008 (*Plastics —Guidelines for the Recovery and Recycling of Plastics Waste*).

When PET bottles are recycled, the outputs from cascade recycling include fruit trays, textiles, waste bins and chairs; the outputs from horizontal recycling are new PET bottles.

Within horizontal recycling of PET bottles (BtoB), the production of PET bottles for beverages must overcome issues of smell and sanitary safety. At present in Japan, both mechanical recycling technology and chemical recycling technology of BtoB for beverage bottles have been approved for safety and put into practice.

2) Densified Fuel*/Cement Material and Fuel

Densified fuel includes refuse derived fuel (RDF) and refuse paper and plastic fuel (RPF).

RDF is made not only from waste plastic but also organic waste and other kinds of municipal waste through drying, crushing, removal of inert materials (e.g. metal), compression and palletization. Volume is reduced to one-fifth and weight to half, resulting in increased portability. The heat value is about 18.0 MJ/kg, which is two-thirds of that of fuel coal, but quality control and cost reduction are obstacles.

RPF, on the other hand, is made from only waste plastic and waste paper. The process basically consists of shredding, foreign material removal, compression and palletization. If the types and quality of waste plastic is predetermined, the preparatory process — such as segregation — can be simplified and the heat value can be as high as fuel coal (the heat value varies depending on the ratio of each material). In Japan, the plastic material used for RPF is mostly industrial plastic waste. RPF users are, for example, cement factories, paper factories and power generation plants.

In addition, waste plastic in a film or sheet form is also used as fluff fuel after being cut into pieces. Fluff fuel has an advantage in that there is a lower initial investment for the production line and less power consumption compared with RPF.

Waste plastic can be used as cement material and fuel, in that its inorganic content (such as additives and fillers) serves as raw material and its heat quantity as energy. After being crushed, waste plastic is fed into the burning process of a cement kiln. If waste plastic contains polyvinyl chloride, chlorine will be generated — and chlorine-containing cement will corrode metal and decrease the strength of steel beams. However, dechloridation technology to lower the chlorine concentration in the cement kiln has been developed and dechloridation facilities have been installed.

3) Incineration with Power Generation

In incineration plant power generation, the heat generated from the waste incineration process is used to generate steam, which then runs turbines and generates electricity. In Japan, wastes categorized as “burnable waste” or “waste for incineration” are collected by municipalities and subject to incineration. Wastes to be incinerated include plastic products other than plastic packages (e.g. cups or toys), plastic packages where there is no package waste collection service, and plastic packages not properly separated even though there is package waste collection service. As plastic has a heat value as high as fossil fuel, it contributes to burning. In Japan, there are 1,152 waste incineration facilities and 348 facilities that generate electricity, almost all of which are 24-hour operations with an average capacity of 330 tons/day (in 2018)[21]. Many countries including Japan apply a Feed-in-Tariff (FIT) system to waste incineration

[21] Calculated from the Excel files available at http://www.env.go.jp/recycle/waste_tech/ippan/h28/index.html.

plants that generate power, recognizing the biomass (food waste and green waste) contained in waste as renewable energy.

4) Incineration with Heat Utilization Facility

In Japan, incineration facilities, such as relatively old ones of 24-hour operation and facilities of 16-hour operation or batch operation, often have heat utilization facilities which utilize heat from plastic to generate hot water or steam. There are examples in which heat is provided to green houses or indoor pools to serve local communities as compensation.

(5) Amount of Plastic Treatment in Japan

The amount of plastic treatment in municipal waste and waste from industries in 2017 in Japan, for each of the applied treatment technologies detailed in this section, is shown in the following figure.

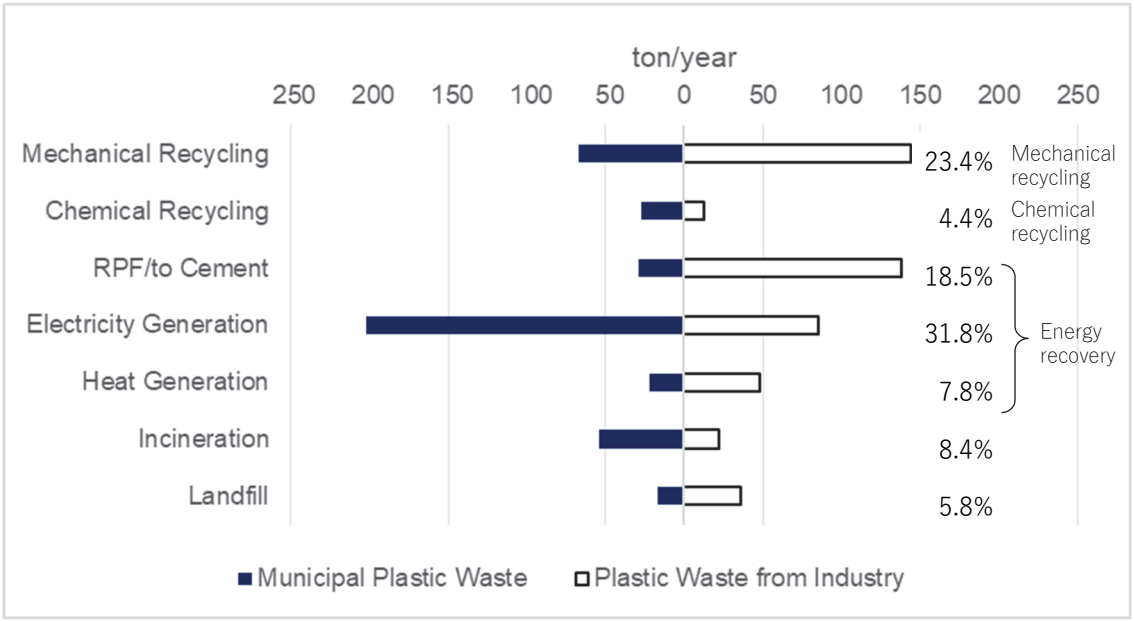


Figure 2-12 Plastic Treatment Amount in Japan (2017)

Source Plastic Waste Management Institute (2018)

When both municipal plastic waste and plastic waste from industry are considered together, incineration with electricity is the most common method; as much as 58% of plastic waste is treated by energy recovery. Material recovery (both mechanical recycling and chemical recycling) is applied to only 28% of plastic waste, although the “Basic Law for Establishing the Recycling-Based Society” stipulates that it is expected to be prioritized as much as technically and economically feasible.

As for municipal plastic waste (the solid black leftward bars in the figure above), incineration with electricity generation stands out. On the other hand, with plastic waste from industry, mechanical recycling and RPF production or the use at cement plants are widely applied, because the types of waste are known and a substantial quantity of a single type of plastic waste is available.

(6) Collection of Marine Plastic

Any waste, not necessarily only plastic waste, floating in the sea or rivers can hamper safe ship navigation or mar the landscape, and the national and local governments of Japan collect or remove waste from water bodies. The vessels used for this purpose have a deck plate with two hulls, between which a container-shaped basket scoops waste from the sea, and a crane to haul driftwood or any other long objects out of the water. Such operations are regularly executed in enclosed waterbodies such as Tokyo Bay, the Seto Inland Sea, and Kumamoto Bay. An attempt has been made to improve collection efficiency by estimating the behavior of drifting waste from climate and oceanographic conditions.

Another collection method is one which has a structure similar to an oil fence and traps waste floating on river surfaces.

On the other hand, the collection of waste that has drifted ashore on sea coasts is often carried out manually by governmental bodies or community groups. Although there is no special collection technology, techniques have been devised to improve collection efficiency. Examples include choosing the best time for operation from the tendencies of wind and sea currents and analyzing image data from drones or web cameras.

(7) Measurement and Monitoring

The method for measuring and monitoring how plastic litter reaches the sea and where and how much marine plastic litter exists includes visual observation, manual sampling, collection using a trawl and net towing. An appropriate method is selected depending on the size of the plastic litter to be measured or monitored and in which part of the sea measurement will take place (seashore, sea surface, sea column, sea floor or another location).

Recent developments in measurement and monitoring methods include the following.

- Use of GPS trackers to study river waste pathways
- Continuous photography of river surfaces and image analysis to monitory river waste amounts
- Use of drones to collect images, which are then analyzed to estimate the volume of waste that has drifted ashore

(8) Technologies Applied in JICA Public-Private Partnership (PPP) Projects

Out of JICA PPP projects implemented through FY 2018, 97 were retrieved using the keywords “solid waste management” in a sector search. Among these, there were 39 projects which handled plastic waste or waste containing plastic waste (when two or more studies of different types of PPP schemes were carried out for a single project, they are counted as one project). These 39 projects were further categorized according to types of waste and types of applied technologies. The results are shown below.

Table 2-19 JICA PPP Projects According to Waste Types and Technologies

Applied technologies	Target Waste		
	Municipal Waste	Medical or Industrial Waste	Specific Waste (End-of-Life Vehicles, WEEE, etc.)
Material substitution	1	0	0
Reduction of Plastic Use/Design for Recycling	0	0	0
Collection/Segregation/Shredding/Compression	4	1	3
Mechanical recycling	3	1	0
Chemical recycling	2	0	0
Densified fuel	4	1	0
Incineration with electricity generation	3	0	0
Incineration without energy recovery	1	15	0
Total	18	18	3

Source: Developed by retrieving projects from JICA PPP project website using a keyword “solid waste management”.
WEEE: Waste Electrical and Electronic Equipment

The most common projects use simple incineration — with no energy recovery — with medical or industrial waste. This type of technology is preferred for commercialization because Japanese incineration technology is superior in incineration performance and for safety and environmental considerations; not only for these reasons, but also because a certain amount of the treatment fees can be collected for medical waste and industrial waste, unlike for municipal waste.

Regarding the eighteen projects indicated in the table above which target municipal waste, the following can be pointed out.

- Seven kinds of technologies were applied, but a clear tendency cannot be found due to the number of projects; however, a relatively large number used collection/segregation/ shredding/compression (four projects) and densified fuel (also four projects).
- Three among these eighteen projects (one each for collection/segregation/shredding/compression, for chemical recycling, and for densified fuel) succeeded in starting as a business in each target country.
- The JICA PPP scheme aims to solve development issues by applying unique technology that the Japanese private sector has developed; it is very common for the technology introduced to be new for the recipient country. In some countries and for some kinds of technologies, approval may be required to apply new technology even if it is in the experimental phase. Attention should be paid to cases where the approval procedure may take more time than expected.

2.2.7 Activities of International Donors

While global commitment towards marine litter, especially plastic waste, is becoming stronger, major donors and international associations have also been carrying out various activities — focusing on plastic waste from its generation at the source to its collection after it has flowed into the sea. In this section, the major activities of international donors and association are introduced.

(1) UNEP

One of UNEP's roles is to take the initiative for measures on marine plastic litter. At the same time, it individually supports some projects as a donor agency. A few are described here.

1) Promotion of Countermeasures Against Marine Plastic Litter in Southeast Asia and India

This is a joint initiative of Japan and UNEP to support countermeasures against the leakage of marine plastic in Southeast Asia (along the Mekong River) and India (along the Ganges River). The government of Japan is providing JPY 123 million (an amount equivalent to over USD 1,100,000). In cooperation with government agencies and experts from Cambodia, Thailand, Vietnam, Laos, and India, the sources and routes of plastic waste leakage will be identified and models of monitoring methods developed. For the survey, satellite imagery analysis and observation with UAV will be introduced. Furthermore, based on the results of the survey, model for a long-term monitoring method will be developed in 2020 — the first in Asia.

2) SEA circular[22]

SEA circular started in February 2019 with a fund of USD 6.3 million. Implemented by UNEP and COBSEA and supported by the Swedish government, it aims to reduce the release of plastic waste into the ocean by reviewing and improving the whole value chain of plastic from production to waste recycling. Project duration will be 4.5 years. The target area is Southeast Asia, from which Vietnam, the Philippines, Thailand and Malaysia are the main countries, with particular attention on Thailand and Malaysia.

There are four major components in this project.

- The reduction of unnecessary plastics and the promotion of recycling necessary plastics through collaboration with the private sector.
- The reduction and monitoring of marine plastic generation in cooperation with the authorities which are responsible for coast and marine management.
- The country-level implementation of a "Clean Sea Campaign".
- Networking among all the stakeholders involved in relevant projects against marine plastic. One of these activities is an event called "SEA of Solutions", held in Bangkok November 11-14, 2019. It is also planned to be held in Vietnam in 2020.

(2) UNDP

1) Project to Support Setting Up Secretariat Function on Marine Plastic Debris in Indonesia[23]

UNDP, with financing of USD 1.8 million from the Norwegian Government, has been providing assistance to the Indonesian Ministry of Environment and Forestry for the strengthening of its functions as secretariat of the national coordination team on marine litter management, which is responsible for the coordination of all activities against marine litter. Three experts have been dispatched to the Ministry. Their support covers how to structure the national coordination team, what operation policy is

[22] From an interview with the UNEP Bangkok Office on August 6, 2019.
[23] From an interview with the UNDP Indonesia Office on July 18, 2019.

suitable for the team and, in future, how to build and manage the reporting system. Furthermore, they will estimate the necessary costs for each activity in the action plan and start assistance for practical implementation.

2) Support for Formulating National Action Plan for Marine Plastic Debris in Vietnam[24]

In Vietnam, UNDP has been supporting the Vietnam Administration of Seas and Islands (VASI) to develop the "National Action Plan on Marine Plastic Debris" by hiring three external consultants. The plan was finally publicized in December 2019 as the Prime Minister's Decision No. 1746.[25]

(3) World Bank

1) Sustainable Development Bond

The Wold Bank (International Bank for Reconstruction and Development: IBRD) annouced new initiatives related to water and marine resources at World Water Week 2018 and started activities focused on SDGs Goal 6 and Goal 14. Until then, Sustainable Development Bonds had been issued for projects on women and children; this was the first time a bond mainly focused on water and marine resouces had been issued. The period of the bond is seven years, and IBRD issued a ten billion SEK bond (equivalent to USD 10 million) targeting both institutional and individual investors.

2) PROBLUE

PROBLUE is a new Multi-Donor Trust Fund (MDTF), implemented as a part of the World Bank's Blue Economy Program, for tackling marine pollution, managing fisheries and fostering the sustainable growth of coastal economies. PROBLUE[26] focuses on and invests in four key themes; namely, "the management of fisheries and aquaculture", "the threats posed to ocean health by marine pollution, including litter and plastics", "the sustainable development of key oceanic sectors such as tourism, maritime transport and off-shore renewable energy", and "building the capacity of governments to manage their marine and coastal resources in an integrated fashion to deliver more and long-lasting benefits to countries and communities.". About USD 75 million has been committed so far to the fund, with the government of Norway providing the initial pledge of USD 15 million, the government of Canada announcing a contribution of USD 50 million to the fund, and with other donors including Germany, Sweden, Iceland and the European Commission.

3) Improvement of Solid Waste Management to Support Regional and Metropolitan Cities[27]

This is five-year loan project to improve solid waste management in the watershed of Citarum River, West Jawa Province, to be started in 2020. Every year, the Citarum River floods in the rainy season, and a large volume of plastic is assumed to flow out through it. Improved solid waste management in this area is expected to reduce the flow of plastic waste into the ocean. Instead of quantitatively measuring

[24] From an interview with the UNDP Vietnam Office on August 1, 2019.
[25] https://www.vn.undp.org/content/vietnam/en/home/library/environment_climate/national-action-plan-for-management-of-marine-plastic-litter-by-.html
[26] https://www.worldbank.org/en/programs/problue/overview
[27] From an interview with the World Bank Indonesia Office on July 15, 2019.

the amount of plastic waste regularly delivered to the sea, increased waste collection on land and the final disposal amount will be monitored to provide an indicator of project performance.

4) Rethinking Plastics Support for ASEAN Region[28]

This is a one- or two-year technical assistance project, which was awaiting approval as of August 2019 (with the final results of that process at the end of 2019). The target countries include the Philippines and Thailand; the World Bank Singapore Office is responsible. It aims to deepen knowledge about marine plastic and to formulate national action plans.

(4) GEF

1) Addressing Marine Plastics - A Systemic Approach[29]

A project funded by GEF and implemented in collaboration by UNEP, the Ellen MacArthur Foundation, the Ocean Conservancy and GRID-Arendal, the project period was from 2017 to 2019, with a total project cost of USD 13 million. The following four components have been implemented:

i) Creation of a global alliance platform to redesign plastics from inception (by New Plastics Economy);
ii) Development of waste management solutions in APEC, providing an upscaled knowledge base (by Ocean Conservancy);
iii) Identification of priority intervention points, providing integrated strategic guideance (by UNEP);
iv) Facilititation of efficient delivery and integration of component outputs (by GRID-Arendal)

The project utilized the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA) and the UNEP Regional Seas Programme. The project summarized a report for global mapping of plastic losses to the environment throughout the plastic value chain, using 2015 as the reference year. The mapping covers plastic production and processing, use of plastics or plastic containers, and disposal of the products.

(5) ADB

1) Ocean Financing Initiative

The Asian Development Bank (ADB) announced the “Action Plan for Healthy Oceans and Sustainable Blue Economies”[30], investing US$5 billion including cofinancing, to tackle the marine plastic litter issue in the Asia-Pacific region, aligning with ADB’s Strategy 2030 Operational Plans. To promote this Action Plan, the Oceans Financing Initiative[31] was launched. Technical assistance and funds will be provided by ADB and donors; there will also be “innovative financing instruments such as revenue guarantees and credit-enhanced blue bonds” that “will reduce project risks and make them ‘bankable’” to encourage the introduction of capital to them.

[28] From an interview with the World Bank Philippine Office on July 22, 2019.
[29] https://www.thegef.org/project/addressing-marine-plastics-systemic-approach accessed on July 7, 2019.
[30] https://www.adb.org/news/adb-launches-5-billion-healthy-oceans-action-plan
[31] https://www.adb.org/sites/default/files/related/145041/Oceans%20Financing%20Initiative.pdf

At present, the project is being designed while considering various questions — what funding sources should be allocated for what kind of project, how to make the project bankable and thereby bring in private financing, and what new financial mechanisms can be applied[32].

2) Promoting Action on Plastic Pollution from Source to Sea in Asia and the Pacific[33]

This is a technical assistance project with a fund of USD 1 million, with target countries of Indonesia, the Philippines, Myanmar, Thailand and Vietnam. It is planned for one pilot city to be selected from each of Indonesia, the Philippines, Thailand and Vietnam and that an action plan will be developed for each. Cities will be chosen from those on the coast or major rivers; current candidates are Cirebon in Indonesia, Metro Manila in the Philippines and one along the Ha Long Bay in Vietnam, while it is still under consideration for Thailand. With attention being paid not only to plastic waste but to the circular economy and climate change, the project will have both institutional and infrastructure aspects. Another point to be considered is how the project will be financed, whether by PPP or another mechanism[34].

3) Capacity Building on River and Ocean Eco-Environmental Management and Plasic Pollution Control

This is a technical assistance project for China, with a USD 6 million budget to assist in the formulation of a road map for managing plastic waste pollution. It will also include case studies and/or lifecycle assessments of plastic films for agriculture and food and beverage packaging. The counterpart will be the Ministry of Environment and Ecology of China.

4) South-South and Triangular Cooperation with Indonesia[35]

ADB and the Indonesian government will cooperate in technical assistance and knowledge sharing, including support to enable policies and regulations, the promotion of private sector engagement, enhancement for developing partnerships, and financing to reduce marine plastic litter in Indonesia and the region of ASEAN and Pacific countries. In May 2019, a Letter of Intent on Collaboration in Areas of Mutual Interest has been signed during the ADB Board of Governor's Annual Meeting.

(6) European Investment Bank (EIB)

1) Clean Oceans Initiative (COI)

The Clean Oceans Initiative (COI) was launched jointly with the KfW group and the Agence Française de Développement (AFD). Its purpose is to develop sustainable, viable and low carbon projects that reduce pollution in the oceans, with a particular focus on marine plastic litter. The initiative will provide up to EUR 2 billion in new lending over the next five years. The first project financed under the COI is a depollution project for the Kitchener drain in the Nile Delta region. This is a five-year project for EUR 214 million, the target of which is the Kitchner drain. At 69 km in length, it extends across the Egyptian governorates of Gharbia, Kafr El-Sheikh, and Dakahlia in the Nile Delta region .

[32] From an interview with ADB headquarters on July 26, 2019.
[33] https://www.adb.org/projects/53068-001/main#project-overview accessed on July 7, 2019.
[34] From an interview with ADB headquarters on July 26, 2019.
[35] https://www.adb.org/news/adb-indonesia-join-forces-tackling-plastic-debris-sea accessed on June 7, 2019

(7) Norwegian Agency for Development Cooperation (NORAD)

1) Marine Environment Protection of the South-East Asian Seas (MEPSEAS)

This a four-year (2018-2021) project funded by NORAD and implemented by IMO, supporting the capacity development of seven target countries in Southeast Asia (Cambodia, Indonesia, Malaysia, Myanmar, Philippines, Thailand and Vietnam) for the ratification and implementation of conventions with high priority (MARPOL 73/78, the London Convention and London Protocol). One of the strategic partners of this project is the Tokyo MOU (regional port state control organization). Under the project, the preparation of national legislation and policy and related capacity building will be implemented in the target countries.

2) Plastic Waste Free Islands

This is a three-year project funded by NORAD and implemented by the International Union for Conservation of Nature (IUCN) in target countries such as Saint Lucia, Grenada, Antigua Barbuda, Fiji, Vanuatu, and Samoa. Project details will be given below.

3) ASEAN-Norwegian Capacity Building Project for Reducing Plastic Pollution (ASEANO)

This project aims to enhance the capacity of governmental agencies and the private sector to combat marine plastic pollution. Pilot activities will be conducted for the Citarum River in Indonesia and the Ylang Ylang River in the Philippines by applying a watershed approach, and will be extended to other countries.

4) Marine Research on the Research Vessel *Dr. Fridtjof Nansen*

NORAD and the Food and Agriculture Organization of the United Nations (FAO) are doing research on the impacts of marine pollution, sustainable fisheries and climate change, employing the co-funded marine research vessel, the *Dr. Fridtjof Nansen*. The vessel is the only one in the world allowed to fly the UN flag and is able to sail freely across different jurisdictional boundaries. The third generation *Nansen* vessel, it is equipped with biomass assessments, ocean floor mapping, a remote underwater vehicle (ROV), and "manta trawls" that collect plankton and microscopic plastic particles. The vessel officially launched in March 2017, but it has already done a demonstration survey in the southern Indian Ocean to collect information on marine litter.[36]

(8) GIZ

1) Reducing the Input of Plastic Litter into the Ocean Around Grenada[37]

This project was launched by GIZ as part of its "Concepts of Sustainable Waste Management Sector Project" in order to contribute to reducing marine litter through the introduction of selected regulatory or economic instruments that promote the reduced use or reduced littering of relevant materials. The study was designed in coordination with GIZ's Integrated Climate Change Adaptation Strategies (ICCAS), and the purpose of the study was to make a case to decision-makers in Grenada about the

[36] http://www.fao.org/news/story/en/item/318488/icode/

[37] https://www.giz.de/de/downloads/giz2015_marine-litter-instruments_grenada.pdf accessed on June 7, 2019

benefits of potential instruments for reducing the amout of litter, especially plastic bottles. The stakeholders involved for this study included the Grenada Ministry of Agriculture, Lands, Forestry, Fisheries and the Environment, Ministry of Health, Grenada Solid Waste Management Authority, Grenada Hotels and Tourism Association, importers/retailers of plastic bottles, NGOs involved in conservation and clean-up activities, and waste collection contractors. The study implemented a baseline survey performed by a national consultant, desktop research carried out by an international consultant, a field visit, and consultations with relevant stakeholders. As its final outcome, the study proposed a deposit-refund system within EPR to contribute a significant reduction of the amount of plastic bottles.

2) Reducing Plastic Waste and Marine Litter in East and Southeast Asia — Supporting the Transition to a Circular Economy[38]

This project's implementation period is from May 2019 to April 2022, with a budget of EUR 10 million (EUR 9 million from the EU and EUR 1 million from the German government). The target countries are China, Indonesia, Japan, the Philippines, Singapore, Thailand and Vietnam. The specific promotion of recycling or incineration is not intended, but rather the aim is to build a mechanism to reduce plastic waste generation. The project consists of the following six components. (Pilot projects are planned for Component 2, Component 3, and Component 4.)

1. Enhancing policy dialogue concerning plastic production and management (by organizing forums and seminars with the participation of EU representatives)
2. Implementing activities on managing plastic waste (assumed to include EPR, deposit return schemes and other upstream activities not entailing recycling or waste management)
3. Implementing activities for sustainable consumption and production of plastic (such as design for reuse, alternatives to plastics and other upstream activities)
4. Reducing waste from ships to the ocean (assumed to include port reception facilities)
5. Strengthening green procurement policies (by learning good practices from Singapore and Japan)
6. Increasing awareness among public authorities and citizens (regarding plastic production and consumption and its environmental impacts in consideration of EU plastic directives and to advocate EU policy on the circular economy)

GIZ and Expertise France are the implementing agencies. The former is responsible for activities for all of the countries except for Vietnam and excluding Component 4; the latter is responsible for all activities in Vietnam and Component 4 for all of the countries. In Indonesia, where a new EPR system has been launched by the issuance of the regulation of the Minister of Environment and Forestry No.75 of Year 2019 which stipulates a road map of waste reduction by manufacturers, GIZ plans to assist the establishment of Producer Responsibility Organization (PRO) for the smooth implementation of the ministerial regulation[39].

[38] From interview with GIZ Thailand office on August 5, 2019.
[39] From an interview at the GIZ office in Indonesia on December 10, 2019.

(9) USAID

1) Municipal Waste Recycling Program (MWRP)

The purpose of this program is to provide grants and technical assistance to non-governmental partners, such as civil society organizations, youth-led or women-led groups, private sector companies, associations, cooperatives, and academic institutions, that can implement municipal waste recycling solutions with a focus on reducing plastic pollution of the marine environment in Indonesia, the Philippines, Sri Lanka and Vietnam. Priority areas for the grants are: 1) strengthening local actors and their collaboration to render urban systems more effective in solid waste management and reducing marine plastics pollution; 2) applied research to identify locally-appropriate technology and improve decision-making processes related to urban solid waste management and recycling; 3) enabling the private sector to develop and implement market-driven solutions for marine plastics pollution and strengthen the recycling value chain. Grants range from USD 50,000 to USD 250,000, and partners had been recruited four times. There have been 32 projects[40] so far.

(10) Activities of Ministry of the Environment (Japan)

The Japanese Ministry of the Environment is sharing knowledge with and developing the capacity of ASEAN member states on sound waste management and 3R by making the best use of the existing forums and institutions such as the Regional 3R Forum in Asia and the Pacific, and the Economic Research Institute for ASEAN and East Asia (ERIA).

1) Regional Knowledge Hub on Marine Plastic

To develop the capacities of developing countries for the sound collection and management of waste, including plastic waste, a knowledge hub center on marine plastic will be established at ERIA. By utilizing this hub center, related policies and best practices from each country in the region will be understood and shared.

2) Project by Japan-ASEAN Integration Fund (JAIF)

This is the JAIF ASEAN +3 project on marine plastics, which is linked with the East Asia Summit Leaders' Statement on Combatting Marine Debris[41]. The objectives of the project are to: 1) assist in the formulation of national action plans; 2) develop support tools for an integrated land-to-sea policy approach; 3) support capacity building for solid waste management activities; and 4) develop marine debris monitoring. Phase 1 was from March 2019 to September 2019 with a budget of USD 300,000 and Phase 2 is through December 2021, implementing assessments in Indonesia and Vietnam.

The table below shows the project implementation of the major donors in the four priority countries for Japan's ODA (Indonesia, the Philippines, Vietnam and Thailand) (see Section 4.1.1).

[40] https://urban-links.org/project/municipal-waste-recycling-program-mwrp/#overview
[41] https://asean.org/east-asia-summit-leaders-statement-combating-marine-plastic-debris/

Table 2-20 Marine Plastic Projects of Major Donors in the Four Countries of Field Survey

Donor	Project	Country			
		Indonesia	Philippine	Vietnam	Thailand
UNEP	(1)-1) Promotion of countermeasures against marine plastic litter in Southeast Asia and India	—	—	○	○
	(1)-2) SEA Circular	—	○	○	○
UNDP	(2)-1) Project to support for setting up secretariat function on marine plastic debris in Indonesia	○	—	—	—
	(2)-2) Supporting for formulating National Action Plan for Marine Plastic Debris in Vietnam	—	—	○	—
WB	(3)-3) Improvement of Solid Waste Management to Support Regional and Metropolitan Cities	○	—	—	—
	(3)-4) Rethinking Plastics Support for ASEAN Region	—	○	—	○
ADB	(5)-1) Ocean Financing initiative	○	○	○	○
	(5)-2) Promoting Action on Plastics Pollution from Source to Sea in Asia and the Pacific	○	○	○	○
	(5)-3) Capacity Building on River and Ocean Eco-Environmental Management and Plastic Waste Pollution Control	—	—	—	—
NORAD	(7)-1) Marine Environment Protection of the South-East Asian Seas (MAPSEAS)	○	○	○	○
GIZ	(8)-2) Reducing plastic waste and marine litter in East and South East Asia – supporting the transition to a circular economy	○	○	○	○
MOE Japan	(10)-1) Regional Knowledge Hub on marine plastic debris	○	—	—	—
	(10)-2) JAIF ASEAN +3 project on marine plastics	○	○	○	○

Note. The numbers added to the project names are those of headings in Section 2.2.7.

2.2.8 Activities of International Institutions and Networks Other than Donors

(1) IUCN

1) Plastic Waste Free Islands

This project was launched as part of IUCN's "Close the Plastic Tap Programme"[42], funded by NORAD and the Didier and Martine Foundation and implemented by IUCN. The project supports Small Island Developing States (SIDs) from three areas that are vulnerable to the impact of marine pollution, namely:

Oceania region : Samoa, Fiji, Vanuatu;
Mediterranean region : Cyprus, Menorca;
Caribbean region : Antiqua and Barbuda, Grenada, Saint Lucia.

The project also aims to repurpose waste into commercially viable products, thereby generating job opportunities and income for local communities. Key regional bodies will also develop and endorse a blueprint for the entire value chains of different sectors, such as tourism and fisheries, from production to disposal.

2) Marine Plastics and Coastal Communities Project (MARPLASTICCs)

This project was launched by IUCN with the support of the Swedish International Development Cooperation Agency (Sida). This is a three-year initiative in South Africa, Mozambique, Kenya, Thailand and Vietnam. The project uses an integrated lifecycle approach which supports the transition

[42] https://www.iucn.org/theme/marine-and-polar/our-work/close-plastic-tap-programme/projects

from a linear take-make-dispose model to a circular plastics economy. Specifically, the activities of the project are:

- To assist governments and regional bodies in Africa and Asia to strengthen, develop and implement legislation and other measures which reduce plastic pollution.
- To equip governments, industry and civil society with tools, knowledge, capacity and policy options to help "close the plastic tap".
- To ensure that the full life cycle of plastics is taken into consideration, not just the impacts of downstream marine litter.

3) PlastiMed

This project is funded by MAVA Foundation in Switzerland and started in 2017. PlastiMed is targeting the Mediterranean Sea region and aiming to advance understanding of the flow of plastic from source to sea and to help with the design of local and achievable solutions.

4) PlastiMed BeMed

This project has received support from the Prince Albert II Foundation and is planned to be implemented from 2019 to 2021. In this project, existing methodology, models and data will be improved to assess plastic waste and leakage, pathways, and sinks by combining modelling and field approaches in the Mediterranean Sea region, with a particular focus on North African countries.

5) Baltic Solutions to Plastic Pollution

This project is funded by the Swedish Postcode Foundation and implemented by the Global Marine and Polar Programme (GMPP) of IUCN. It demonstrates the impacts of plastic pollution in the Baltic region on climate change, biodiversity and food safey. GMPP has brought together a network of scientists to conduct desk and field research and laboratory experiments, and to provide sound scientific evidence of the negative environmental and social impacts of plastic pollution in the region. Based on the evidence obtained, and together with leading regional experts and grassroots organisations, GMPP will then investigate policy leveraging mechanisms to provide entry points for recommendations.[43]

(2) World Economic Forum (WEF)

1) The Global Plastic Action Partnership (GPAP)

The Global Plastic Action Partnership (GPAP)[44] is a public-private partnership for solving the plastic pollution issue that brings businesses, civil society, national and local governments, community groups and world-class experts together in collaboration. GPAP is funded and supported by the governments of Canada and the United Kingdom, as well as several companies, namely the DOW Chemical Company, The Coca-Cola Company, PepsiCo Foundation, and Nestlé, as well as the World Resources Institute and World Bank. The first GPAP collaboration was with the government of Indonesia, which became the first country that have launched the National Plastic Action Partnership (NPAP), the

[43] https://www.iucn.org/theme/marine-and-polar/our-work/close-plastic-tap-programme/projects
[44] https://www.weforum.org/gpap

equivalent with GPAP at the country level. The members of NPAP include the Coordinating Ministry of Maritime Affairs, the Ministry of Environment and Forestry and the Ministry of Industry from the government side, Chandra Asri Petrochemical, Coca-Cola Amatil, Dow Chemicals, the Ellen MacArthur Foundation, Evoware, Giti Group, the Indonesian Business Coucil for Sustainable Development (IBCSD), the Indorama Group, Indofood, PepsiCo, Nestlé, the World Bank, and WWF Indonesia from the non-governmental side, and also the govenors/mayors of four municipal governments.

(3) World Wildlife Fund (WWF)

1) ReSource: Plastic

ReSource: Plastic[45] is an initiative launched by the WWF for member companies to reduce plastic waste. In this initiative, the WWF will give support for the following:

- Identification by experts of the most effective measures for reducing plastic waste
- Providing experts and tools that include step-by-step guidance on best practices and a measurement framework to help in the reduction of plastic waste
- Collaboration between companies, stakeholders and governments that are working on plastic waste issues

Current major member companies are Keurig Dr Pepper, McDonald's, Procter & Gamble (P&G), Starbucks, Tetra Pak, and The Coca-Cola Company.

(4) Other NGOs and Foundation Working on Marine Conservation and Measures for Marine Litter

1) Ocean Conservancy

Ocean Conservancy is an NGO based in the United States. The organization has held the International Coastal Cleanup (ICC) for over thirty years, since 1986, cleaning up the world's marine environment as well as collecting data on marine litter. The collected data is utilized to formulate international laws and conventions regarding marine pollution. Moreover, every year the organization holds a workshop for activities such as disseminating information on marine litter.

2) The Ocean Cleanup

The Ocean Cleanup is an NGO launched in 2013 in the Netherlands. Their activities are the development of original system to remove floating marine litter and the collection of various data in the Great Pacific Garbage Patch. The organization is targeting the removal of 90% of marine plastic litter by 2040 as a final goal.

3) Ellen MacArthur Foundation

The Ellen MacArthur Foundation is a charity based in the United Kingdom which is leading the promotion of the circular economy. The Foundation leads an initiative called the "New Plastics

[45] https://resource-plastic.com/about

Economy Global Commitment"[46] (mentioned above), to address the marine plastic issue, and is working for the elimination of unnecessary plastic packaging and containers, the transition to reusable, recyclable, and compostable items, and the development of the circular plastics economy.

4) Break Free from Plastic

Break Free from Plastic[47] is an international movement formed in September 2016 by international environmental NGOs such as Greenpeace and the Basel Action Network to prevent plastic pollution. About 1,500 environmental NGOs have joined and they implement plastic waste surveys and present policy recommendations. They carry out a "Brand Audit", in which waste collected on the beach is classified and displayed according to brand, in order to urge companies to curtail the production and sale of disposable plastic containers.

5) Basel Action Network (BAN)

This[48] is an international environmental NGO based in Seattle, USA, and one of the core organizations of the "Break Free From Plastic" movement. Their activities include research, visualization of the movement of electronic waste and electronic equipment, recycling of discarded vessels, and policy recommendations on transboundary waste movement. They have actively made efforts for the amendment to Annex II of the Basel Convention at COP14 to control the contaminated plastic waste.

6) Global Ghost Gear Initiative (GGGI)

This[49] is the world's largest alliance across sectors that is organized to cope with ghost gear (abandoned or discarded fishing gear). As of June 2019, 92 NGOs and companies, fourteen governments and two international organizations have participated. Using dedicated smartphone applications, information on ghost gear, including plastic items, is collected from all over the world and put into a database. Affiliated organizations in each country carry out surveys and projects of collection and recycling.

7) Japan Environmental Action Network (JEAN)

JEAN is an NGO which coordinates "International Coastal Cleanup" activities in Japan. The organization launched the "Marine Litter Issue Platform Japan" in 2005 and has been holding various related events. In addtion, through workshops for Japanese Diet members, the organization raised the marine litter issue with the government and contributed to the formulation of the July 2009 "Act on Promoting the Treatment of Marine Debris Affecting the Conservation of Good Coastal Landscapes and Environments to Protect Natural Beauty and Variety".

8) Plastic Waste Management Institute (PWMI)

PWMI is an institute which carries out the surveys and research of plastic waste recycling aiming to reduce the environmental load of plastics throughout its life-cycle, encourage the sound development of

[46] https://www.newplasticseconomy.org/projects/global-commitment
[47] https://www.breakfreefromplastic.org/
[48] https://www.ban.org/
[49] https://www.ghostgear.org/

plastic-related industries and eventually contribute to the creation of a society capable of sustainable growth"[50]. It also implements surveys and research related to the cyclical usage of plastic waste, among other things. The institute also put together a pamphlet entitled *Basic Knowledge of Plastic* and disseminates information on the disposal and recycling of plastic waste.

9) NGO Network Realizing Reduced Plastic Society

This is a collaborative organization which is composed of fifteen environmental organizations and networks in Japan. The organization has submitted a recommendation for the Japanese Ministry of the Environment's "Resource Circulation Strategy for Plastics", requesting the inclusion of the following: 1) actions which exceed the items of the "Ocean Plastics Charter"; 2) the significant reduction of single-use plastics; and 3) the exclusion of the amount of thermal recycled plastic waste from the resource utilization rate.

2.3 Achievement and Trend of Waste Management Projects by JICA

None of JICA's projects in the waste management sector address the marine plastic litter issue clearly, but waste management is fundamental and essential in combating the issue. In this light, this section reviews the achievements and trends in JICA waste management projects.

(1) Projects to be reviewed in This Survey

Technical cooperation projects in the solid waste management sector that were started from March 2009 onwards, according to the JICA knowledge site as of March 2019, and Japan's grant assistance, for which grant agreements were signed in and after FY 2009 according to the "ODA Visibility Site", were as follows.

Table 2-21 JICA Project in Solid Waste Management Sector since March 2009

	Number of Projects Commenced/GA from March 2009 Onwards
Technical cooperation projects	22
Development studies	0
Technical cooperation with development studies	3
SATREPS*	2
Projects associated with Yen-loans	1
Grass-root projects (in partner style)	3
Grass-root projects (in local proposal style)	35
Grass-root projects (in assistance style)	6
Grant aid	10
Total	82

*SATREPS: Science and Technology Research Partnership for Sustainable Development

[50] https://www.pwmi.or.jp/ei/about.pdf

This survey will review 38 projects (indicated by the shaded cells above), including technical cooperation projects, development studies, a technical cooperation with development study, SATREPS, and projects associated with Yen loans, which started from March 2009 onwards, and grant aid projects for which grant agreements were signed after March 2009.

(2) Viewpoint of the Review

The previous sections described the current status of the marine plastic waste issue and countermeasures in the international community. From what was outlined, the marine litter issue can be thought to consist of the following matters.

A) Understanding of the status of plastic waste, such as generation and flow.
B) Prevention of plastic waste from being released into the environment, explicitly including the reduction and separation of plastic waste and proper collection and final disposal of plastic waste that is not recycled.
C) Promotion of plastic recycling so as to promote waste separation
D) Understanding of the pathway of plastic waste released into the environment
E) Collection of plastic waste from the ocean
F) Microplastic reduction and release prevention
G) Understanding of the behavior of marine plastic litter in the ocean and monitoring thereof

The 38 selected projects were reviewed from the viewpoint of whether they are related to these matters and whether they can contribute to solving them.

(3) Results of Review

Out of the 38 projects under review, the number that included actual activities or plan development related to matters A to G listed above is shown in the table below.

Table 2-22 Areas of Issues Included in JICA Projects

Plastic litter issues		Technical Assistance		Grant Aid
		Actual activities	Plan development	
A. Understanding waste generation and flow	Waste generation amount composition analysis	18 (11)	0 (0)	0 (0)
	Recycling market study	11 (4)	0 (0)	0 (0)
B. Prevention of waste release	Collection improvement	16 (0)	8 (0)	9 (0)
	Separate collection introduction	14 (9)	12 (0)	0 (0)
	Enhanced intermediate treatment	6 (2)	8 (0)	1 (1)
	Final disposal improvement	9 (0)	12 (0)	6 (0)
C. Recycling promotion	Promotion of recycling industry	4 (0)	4 (0)	0 (0)
	Assistance for recycling technology	1 (1)	0 (0)	0 (0)
	Assistance for energy recovery	0 (0)	0 (0)	0 (0)
D. Understanding of the pathway of waste to the ocean[1)]		0 (0)	0 (0)	0 (0)

E. Collection of plastic waste from the ocean[2)]	0 (0)	0 (0)	0 (0)
F. Reduction and release prevention of microplastics	0 (0)	0 (0)	0 (0)
G. Understanding of the behavior of marine plastic litter in the ocean and its monitoring	0 (0)	0 (0)	0 (0)

Note: Figures in parentheses show the number of projects involving activities A-G targeting plastic waste. Project completion reports and/or final reports for the projects available on the internet were consulted as much as possible for information about project activities or the content of plans developed in the projects.
1) Although not included in the 38 project above, one of the SATREPS projects approved for the fiscal year 2019 "Formation of a Center of Excellence for Marine Plastic Pollution Studies in the Southeast Asian Seas" (Thailand) has a component to research the generation and pathway of plastic waste.
2) Although not included in the 38 project above, a Yen-loan project "Rehabilitation and Improvement Project of Jakarta Fishing Port" installed a water purification facility with a function of plastic waste collection.

This table implies the following.

- Many of these JICA projects have carried out studies on waste generation amount and composition and waste flow. In particular, conducting surveys on waste amount and composition is almost a routine component of the projects. Furthermore, in waste composition surveys there are some cases where the category "plastic" is divided into" PET bottles and others" or "hard plastic and soft plastic". As regulations regarding plastic waste are becoming popular, understanding the real situation regarding plastic waste generation is more important than ever. The experience and know-how from these JICA projects in this area will be useful.
- There are also many projects that contribute to the prevention of waste release into the environment by improving waste collection or promoting separate resource collection. Through grant aid assistance, waste collection capacity has been strengthened by providing collection and transportation vehicles and/or vehicle maintenance equipment. When waste collection is to be improved by technical assistance, it is important to improve residents' waste discharge behavior. The promotion of proper waste discharge by residents is often associated with resource separation at source, and plastic waste — PET bottles in particular — is one of the categories targeted for separation. The collection and management of waste is one of the most important countermeasures against the release of plastic waste into the environment in developing countries (UNEP 2016). Projects of this type will remain important in future.
- Jambeck, et al. 2015 used information about final disposal practices in order to estimate the ratio of plastic waste released into the environment to mismanaged plastic waste. This in turn means that the improvement of final disposal will contribute to the prevention of waste release. The number of grant aid projects to develop final disposal sites are not many, but proper operation and maintenance is rather more important for the prevention of marine plastic release and it is worth writing that many technical assistance projects have been implemented for final disposal improvement. Leachate circulation is the typical treatment methodology employed in the JICA projects, as the evapotranspiration rate is high in most developing countries in the tropics; moreover, leachate circulation is affordable for local authorities. Considering research results that indicate that leachate from final disposal contains microplastics that are fragments of disposed of plastic waste (van Praagh, Hartman and Brandmyr 2018), circulation treatment will be also appropriate in terms of preventing the release of microplastics.
- Separate resource collection has been attempted in many projects, but project activities have often ended when resources are sold to private agents, so they have not entailed the promotion

of the recycling industry or technical support for recycling. It can be thought that this is because the counterparts of JICA projects are usually the waste management sections of local governments, and that these counterparts do not have such responsibilities. It is to be noted that JICA has a scheme employing public and private sector partnership, whereby support is given for recycling technology. This type of JICA assistance will be reviewed in the second domestic work onwards in this survey, when the utilization of the technologies of the Japanese private sector is examined.

- None of these projects involved activities or plan formation in regard to understanding the pathways plastics take to the ocean, the reduction and prevention of the release of microplastics, or plastic litter behavior in the ocean. These are considered possible areas for new cooperation in the future. It is to be noted that this section only reviews JICA projects in the waste management sector, but those in waste sector may have contributed to preventing the release of microplastics, as wastewater treatment plants can remove microplastics from wastewater (Sun, et al. 2019).

Table 2-23 JICA Project Review (Grant Aid)

Country	Project	Grant	G/A	Collection	F.D.	Recycling
Jordan	Improvement of Waste Management Equipment in Northern Region Hosting Syrian Refugees	1.631	05/2018	x	x	
Palau	Construction of National Landfill	1.311	05/2018		x	
Palestine	Improvement of Collection and Transport System for Solid Waste Management	1.785	02/2019	x		
Bangladesh	Improvement of Solid Waste Management Equipment	1.486	05/2015	x		
Sudan	Improvement of Solid Waste Management in Khartoum State	1.534	02/2014	x	x	
Laos	Improvement of Solid Waste Management in Environmentally Sustainable Cities	1.384	03/2014	x	x	
Palestine	Improvement of Solid Waste Management in the West Bank	0.8	12/2012	x	x	x
Djibouti	Provision of Waste Management Equipment	1.346	12/2012	x	x	
Kosovo	Improvement of Solid Waste Management	0.543	03/2011	x		
Syria	Improvement of Equipment for Solid Waste Treatment in Local Cities(Phase 2)	0.985	03/2010	x		

Grant aid amount in billion yen. G/A (Grant Agreement) in mm/yyyy. F.D. stands for final disposal.

Table 2-24 JICA Project Review (Technical Assistance)

Country	Year of Commencement	Project	A. Understanding of waste		B. Prevention of waste release				C. Recycling promotion		
			Waste generation amount composition analysis	Recycling market study	Collection improvement	Separate collection introduction	Enhanced intermediate treatment	Final disposal improvement	Promotion of recycling industry	Assistance for recycling technology	Assistance for energy recovery
Mongolia	2009	Strengthening the Capacity for Solid Waste Management in Ulaanbaatar City	○	○	□	□	□	□	—	●	—
Cuba	2009	Improvement of the Capacity on Urban Solid Waste Management in Havana City, the Republic of Cuba	—	—	○	□	○	○	—	—	—
Dominica	2009	Project for Appropriate Waste Management in Santo Domingo National District	—	—	○	○	—	□	—	—	—
China	2010	The project for promotion of municipal solid waste recycling	○	○	—	□	—	—	○	—	—
Mexico	2010	The Project for the Establishment of End-of-Life Vehicle (ELV) Management Plan	○	○	□	□	□	□	□	—	—
Malaysia	2011	The Project for Model Development for E-waste Collection, Segregation and Transportation from Households for Recycling	○	○	○	●	●	—	○	—	—
PICs	2011	Japanese Technical Cooperation Project for Promotion of Regional Initiative on Solid Waste Management	○	—	○	—	—	○	—	—	—
S. Sudan	2011	The Project for Capacity Development on Solid Waste Management in Juba	●	●	○	●	—	○	—	—	—
Kosovo	2011	The Project for Enhancement of the Capacity for Waste Management toward Sound Material-cycle Society	●	○	○	●	—	—	—	—	—
Sri Lanka	2011	The project for development of pollution control and environmental restoration technologies of waste landfill sites taking into account geographical characteristics in Sri Lanka	●	—	—	—	—	○	—	—	—
Colombia	2012	Master Plan Study for Integrated Solid Waste Management in Bogota D.C.	—	—	□	□	□	□	—	—	—
Kenya	2012	Capacity Development of Solid Waste Management of Nairobi City	—	—	○	○	—	○	—	—	—
Indonesia	2013	The Project for Capacity Development of Central and Local Governments for 3R and Domestic Solid Waste Management System	●	●	○	●	●	—	—	—	—
Mozambique	2013	The Project for Promotion of Sustainable 3R Activities in Maputo	●	●	○	●	○	□	—	—	—
Morocco	2013	The Project for Capacity Development for Solid Waste Management in Tiznit Municipality and Neighboring Communes	●	●	○	●	—	□	—	—	—
Vietnam	2014	Project for Capacity Development on Integrated Management of Municipal Solid Waste	—	○	□	□	□	□	□	—	—
Brazil	2014	Project for E-waste Reverse Logistics Improvement	○	○	○	○	○	—	□	—	—
Sudan	2014	The Project for Strengthening Solid Waste Management in Khartoum State of Sudan	●	—	○	□	—	○	—	—	—
Albania	2014	Project for the Support of Waste Minimization and 3R Promotion	●	—	○	●	○	—	—	—	—
Pakistan	2014	Project for Integrated Solid Waste Management Master Plan in Gujranwala	—	—	□	□	—	□	—	—	—
Malaysia	2015	The Project for development of mechanism for household E-waste management in Malaysia	○	○	○	●	●	—	○	—	—
Nigeria	2015	The Project for Integrated Solid Waste Management System in Federal Capital Territory	○	—	○	○	—	○	—	—	—
Palestine	2015	Project for Technical Assistance in Solid Wastes Management	—	—	○	□	□	○	—	—	—
Bangladesh	2017	Project for Strengthening of Solid Waste Management in Dhaka North City, Dhaka South City and Chittagong City	●	—	○	○	—	□	—	—	—
PICs	2017	Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries Phase 2	○	○	○	●	—	○	○	—	—
Vietnam	2018	Establishment of Environmentally Sound Management of Construction and Demolition Waste and Its Wise Utilization for Environmental Pollution Control and for New Recycled Construction Materials in Vietnam	—	—	—	○	○	—	—	○	—
Morocco	2018	Project for Elaboration of the National Strategy for Treatment of Household and Similar Waste for the Kingdom of Morocco	●	—	□	□	□	□	—	—	—
Sri Lanka	2019	Project for Formulation of Western Province Solid Waste Management Master Plan	—	—	□	□	□	□	—	—	—

Note: ○Waste as a whole is dealt with in actual assistance activities. ●Plastic waste is dealt with in actual assistance activities.
□Waste as a whole is dealt with in assistance for planning. ●Plastic waste is dealt with in assistance for planning.
—Not included in the project.

(4) Project Examples Potentially Contributing to Marine Plastic Issue

Out of the 38 projects, those introduced below are examples that were implemented in coastal areas and are thought to have contributed to responses to the marine plastic issue.

1) Improvement of the Capacity on Urban Solid Waste Management in Havana City, the Republic of Cuba (September 2009 – September 2014)

The waste collection system in Havana is a container system, where anyone who needs waste collection service can use it. There was a problem, however, in that when a collection vehicle failed to be arranged and collection service was delayed, waste in containers accumulated to the point of spilling over, resulting in a substantial amount of litter around the containers. The background to this was that the city had been using too many types of collection vehicles from different foreign donors, for which it was difficult to obtain spare parts (some of which were in the first place difficult to find within the country), so the vehicle operation rate was low. In response to this situation, one of the outputs aimed for by the project was improvement of the collection and transportation capacity of the city authority. The vehicle maintenance system was enhanced through the provision of necessary equipment and training opportunities. This can be confirmed from the output indicators below.

- 10% reduction of time required by mechanics for major repair and maintenance.
- Improvement of the productivity per liter of oil from $0.80m^3$/L to $0.90m^3$ /L.

Potential Contribution on Marine Plastic Issue:
Before the project, areas where waste collection containers were placed were sometimes full of waste; it is likely that some of the plastic waste could easily fall into street gutters. It is thought that, after the project, improved vehicle operation made it possible to collect waste from containers in a timely manner, reducing the chances that plastic waste would be released into the environment.

2) The Project for Capacity Development of Central and Local Governments for 3R and Solid Waste Management in the Republic of Indonesia (March 2013 – October 2016)

This project, as its title shows, focused mainly on 3R activities. Pilot projects for waste separation at source, separate waste resource collection, and the trade of salable items were carried out in two pilot cities, Palembang and Balikpapan. The pilot project in Palembang included a waste collection fee discount for residents practicing source separation, the establishment of a waste bank as recommended by the Ministry of Environment and Forestry, Indonesia, and the introduction of a crushing process so as to improve the portability and economic value of waste resources. In contrast, in Balikpapan the pilot project included the improvement of waste discharge behavior through the introduction of the waste collection station system usually seen in Japanese cities, the establishment of a material recovery facility and enhancement of the salable items trade. In Indonesia, waste collection in most cities consists of two stages: in the first stage, residents are responsible for bringing waste to the primary collection places, which can be containers or an area surrounded by three concrete walls; in the second stage, the city authorities transport waste from the primary collection places to the final disposal sites. This system seems to be effective, but the primary collection places make it overly convenient for people to dispose of waste; they thus do not coexist well with the practice of waste separation, which requires certain norms or a certain moral outlook. Nevertheless, these pilot projects were intended to raise awareness about source separation and propose 3R models, which is the first step forward toward the circular economy.

Potential Contribution to Marine Plastic Issue:

The project promoted the source separation of waste and also enhanced peoples' awareness regarding appropriate waste discharge behavior, which will eventually prevent the release of plastic waste into the environment. Residents' participation in building the circular economy can also reduce waste resource collection costs and promote plastic recycling.

3) The Project for Improvement of Solid Waste Management Equipment in Bangladesh (1.864 Billion Yen, G/A in FY 2015) and Project for Strengthening of Solid Waste Management in Dhaka North City, Dhaka South City and Chittagong City (May 2017 – April 2021)

Chittagong City is one of the most populated coastal cities in Bangladesh, with the country's largest port. Through grant aid in FY 2015, Dhaka North City, Dhaka South City and Chittagong City were provided with 150 waste collection vehicles, of which 38 were for Chittagong City. According to the preparatory study report, the waste collection rate of the city was expected to increase from 75% as of 2014 to 98% in 2019 as a result of the aid. In order to achieve this target, a technical cooperation project started in 2017.

Potential Contribution to Marine Plastic Issue:

By 2019, the grant aid and the technical assistance will have contributed to an increase in waste collection capacity per day by 662 tons, compared with that in 2014. This in turn implies that about sixty tons of plastic waste per day will be diverted from the release pathway to the environment.

4) Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries Phase 2 (J-PRISM II) (February 2017 – February 2022)

Island countries, including those covered by J-PRISM II, often have a problem of low waste collection rates and limited land for final disposal. Plastic litter as well as other types of waste are, therefore, likely to be discharged into the ocean. On the other hand, as most of the population lives near the coast, enjoying the marine resources, marine pollution is a life-and-death problem. So strong interest has been shown in 3R activities. One of the effective 3R approaches introduced, mainly in the Micronesian region, is a deposit system for beverage containers. Taking the deposit system introduced in Yap State and Kosrae State, the Federated States of Micronesia, with the assistance of UNDP in late 2000s as a model, J-PRISM II assisted the establishment of a deposit system for beverage containers in the Marshall Islands, as shown in the figure above. Beverage importers pay six cents per container as a deposit at customs. This deposit goes to a special account of the Ministry of Finance.

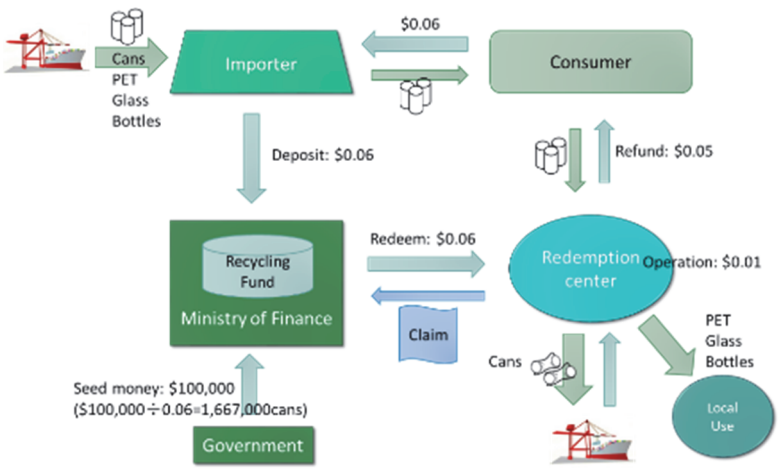


Figure 2-13 Beverage Container Deposit System in Marshall Islands

Consumers bring the containers to the redemption center and get five cents per container as a refund. Private operators running the redemption centers receive six cents per container that they have bought from the special account of the Ministry of Finance. In total, the private operators obtain one cent per container as an operation cost. The seed money shown in the figure will be used to buy containers which had been imported before the system was established.

Potential Contribution on Marine Plastic Issue:

The containers covered by the deposit system started in the Marshall Islands by J-PRISM II include PET bottles. According to redemption center records, 5,067,542 PET bottles were bought from the system's commencement through the end of May 2019. As it remains difficult to export PET bottles, they unfortunately get disposed of after being compressed. Nevertheless, without the deposit system, a substantial number of PET bottles would not have been collected but instead thrown along the roadsides, into mangrove areas, or near or into the ocean, leading to the conclusion that the deposit system has made a significant contribution to solving the marine plastic litter issue. As J-PRISM II plans to extend the deposit system to other island countries or states, the contribution made by the project will also be extended.

5) The Project for the Construction of National Landfill in Republic of Palau (1.311 Billion Yen, G/A in FY 2018) and the Promotion of Regional Initiative on Solid Waste Management in Pacific Island Countries Phase 2 (J-PRISM II) (February 2017 – February 2022)

For Palau, an island country whose abundant nature is its largest resource for tourism, one of the most serious national concerns has been the proper management of waste and the minimization of its environmental effects, since waste has increased along with tourism development.

With this grant aid in FY 2018, the design and construction of a new final disposal site was begun, for operation from FY 2020 onwards. In addition, J-PRISM II carried out engineering work in 2018 at the current disposal site in order to prolong its service life. That site will be operated until 2020 as a sanitary landfill, with due care for the surrounding environment.

Figure 2-14 M-Dock Final Disposal Site, Palau

Created from UAV images. The third embankment preventing waste release. The harbor is on the right bottom side of the site.

Potential Contribution on Marine Plastic Issue:

The third embankment constructed under the assistance of J-PRISM II effectively works to keep plastic waste (excluding PET bottles, which are collected by the deposit system) that is disposed of within the embankment from scattering outside of it or even flowing into the ocean, which is right next to the site. It also helps in preserving the landscape, as few tourists landing on the island at the nearby harbor notice that there is a waste disposal site nearby. The site, after being filled with waste and closed, will be used to build a recycling facility.

Chapter 3 Organization and Integration of Information for the Examination of JICA Assistance Policies for the Marine Plastic Litter Issue

3.1 Needs Identification and Possibilities of Assistance Utilizing JICA Projects

The contributions made by JICA's projects on the marine plastic litter issue, as reviewed in Interim Report 1, have been found to be mainly in the understanding of waste generation and flow, and in the strengthening of management systems of waste collection and disposal to prevent waste from being released into the environment. The main concern is the preservation of a sanitary living environment, at which waste management inherently aims. In addition, activities within the scope of a waste management model consisting of "discharge-collection-transportation-treatment-final disposal" are prevalent in the projects, even though not a few of them advocate material circulation or 3R, considering waste to be a resource. The scope of this waste management model is, in fact, also that of the authority of the local governments that are the counterparts of the JICA projects. Accordingly, JICA projects inevitably remain within that scope, emphasizing the capacity development of the local governments.

On the other hand, regarding marine plastic waste, countermeasures have been taken in many countries and cities not only for plastic after it has become waste, but also for plastic products before they have been discarded. Examples include bans on shopping bags, restrictions on their thickness, and the substitution of straws made from materials other than plastic for plastic straws. The Japanese government's "Resource Circulation Strategy for Plastics" (discussed above) is the official policy on the marine plastic litter issue and, as its name and the keyword "circulation" clearly show, measures for all stages from the upstream to downstream of plastic are important. This implies that the need to tackle the marine plastic issue exists across the plastic material flow. Furthermore, in regard to stakeholders in the plastic material flow, manufacturers and distributors in the private sector are the major players in the upstream; moreover, the role of the private sector is also growing in the downstream because of the waste trading market and improved PPP systems. In the public sector, different ministries and agencies in industry, commerce, environment, energy and other fields are concerned with the plastic material flow.

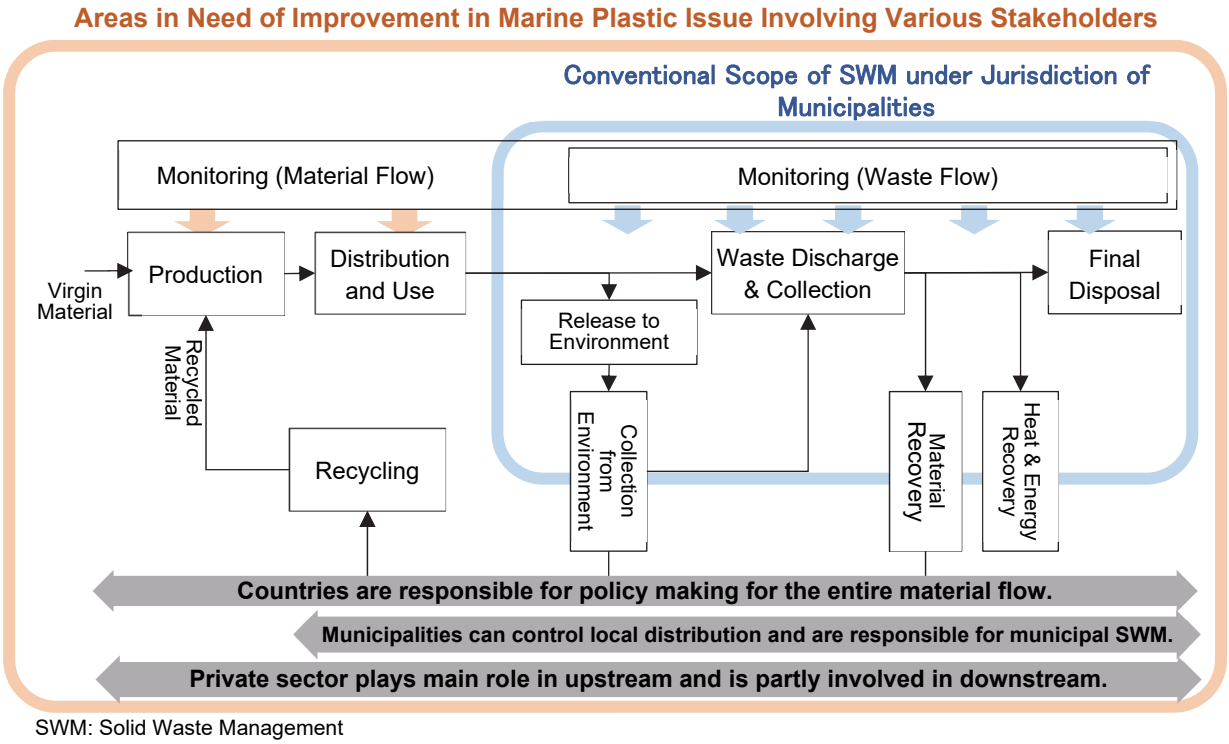


Figure 3-1 Scope of Conventional SWM and the Areas in Need of Improvement in Marine Plastic Issue

Recognizing the disparity between the scope of conventional solid waste management and the scope of needs for marine plastic countermeasures, the following can be pointed out regarding the possibilities of assistance utilizing JICA projects.

- In the upstream of the material flow, the relationship between the private sector and the government is such that the former is the main implementer and the latter oversees what is implemented. Taking this into account, JICA projects can give assistance such as capacity development for government organizations and institutional design to promote private sector activities. In addition, since private Japanese organizations in the plastic industry are now active in collaborating and exchanging opinions with similar organizations overseas, JICA projects can assist or work with them.
- In the downstream of the material flow, the private sector assumes a large role in the recovery of material and energy, unlike within conventional waste management. JICA projects in conventional waste management used to divert reusable material out of the waste flow by promoting waste separation. In order to further facilitate the material circulation of waste plastic, however, the markets for recycling and/or thermal recovery have to be expanded so that reusable waste can be further pulled in from the waste flow. JICA projects can contribute on this point by promoting the recycling industry, the enhancement of the PPP system, capacity development of local governments as procurement agencies, and in other ways.

3.2 Cooperative Approaches Deemed to be Effective

From the aforementioned possibilities for assistance, countermeasures on the marine plastic litter issue were considered from the policy/regulation/planning, technical, and monitoring aspects, and cooperation

approaches deemed to be effective were examined.

Table 3-1 Countermeasures on the Marine Plastic Litter Issue and Cooperation Approaches

	Countermeasures on Marine Plastic Litter Issue	Yen Loan	Grant Aid	Technical Assistance	PPP	SATREPS	Training in Japan
A	Policy/regulation/planning aspect						
	A.1 By national/local governments • Developing strategies and plans regarding marine plastic Middle- to long-term policy development on the marine plastic issue as a whole, role demarcation of relevant agencies, setting of implementation targets, etc. • Developing policies, regulations and plans regarding plastic products Restriction of material or design, fees on plastic products, rules of material labelling, extension of product lives, improved recyclability, etc. • Developing policies, regulations and plans regarding plastic waste management Promotion and regulation of proper recycling of plastic waste and other waste, role demarcation, target setting, etc.			X		X	X
	A.2 By private sector actors voluntarily • Reducing plastic waste amount Material substitution, weight reduction, curtailment of shopping bag distribution, restrictions on microbeads, prevention of the release of resin pellets, etc. • Collection and recycling of plastic waste Collection of used products containing plastic, design for easy dismantling and separation, voluntary recycling targets, etc.			X		X	X
B	Technical aspect						
	B.1 Production stage • Reducing the use of plastic Material substitution, refillable packaging, light packaging, etc.			X	X	X	X
	B.2 Post-use stage						
	• Preventing plastic litter release into the environment Public education on proper waste discharge, waste collection, development and proper operation of waste treatment and disposal facilities	X	X	X		X	X
	• Recycling plastic waste Efficient and effective collection and separation, technical introduction of mechanical recycling, chemical recycling, energy recovery and heat recovery	X			X	X	X
	• Collection of plastic litter from the environment Collection of drifting and/or waste that has drifted ashore, estimation its generation and accumulation		X	X		X	X
C	Monitoring aspect						
	• Understanding of material flow Quantitative analysis of material input, production, distribution, waste discharge, collection, transportation, treatment and final disposal			X		X	X
	• Understanding of marine plastic Standardization of monitoring methodology, identification of source and pathways, process analysis of secondary microplastic generation, establishment of international monitoring network			X		X	X

PPP: Public-Private Partnership project scheme of JICA
SATREPS: Science and Technology Research Partnership for Sustainable Development

In the table above, “technical assistance” excludes training programs in Japan. Training programs can include all subjects as part of the training curriculum. In this survey, an invitation program is planned and proposals and recommendations for the training program will be reported after the invitation program is implemented. In this report, therefore, JICA cooperation approaches other than training programs are proposed.

A. Policy, Regulation and Planning Aspects

A.1 Assistance for National and Local Governments

National and local governments are expected to promote countermeasures on marine plastic litter by developing policies, regulations and plans. Assistance for this is possible through technical cooperation projects or the dispatch of experts.

Assistance will include the development of policies, strategies, and mid- and long-term plans on the entire issue of marine plastic. In developing these, some other work will be necessary — such as examining the roles of authorities in such fields as the marine environment, waste management, and the plastics industry, as well as understanding the construction of coordinating mechanisms among them and, as a basis for setting targets, clarifying current waste plastic conditions.

The assistance can focus either on matters related to plastic manufacturing or matters related to plastic waste, both of which make up the marine plastic litter issue as a whole. Regarding the former, assistance aims at the development of policies promoting the restriction of materials or designs, fees on plastic products, the development of material labelling rules, the extension of product life and the efficient use of products by placing importance on valuing “sharing” more than “ownership”, and the promotion of design for recycling. Assistance that focuses on the latter will include a policy assistance project on conventional solid waste management with a particular focus on coastal or watershed areas which have a high risk of marine litter generation or a project that aims at the intensive use of waste plastic as a material or energy source.

Further, SATREPS can contribute to decision making and policy designing through its findings in such research fields as the effectiveness and economic feasibility of each technology and the environmental impact assessment of different plastics and plastic alternatives throughout their lifetime.

A.2 Assistance for Voluntary Activities by the Private Sector

The private sector is actively responding to the marine plastic issue, and technical advancements introduced in Section 2.2.6, such as material substitution and package weight saving, have resulted from efforts in the private sector.

Official Development Assistance (ODA) cannot target such private sector activities in a direct manner. Instead, it is possible to assist them indirectly by adding measures that promote private voluntary activities to the policy assistance mentioned in the previous section. In Japan, the “Act on the Promotion of Effective Utilization of Resources” requires manufacturers to reasonably and effectively utilize resources, and based on this the Council for PET Bottle Recycling has been promoting voluntary actions by issuing Voluntary Design Guidelines for Designated PET bottles.

B. Technical Aspects

B.1 Assistance on Measures in the Production Stage

Measures in the production stage are those to minimize the generation of waste plastic in the product upstream, such as material substitution, the introduction of refillable packages, weight saving by improved product design, the avoidance or substitution of microbeads, and the development of synthetic fibers that are resistant to abrasion.

Assistance for the development or introduction of manufacturing technology can be conducted by JICA's PPP scheme, but there is so far only one PPP project of this kind which aims at the introduction of biodegradable plastic. There are, however, many examples of PPP projects in the manufacturing sector, and this rather new area is expected to grow in the future. Backed by an institutional environment improved by the assistance mentioned in Sections A.1 and A.2, PPP assistance will proceed more easily.

Another assistance possibility is SATREPS, whereby new recycling technology will be researched, aiming to utilize its output for social needs.

B.2 Assistance on Measures in the Post-Use Stage

In the post-use stage, countermeasures include the appropriate treatment and disposal of waste plastic to prevent its release into the environment, the maximum utilization of waste plastic as recyclable material, and the collection of waste plastic already released into the environment despite these measures.

The first measure — i.e. the thorough collection and transportation, intermediate treatment as necessary, and appropriate final disposal against plastic litter release — can be assisted by Japanese yen loans, grant aid or technical assistance projects; in fact, a number of similar projects have been implemented in many countries. Specifically, the following has been carried out: the procurement of vehicles for collection and transportation; the development of maintenance workshops, transfer stations and final disposal sites; the enhancement of operation and maintenance systems for these facilities; and public awareness raising to ask for community cooperation, among other things. In the context of marine plastic litter, assistance will be more effective if it is carried out in coastal and/or watershed areas and is associated with activity to monitor plastic waste released into waterbodies before and after the project. Assistance through SATREPS is also possible in order to explore appropriate waste management technologies suitable for local conditions.

Assistance for recycling can be conducted by such schemes as Yen loans or grants, which aim to introduce technologies for effective and efficient waste collection and separation, mechanical recycling, chemical recycling and energy recovery. Technical assistance can also contribute to facilitate the development of facilities or to improve recycling systems. Further, it is possible to apply the PPP scheme to utilize the private sector technologies introduced in Section 2.2.6, or SATREPS, whereby appropriate technology is studied so that it can be practically employed.

As a countermeasure on plastic after it has been used, the prevention of its release into the environment, through treatment and disposal or recycling, is of the foremost importance; however, once it has reached the environment, it must be collected as soon as possible before sedimentation or fragmentation. The procurement of special vessels to collect drifting waste and technical assistance for the formulation of a vessel operation plan for the highly efficient collection of waste — based on information on the actual state of floating waste generation and about sea currents and waves in the target sea area — will be effective.

C. Assistance for Monitoring

Broadly speaking, there are two monitoring targets: plastic that goes through the entire material flow, from production to final disposal, and plastic that is discarded and released into the sea. The former is plastic monitoring on land and the latter plastic monitoring in water.

On-land monitoring is mainly quantitative analysis of the amount of plastic at all stages — including virgin/recovered material input, production, distribution, waste discharge, collection/transportation, treatment and final disposal. There are many stakeholders and the informal sector is heavily involved, so consideration is being given to providing technical assistance that aims to locate data sources, establish a data collection methodology, and to statistically estimate data from sampling surveys. In Japan's "Resource Circulation Strategy for Plastics", the numerical targets are set regarding the reduction of single-use plastic waste or the effective utilization of waste plastic. Quantitative understanding of material flow is important to objectively monitor such targets.

Plastic monitoring in water, however, is an area where methodologies have being still explored. Assistance will be through technical assistance or SATREPS, taking account of areas in which Japan is ahead, such as microplastic monitoring guidelines developed by the Ministry of the Environment Japan and the international information hub to be established with the support of the Ministry.

3.3 Considerations Necessary for Project Formulation

As shown above, assistance on the marine plastic litter issue can be considered by effectively applying cooperation schemes, but some considerations such as those detailed below will be necessary for project formulation.

(1) Selection of Countries Sufficiently Concerned About Marine Plastic

Marine plastic litter is regarded as an issue of international importance, but information regarding its substance and scale is still fragmentary. It is unknown quantitatively or qualitatively what kinds of plastics undergo what pathways to cause what problems.

To manage the issue, on the other hand, countermeasures are required at all stages of the material flow, from production to disposal. Because plastic has become profoundly and widely dispersed in our daily lives, any countermeasure that is taken can potentially influence some part of society in a variety of ways.

For a country to take action against marine plastic, it must set this forth clearly as national policy; moreover, the policy must be supported by the general public. This should be also kept in mind in project formulation, and countries which are seriously concerned with marine plastic should be selected.

(2) The MARINE Initiative of the Japanese Government

Toward the realization of the "Osaka Blue Ocean Vision through which the aim is to reduce additional pollution by marine plastic litter to zero by 2050, and which was shared at the G20 Osaka Summit, the Japanese government has launched the "MARINE Initiative" focusing on (1) **Ma**nagement of wastes, (2) **R**ecovery of marine litter, (3) **In**novation, and (4) **E**mpowerment. Under this initiative, Japan will

support empowerment in developing countries to promote waste management, the recovery of marine litter, and innovation.

The concrete policy measures will be: (1) international cooperation including bilateral ODA and assistance through international organizations; (2) international operations by Japanese companies, NGOs, and local governments; and (3) dissemination and sharing of best practices of the Japanese public and private sectors.

Considering this policy direction of the Japanese government, project formulation is expected to be centered on the four areas of MARINE and to employ not only normal ODA schemes but also the knowledge and experience of private organizations and local governments.

(3) Selection of Appropriate Counterpart Agencies

Measures on the marine plastic litter issue can be implemented any stage — from plastic production to final disposal — so there can also be a variety of governmental agencies responsible for them and a variety of relevant organizations. Therefore, it is important to select appropriate counterpart agencies from among these possibilities prior to project implementation.

In cases where the recipient country has already developed an action plan for marine plastic litter and roles are demarcated for each organization, counterpart selection is relatively straightforward. On the other hand, when there is no action plan and the responsibility to tackle the marine plastic litter issue not has not been clearly assigned, careful consideration is necessary to select the counterpart.

(4) Collaboration and Separation of Work with Other Donors and Private Organizations

Other donor agencies such as UNEP, UNDP and GIZ have already started earlier support programs addressing marine plastic issues. These are mostly regional programs targeting two or more countries, mainly Southeast Asian countries and India. They also tend to put emphasis on institutional aspects of upstream policy matters, with the terms “Circular Economy” or “Blue Economy” as key words.

There are also private organizations which have started assistance by financing or introducing technical knowledge, such as AEPW internationally and JaIME[51] and CLOMA[52] from Japan. International donors have been working with international bodies such as IUCN and WWF and even major manufacturers.

In JICA’s project formulation, the activities of other donors and private organizations should be studied well and confirmed in order to avoid unnecessary duplication. On the other hand, considering the complexity of the marine plastic litter issue in terms of sectors and actors, the effectiveness of the JICA project by itself might not be sufficient and collaboration with other organizations becomes important.

[51] Japan Initiative for Marine Environment. This was established by five organizations, namely the Japan Chemical Industry Association, the Japan Plastics Industry Federation, the Plastic Waste Management Institute, the Japan Petrochemical Industry Association and the Vinyl Environmental Council, from the recognition that the chemical industry has to be strongly committed to taking voluntary actions against marine plastic problems.

[52] Clean Ocean Material Alliance. This new initiative aims to promote the sustainable use of plastic products and the development and introduction of alternatives to plastics, as well as to accelerate innovations as part of an effort to solve issues concerning marine plastic debris. Its members include providers of raw materials and user companies and will strive to engage in such activities as information sharing and collaboration with international organizations.

In addition, although JICA's contribution to manufacturers and distributors is possible only in an indirect manner, if existing activities of Japanese private organizations are coordinated and assistance can be provided by an All-Japan approach, its effectiveness can be increased.

(5) Attention to Plastic or Waste

The marine plastic litter issue is considered a serious and difficult international matter because of the nature of plastic — cheap, stable and easily used in a variety of daily products.

It is reported that 80% of marine plastic originates on land, and that 75% of land-based marine plastic comes from uncollected waste (McKinsey & Company and Ocean Conservancy 2015). In order to prevent plastic waste from reaching the sea, it is necessary to consider waste management as a whole and not just focus on plastic litter. In small and medium-sized cities, suburbs and rural areas in developing countries where a substantial percentage of waste is not properly collected, attention should be carefully given to the influence of uncollected waste on the living environment as an urgent problem to be solved. In other words, measures to improve solid waste management should come first and then the impacts on plastic waste associated with those measures should be reviewed afterward.

Furthermore, when material substitution as an upstream countermeasure is considered, it must be acknowledged that the reduction of plastic use can induce an increase in the use of other materials, and that these will eventually become waste.

Therefore, in project formulation, while it is important to consider its effect on the marine plastic litter issue, attention should also be paid to solid waste management in total.

(6) Countermeasures on Marine-Based Plastic Litter

In this survey, emphasis is placed on land-based plastic litter, regarding which countermeasures and assistance needs are to be examined.

Some causes of marine-based plastic litter are unavoidable, such as bad weather and the entanglement of gear, but others result from intentional actions, like the dumping of damaged gear at sea and the deliberate discarding of gear after it has been used for illegal fishing. Among these, dumping gear at sea is caused in part by a lack of waste receiving facilities at ports. Easily accessible reception facilities are also important to encourage fishers to bring waste caught in fishing nets back to ports.

Although countermeasures on marine-based plastic litter are outside the scope of this survey, it should be noted that there are important land-based countermeasures on marine-based plastic litter.

3.4 Technologies of Japanese Firms Expected to Be Utilized

(1) Material Substitution Technology

Plastic material substitution is an attempt to avoid, from the manufacturing stage, things that can become waste plastic after use. It is of rather great interest in developing countries, where plastic waste management is insufficient. There is a great need for plastic alternatives in countries and cities where

there are strict laws and regulations to control single-use plastics[53], such as plastic bags and straws, or there are many private distribution companies that have policies to reduce single-use plastics. In addition, when composting is promoted to respond to the increase in waste due to urbanization, a demand for biodegradable bags for organic waste discharge is expected[54].

On the other hand, the development of alternative materials is thriving in many countries, including developing countries, and severe price competition is inevitable.

Among alternative materials, plastic which is biodegradable even in the sea has high additional value. "OK biodegradable MARINE"[55] is a certificate of marine biodegradable plastic granted by a certification body in Austria. Only four companies have this certificate, one of which is a Japanese company. The standards of marine biodegradability are currently being developed by the International Organization for Standardization (ISO). Japanese organizations, including the Ministry of Trade and Industry, research institutes and private organizations, are working together to propose evaluation methodologies. Through such activities, Japan will gain an advantage from its superior marine biodegradable technologies, resulting in the promotion of business development overseas.

(2) Reduction of Plastic Use/Design for Recycling

Japanese manufacturers of plastic products or distributors of products that use plastic packages are making continuous efforts to develop technologies to reduce the thickness of packages while maintaining their strength, or to improve product design with higher recyclability.

In order to comply with recycling-related laws such as the "Law for the Promotion of Effective Utilization of Resources", the "Home Appliance Recycling Law" and "Containers and Packaging Recycling Law", private organizations of relevant sectors in Japan play a central role in developing voluntary guidelines for recycling promotion[56]. The development of designs for material-saving or recycling is largely attributed to the voluntary efforts of each company, with the background being recent widespread social expectations held toward companies in terms of the environment, society and governance (ESG).

The technologies of each company can be utilized. Further, the institutional arrangements that have encouraged the private sector's efforts are worth introducing through overseas assistance.

(3) Collection/Segregation/Shredding/Compression

This process influences the value of waste plastic as recyclable material. How effectively and efficiently collection and separation can be done, however, largely depends on the regulations and actual

[53] For example, Malaysia adopted the "Roadmap towards Zero Single-Use Plastics" in January 2019. In order to implement the roadmap, the use of biodegradable plastics is encouraged as one of the major approaches.

[54] There are cases where compost, which is the product of organic waste compositing out of municipal waste, contain microplastics (Woods End Laboratories & Eco-Cycle, 2018, as an example). Biodegradable plastic bags are useful when organic waste has to be separately discharged for a purpose of composting, but this has to be associated with a measure to exclude ordinal plastic products.

[55] See footnote 19.

[56] Examples include "PET Bottles Voluntary Design Guidelines" by the Council for PET Bottle Recycling, "Guidelines for Labelling and Recycle Symbols of Plastic Parts used in Electric Home Appliances" and "Electric Home Appliance Assessment Manual" by the Assosiation for Electric Home Appliances.

performance of local solid waste management. Moreover, the labor force is cheap in developing countries; consequently, it might be difficult for Japanese companies to demonstrate their technical advantages.

Nevertheless, the aforementioned compression technology for foamed polystyrene can be attractive. In terms of volume, 98% of foamed polystyrene is air, and the amount of resin per unit volume is very low. This means very low transportation efficiency if it is transported as is. If volume is compressed to one-fiftieth of what it was, the value per unit volume increases by 50 times and trade opportunities will greatly increase. It is to be noted, however, there may be no market to trade foamed polystyrene in some cities and, in such cases, it will be necessary to develop the market.

(4) Recycling

1) Mechanical Recycling

Mechanical recycling is mostly cascade recycling, where recycled plastic is of lower quality than the waste plastic used as material. Developing countries tend to make products that have lower quality but still have economic value as a result of accepting incomplete separation and the presence of impurities in plastics, rather than spending time and money for pre-treatment. To the extent that there is market demand for such low-quality recycled products, recycling can be sustained, but this type of recycling is in most cases "one-and-done" — that is, the recycled products must go to a final disposal site or energy recovery facilities after they have been used.

In the case of horizontal recycling, a large amount of energy and careful plastic segregation is required. Although cost is a problem, it is thought that even in cascade recycling it is desirable for there to be, as much as possible, recycling that does not reduce quality, and for technology that approaches horizontal recycling.

It is to be noted, however, that in countries like Thailand, where recycled plastic is not allowed in the production of containers and packages for food and beverages, the first thing required is the development of a system that promotes recycling and guarantees food safety.

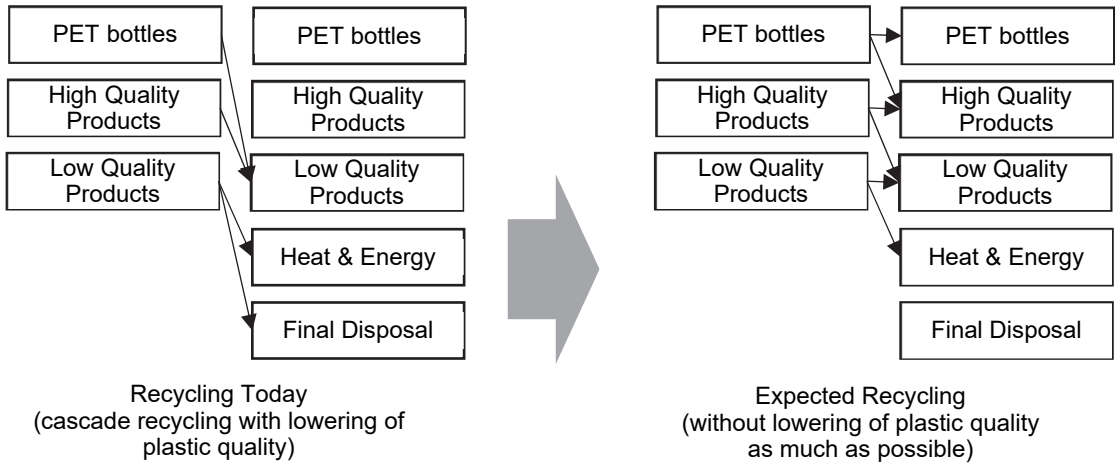


Figure 3-2 Expected Transition of Mechanical Recycling

(Figure taken from Fujii et.al. (2009) and modified)

2) Chemical Recycling

The demand for chemical recycling depends on the situation of industry in the concerned countries or cities (such as the existence of blast furnaces or chemical industry factories). If there is a demand from such industries, the technology of Japan will have advantages in the quality control of waste plastic, chlorine removal from waste plastic, and the effective utilization of slag as a by-product of recycling.

3) Densified Fuel*/Cement Material and Fuel

Waste-to-energy (WtE) business using RDF has become popular in developing countries such as Thailand, supported by the establishment of a FIT. Since waste plastic, once separated from general waste, has monetary value in developing countries, it is important to recognize that the baseline for business feasibility is different from that in Japan. The key issue is how the necessary amount of good quality waste plastic is secured. This is, actually, also the case for mechanical recycling or chemical recycling.

An example of a local business initiated using the JICA PPP scheme is a fluff fuel producing facility in the Philippines. The production costs are lower for fluff fuel compared to RDF. In addition, the facility also includes a process for separating plastic from general waste transported to the final disposal site, which is a factor contributing to its success.

4) Incineration with Power Generation

Incineration with power generation is the core technology for solid waste management in Japan. Moreover, it has already been introduced not only domestically but also internationally, in Asia and Europe. It has the highest level of technology in the world, as it can accept waste from developing countries that typically has high water content, and it ensures a stable and environmentally-friendly operation.

On the other hand, it is often pointed out that Japanese incineration facilities with power generation are expensive and do not match the actual conditions of developing countries. Cost reduction is a major issue. One point to be considered in reducing costs is the difference between site conditions in Japan and overseas. As far as the information collected regarding incineration facilities during the visit to the four countries in this study is concerned, in cities where urbanization has progressed to the point where incineration is necessary, the acquisition of land for incineration facilities requires great social costs and, in most cases, incineration facilities are constructed on the site of existing final disposal sites. This is very different from the case in Japan, where they are built even in residential areas. As a result, it is common in Japan for facility operators to set emission standards to be stricter than those set by the law or local ordinances, and to harmonize the exterior of the facility buildings with the surrounding city landscape as much as possible. Construction costs can be reduced by simplifying pollution control equipment or eliminating building structures from specifications depending on local conditions.

(5) Collection, Measurement and Monitoring of Marine Plastic

The collection of marine plastic means physically catching and removing it from the sea. Japan does not have any particular technical advantage in this regard.

On the other hand, as for the behavior of floating waste and the measurement of the amount of waste that has drifted ashore, research that uses the results of weather and ocean information analysis and imagery information taken by drones and satellites is progressing. Based on such marine plastic measurement and simulation technology, the collection of floating waste can be more efficient.

As already mentioned, Japan already has substantial experience in the measurement and monitoring of microplastics, and there is considerable storage of data and information on microplastics in the ocean near Japan. The dissemination of Japanese measurement and monitoring technology not only satisfies information needs overseas, but also has the effect of accelerating the accumulation and networking of data obtained by standardized methods.

Chapter 4 Organization of Information for the Examination of Assistance for Priority Countries

4.1 Selection of Priority Countries

Interim Report 1 showed the estimated generation amount of marine plastic litter by country (Jambeck, et al. 2015). It is shown again below.

Table 4-1 Plastic Litter Generation Amount by Country

Country	Urban Waste Generation Rate (kg/day/capita)	Middle[*1] (Million tons/year in 2010)	Share
China	1.1	2.43	28%
Indonesia	0.52	0.88	10%
Philippines	0.5	0.52	6%
Vietnam	0.79	0.50	6%
Sri Lanka	5.1	0.44	5%
Thailand	1.2	0.28	3%
Egypt	1.37	0.27	3%
Malaysia	1.52	0.26	3%
Nigeria	0.79	0.23	3%
Bangladesh	0.43	0.22	2%
World Total		8.76	100%

For the following reasons, the countries ranked higher in this table are considered priority countries for assistance.

- The figures and ranks shown by Jambeck, et al. 2015 are presented in almost all reports of international and/or donor agencies, background documents of their projects, newspaper articles and other sources.
- Therefore, international or donor organizations are active in the countries ranked higher on the list and governmental agencies and private companies of those countries are also very concerned about the marine plastic litter issue.
- Individual numbers used in estimation are debatable, but there are no other data or estimates of marine plastic generation by country.
- The calculation methodology (coastal population x waste generation rate x plastic composition rate x unmanaged waste rate x marine release rate) is reasonable.

As for Sri Lanka, however, the waste generation rate used for it in the calculation is abnormally high. Consequently, Indonesia, the Philippines, and Thailand have been selected as priority countries for Japan's ODA.

4.2 Measures Taken in Priority Countries

4.2.1 Indonesia

(1) Policy and Organizations Related to the Marine Plastic Litter Issue

At the World Ocean Summit held in Bali in 2017, the Minister of the Coordinating Ministry of Maritime Affairs (CMMA)[57] declared its commitment to a 70% reduction in marine litter by 2025, which was followed by a Presidential Decree on marine litter management (No. 83 from 2018)[58] in response to this commitment.

This Presidential Decree first presents the National Plan of Action for 2018 to 2025, to reduce marine litter, in particular plastic waste[59]. The action plan consists of the strategies and programs shown in Table 4-2. There are five strategies covering all ranges of the marine litter issue, including awareness raising, management of waste from land and ocean, the implementation environment such as for financing and legislation, and research and development.

Table 4-2 Strategies and Programs of Marine Litter National Plan of Action

Strategies	Programs
First Strategy. National Movement on Enhancement of Stakeholders Awareness	Program 1: Enhancement of Community Awareness
	Program 2: National Movement on Marine Debris Awareness through Education for Civil Servants, Students, College Students, and Educators
Second Strategy. Management of Waste Originated from the Land	Program 1: Control of Waste on River Flow Area
	Program 2: Control of Plastic Waste from Upstream Industrial Sector
	Program 3: Control of Plastic Waste from Downstream Industry Sector
Third Strategy. Management of Waste On Coast and Ocean	Program 1: Management of Plastic Waste Originated from Sea Transportation Activity
	Program 2: Management of Plastic Waste Originated from Activity on Marine Tourism Area
	Program 3: Management of Plastic Waste Originated from Maritime and Fisheries Activities
	Program 4: Management of Waste Originated from Coastal and Small Islands Activities
Fourth Strategy. Management of Funding, Institution Strengthening, Monitoring, and Law Enforcement	Program 1: Diversification on Funding Scheme Outside of State Budget/Regional Budget
	Program 2: Strengthening Institutions
	Program 3: Increasing the Effectiveness of Monitoring and Implementation of Law Enforcement
Fifth Strategy. Research and Development	Program 1: Promoting Management Innovation and Overcoming Marine Debris Pollution through Research and Development

[57] Renamed the Coordinating Ministry of Maritime Affairs and Investment upon the formation of the new governmental administration in 2019.

[58] https://peraturan.bpk.go.id/Home/Details/94716/perpres-no-83-tahun-2018

[59] It is to be noted that at the annual meeting of World Economic Forum in Davos in January 2020, the Government of Indonesia announced its action plan, which consists of 5 components namely, i) Reduce or substitute plastic usage, ii) Redesign plastic products and packaging with reuse or recycling in mind, iii) Double plastic waste collection to 80% by 2025, iv) Double the current recycling capacity and v) Build or expand safe waste disposal facilities. It further stated that it would publicize more details of this action plan in March 2020. The relationship between this action plan and the one issued by the Presidential Decree is not clear.

Further, for the realization of this action plan, the decree set up a "Marine Litter Management National Coordination Team". The team is chaired by CMMA, with MOEF as the secretariat and other members from sixteen ministries and agencies. The team holds a coordinating committee regularly and at the committee on December 13, 2019, the research result of baseline figures of marine plastic amount discharged by Indonesia was reported by NPAP[60], the World Bank and Indonesian Institute of Sciences. The committee concluded that the baseline is to set between 0.27 million ton/year and 0.59 million ton/year.

Each member organization of the team is assigned to coordinate 59 activities as shown in Table 4-3 under the programs.

Table 4-3 Activities of the Marine Litter Action Plan and Coordinating Bodies

Coordinating Body	No.	Activities	Strategy No.	Program No.
Ministry of Industry (MOI)	1	Organize national socialization movement on the usage of plastic that is good for health and environment, decomposes easily, and can be recycled	1	1
	2	Perform socialization on utilization of waste management technology	1	1
	3	Organize technical guidance on choosing plastic waste as raw material for plastic recycling industry	1	1
	4	Organize campaign on roles of plastic industry and plastic that is good for health and environment, decompose easily, and can be recycled to reduce plastic waste generation	1	1
	5	Encourage upstream industry to produce plastic polymer material that decomposes easily and can be recycled (biodegradable plastic)	2	2
	6	Compilation of a review on incentives for biodegradable plastic industry	2	2
	7	Compilation of a Good Manufacturing Process (GMP) guideline for biodegradable plastic products	2	2
	8	Construction of a prototype for a Waste-to-Energy (WtE) Power Plant	2	2
	9	Construction of a waste utilization unit that convert plastic into oil fuel	2	2
	10	Provision of plastic waste recycle tools or equipment	2	3
	11	Compose profile of producers and stocks of recycle chopped plastic	2	3
	12	Compose review of plastic recycling industry spread to tourist destinations	2	3
	13	Encouraging growth of recycling industry	2	3
	14	Encourage downstream industry to produce biodegradable and recyclable plastic	2	3
	15	Compilation of Indonesia National Standard (INS) regulation for bio-degradable plastic	4	3
	16	Compilation of review of plastic recycling industry spread to marine tourist destination areas	5	1
	17	Compilation of INS biodegradable plastic products	5	1
Ministry of Transport	18	Perform monitoring and implementation of Ministerial Regulation of Minister of Transportation Affair Number 29 of 2014	3	1
	19	Construction of reception facility and infrastructure at every public harbor/port	3	1
	20	Implementation of International Environmental Management Certification ISO 14001 for solid-waste and waste management at every public port	3	1
	21	Socialization of waste management procedure for passengers by ship crew when ships are going to sail	3	1

[60] See 2.2.8 (2).

	22	Awareness raising of waste disposal procedures to port organizers and stakeholders	3	1
	23	Compilation of Standard Operating Procedures (SOP) on management of waste from activities in marine tourism areas	3	2
	24	Implementation of SOP on management of waste from activities in marine tourism areas	3	2
	25	Establishment of waste management unit in marine tourist destination areas	4	2
	26	Presentation of rewards and penalties to regional governments, organizers, and communities for compliance and violation of SOP on waste management in marine tourism destination areas	4	3
Ministry of Maritime and Fisheries Affairs	27	Organize “Indonesian Maritime School” Program	1	1
	28	Waste control in river estuaries	2	1
	29	Construction of waste handling facility and infrastructure at every public Ocean Fishing Port (OFP) and National Fishing Port (NFP)	3	1
	30	Implementation of ISO 14000 Certification for solid-waste and waste management at every OFP and NFP	3	1
	31	Compilation of SOP on eco-friendly fish catching activities	3	3
	32	Compilation of SOP on eco-friendly fish farming activities	3	3
	33	Construction of Temporary Collection Site (TCS) or Recycle Center facilities on small outer-islands	3	4
	34	Organize National Movement on Cleaning Beaches and Seas	3	4
	35	Research on marine debris pollution and its effect	5	1
Ministry of Environment and Forestry (MOEF)	36	Organize a national socialization movement on the negative effect of waste on the ocean, especially plastic, for health and the ecosystem, also socialization regarding integrated waste management	1	1
	37	Organize training on sorting and utilization of plastic waste	1	1
	38	Form a collaboration program with the private sector, mass media, community groups, and traditional/religious institutions	1	1
	39	Give awards to the private sector, mass media, community groups, and traditional/religious institutions, related to innovation and/or pioneering activity on management of waste recycling including plastic	1	1
	40	Increase the amount of utilized plastic waste	2	2
	41	Formulate Ministerial Regulation of the Minister of Environment and Forestry on Road Map for Waste Reduction by Producers	2	3
Ministry of Public Works and Housing (MPWH)	42	Provision of waste collection infrastructure on rivers	2	1
	43	Management of waste including plastic waste in regencies/cities	2	1
	44	Increase of plastic waste usage as additional material (additive) on road construction (Plastic Asphalt Utilization Activity)	2	3
	45	Construction of plastic waste management facility and infrastructure in marine tourism area	3	2
Coordinating Ministry of Maritime Affairs (CMMA)	46	Cooperate with related ministries/institutions to organize Environment and Clean Awareness Program	1	2
	47	Organize joint-action on cleaning plastic waste in coastal and small islands	3	4
	48	Encouragement of plastic waste management funding scheme through Public Private Partnership (PPP), Corporate Social Responsibility (CSR), community fund, and other legal funding sources in compliances with the applicable regulations	4	1
	49	Construction of integrated information system for marine debris monitoring and prevention	5	1
Indonesia Maritime Security Agency	50	Increase of coordinated actions on violations related to marine debris	4	3
Ministry of Foreign Affairs	51	Management of cross-border marine plastic waste	3	4

Ministry of Education and Culture	52	Implementation of education for preschool and school children on culture/behavior about clean and healthy living and environmental awareness	1	2
Ministry of Research, Technology and Higher Education	53	Encourage the invention of plastic replacement material with eco-friendly material	5	1
BAPPENAS	54	Encourage executive (central and regional) commitment to prioritize budget allocation on plastic waste management sector	4	2
Ministry of Finance	55	Compose regulations regarding plastic tax	2	2
Ministry of Communication and Informatics	56	National movement campaign for marine debris awareness, especially of plastic waste, through mass and electronic media, social media, and other communications media	1	1
Ministry of Home Affairs	57	Implementation of general guidance at the regional level related to plastic waste management	4	2
Ministry of Health	58	Review on the effect of micro and nano plastic on the human body	5	1

Source: Presidential Decree concerning National Plan of Action (No. 83, 2018). The number from 1 to 58 are put for convenience.

The ministry assigned the largest number of activities is MOI, which coordinates activities such as material substitution, waste management, and plastic waste recycling, all of which are related to plastic manufacturers or plastic treatment companies under its jurisdiction. The next largest number are those assigned to the Ministry of Transport, which supervises ports, and the Ministry of Maritime and Fishery Affairs, which coordinates activities for fishery and island areas, with nine activities assigned respectively. MOEF is responsible for activities for public awareness raising regarding the marine litter issue, MPWH for infrastructure development for marine litter management and plastic litter utilization for road construction, and CMMA for awareness raising among national authorities and for overall monitoring of marine litter management.

According to the Decree, the implementation report of the action plan must be submitted to the President at least once a year, although it has not yet been done as of July 2019 and it was not available during the second visit in December 2019. With financial support from the Norwegian government, UNDP is assisting in cost calculation for each activity in the action plan, based on which allocation of national or local budgets and requests for foreign aid will be examined.

Further, the “Fourth Intergovernmental Review Meeting on the Implementation of the Global Programme of Action for the Protection of the Marine Environment from Land-based Activities (GPA)” was held in October 2018 in Bali and the Bali Declaration was issued. This led to the establishment of a “Regional Capacity Center for Clean Seas” (RC3S) in Bali by MOEF in March 2019. RC3S is in the MOEF’s regional office in Bali, but from the institutional point of view, it is under the Directorate of Coastal and Marine Pollution and Degradation Control of MOEF and its Director also acts as the Executive Director of RC3S. The heads of three divisions and one of the secretary staff have been appointed.

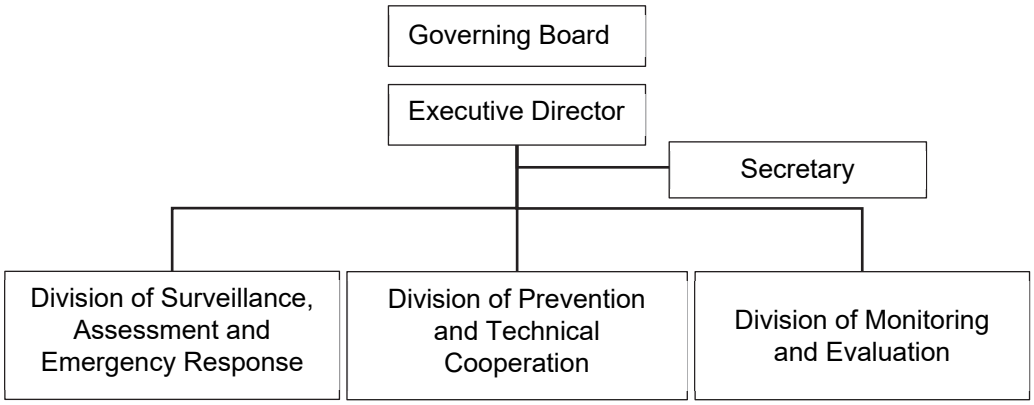


Figure 4-1 Organizational Structure of RC3S

The purpose of the RC3S is to contribute to the reduction of land-based impacts by the humans on the ocean with a particular focuses on nutrients, wastewater and plastic litter and its activities include huma resource development, stakeholder networking, collaboration development and information sharing. Since its inauguration, it has already organized training sessions and workshops several times in collaboration with international organizations. The main area of its activity at present is monitoring, although it does not have laboratory functions and contracts out water analysis to universities. Their current concern is how to empower their activities and raise its popularity so that the role of RC3S is widely and clearly understood in international society.[61]

As for the public-private partnership, Indonesia Partnership for Plastic Waste Management (IP2WM) has been established with an initiative of the private sector prior to the NPAP. Its members compose several taskforces, which are planning to carry out the development of circular economy model cities, public awareness raising and technical innovation.

(2) Situation of Plastic Litter Reduction

The “Waste Management Act of 2008” states that waste is to be managed by reduction and handling. The Act further states that reduction consists of generation limitation, reuse and recycling. Under the Act, MOEF issued its Minister’s Decree No.75 Year 2019 regarding waste reduction roadmap for manufacturers, as shown No.41 of Table 4-3. Manufacturers here include not simply manufacturers but also food and beverage industries and retailing industry, and the decree aims to have those industries reduce waste of packaging and container made of aluminum, plastic, glass and paper by 30% by 2029. How to practically implement this roadmap is the new challenge.

On the other hand, MOEF issued a request in 2016 to relevant sectors to avoid the free provision of single-use plastics to their customers. In response, there is a working group with members from fifteen major retailers in the Retailers Association (known as APRINDO) that shares the basic idea that single-use plastic should not be provided free of charge without customer request, often charging for shopping bags (usually 200 rupiah per bag). Although some companies have their own target figures and monitor achievement of these targets, neither the working group nor the association have overall targets, nor do

[61] From interview with MOEF on December 13, 2019.

they collect data on achievement from members. Moreover, the extent to which plastic waste has been reduced is not known.

In addition, there are local governments that restrict the use of plastic bags through local regulations. According to MOEF, plastic bags are regulated in one province, twelve cities and one regency.

Measures in the manufacturing industry include the development of tasteless and odorless packaging materials that are made from seaweed, and the development of PET bottles which have information embossed on the bottles without plastic labels.

(3) Situation of Plastic Litter Recycling Promotion

Municipal waste recycling, including plastic litter recycling, has depended on informal waste collection. In addition, formal collection, through waste banks and material recovery facilities, has become widespread.

In order to promote waste bank activities, MOEF issued guidelines for waste bank operation as Minister Decree No. 12, 2013. According to MOEF's database, there are as many as 5,475 waste banks. Some of these are quite active, with the support of local governments and/or through the introduction of a system in which recyclable waste can be used as payment for electricity or insurance.

As for material recovery facilities, intermediate treatment facilities have been introduced in many cities and regencies, which segregate recyclable waste and, in some cases, add some processing such as crushing and make compost from organic waste.

Furthermore, now that the waste reduction roadmap for manufacturers was enacted as the Ministerial Decree, the manufacturers regulated by the decree are expected to promote plastic recycling as a means of achieving 30% reduction of packaging wastes.

(4) Measures to Prevent the Release of Plastic Litter into the Ocean

Since the blockage of rivers and waterways is one of the main causes of flooding, waste removal from rivers and waterways has been carried out by local governments. In most cases, the implementation body is the department related to public works or waste management, depending on the local government. Waste traps which stop river waste are used by some local governments. The World Bank (2018) reports that these traps have been introduced in some rivers in Jakarta Province, while there are no traps in Balikpapan City or Manado City.

In the National Plan of Action, the introduction of facilities to catch floating waste in thirty major rivers is planned as Activity 42 in Table 4-3.

As part of the cleanup activities of the Citarum River, MPWH has a plan to install incineration facilities along it which treat river waste containing a lot of plastic matters provided that an appropriate incinerator is selected[62].

[62] From interview with MPWH on December 12, 2019.

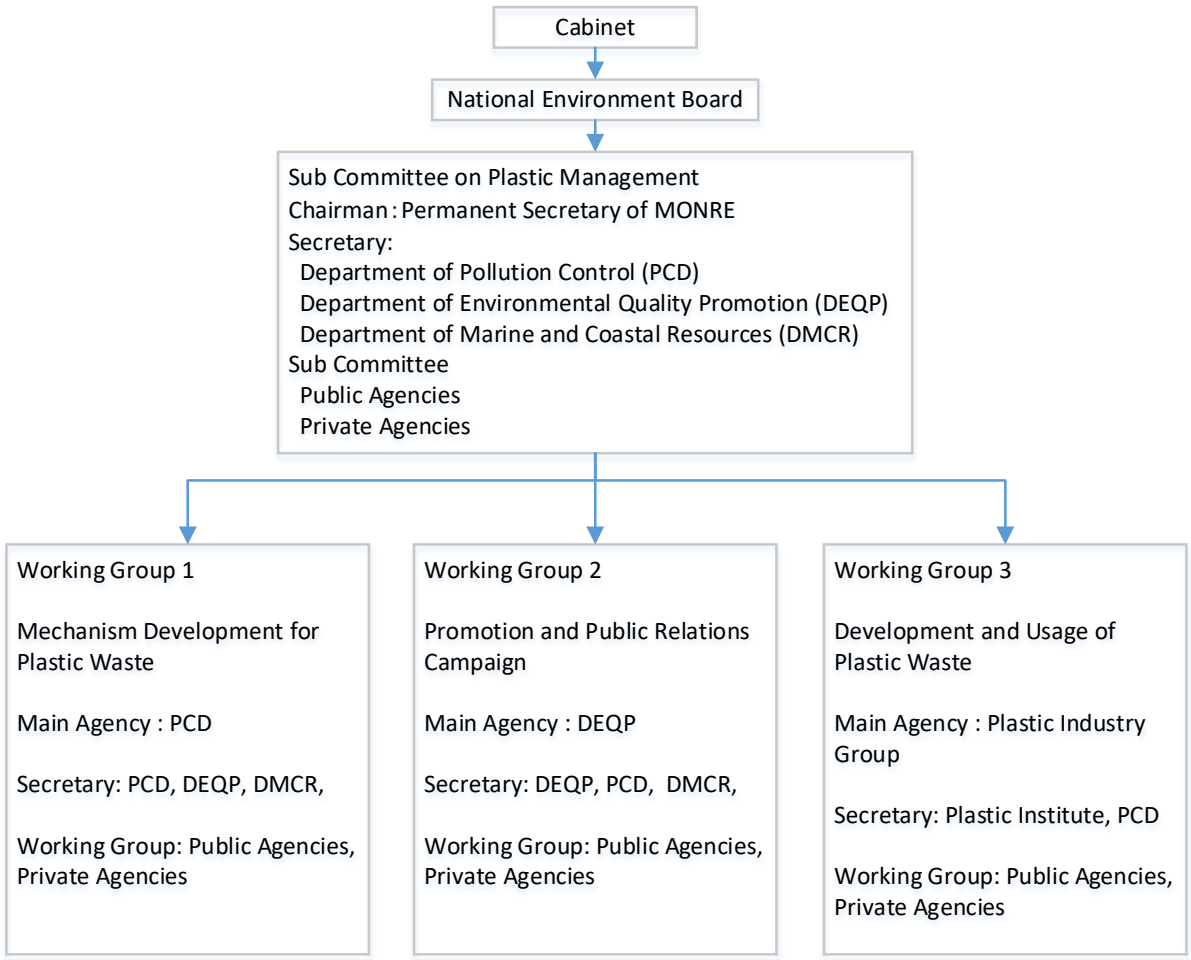
4.2.2 Thailand

(1) Policy and Organizations Related to the Marine Plastic Litter Issue

In Thailand, at a cabinet meeting on April 17, 2018, the Minister of Natural Resources and Environment and related ministers resolved to address the issue of plastic waste and work to protect the environment. In response to this, the Ministry of Natural Resources and Environment (MONRE) established sub-committees on plastic waste management under the National Environment Board, with the MONRE Secretary General appointed as the chairperson, and the Department of Pollution Control (PCD), Department of Environmental Quality Promotion (DEQP) and Department of Marine Coastal Resources (DCMR) appointed as Secretariats.

Three working groups were formed under the Plastic Waste Management Sub-committee. PCD became the main agency for mechanism development for plastic waste in Working Group 1, DEQP became the main agency for the promotion and public relations campaign in Working Group 2, and the Plastic Industry Group became the main agency for Working Group 3, on the development and usage of plastic waste.

Table 4-4 Structure of the Committee and Working Groups on Plastic Waste



PCD, as the main agency for Working Group 1, formulated the "Roadmap on Plastic Waste Management 2018-2030". This roadmap was submitted to the National Environment Board and approved, then submitted to the Cabinet in January 8, 2019 and approved in April 2019.

Target 1 of this roadmap sets a goal of banning the use of three types of plastics by 2019 and four types of plastics by 2021. Target 2 aims at 100% recycling (including energy recovery) of specific waste plastics by 2027, and will advance technological development for that purpose.

Table 4-5 Thailand's Roadmap on Plastic Waste Management 2018-2030

Vision	Moving Towards Sustainable Plastic Management by Circular Economy
Objective	To be used as a framework and direction for the protection of the environment and to solve the problems of plastic waste management, with cooperation from all parties, including the public and private sectors and citizens.
Target	The "Roadmap on Plastic Waste Management 2018-2030" is in accordance with the UN's Sustainable Development Goals, especially target No. 14 — "Conserve and sustainably use the oceans, seas and marine resources" — comprising the two following targets.
Target 1	Reduce or prohibit the use of target plastics by replacing them with environmentally-friendly use material as follows: - Prohibit by 2019 for three types: 1) cap seals; 2) oxo-biodegradable plastics; and 3) microbeads - Prohibit by 2021 for four types: 1) plastic bags with thickness less than 36 microns; 2) foam food containers; 3) plastic cups (single-use); and 4) plastic straws
Target 2	Targeted plastic wastes can be recycled 100% by year 2027. This target will be studied and target plastics identified for recycling, and waste will be managed correctly by incineration for waste-to-energy.

The action plan for the implementation of the above roadmap has been prepared by the PCD, and as of August 2019 it had been submitted to the National Economic and Social Development Agency (NESDC) for discussion. The PCD was aiming for approval by the end of the fiscal year (September 2019), but a delay was expected due to the formation of the Cabinet.

(2) Situation of Plastic Litter Reduction

In Thailand, the "National Solid Waste Management Master Plan (2016-2021)" was formulated as a basic plan for solid waste management and approved by the Cabinet in May 2016. In this master plan, the basic concepts include 1) the promotion of waste reduction at the source under the concept of 3R, 2) the proper handling of generated waste, and 3) the participation of all organizations related to waste management.

The goals of the master plan include numerical targets such as the proportion of properly treated waste and the proportion of hazardous waste that is separated. In order to further enhance the effectiveness of this master plan, the Thailand Zero Waste Action Plan was issued in 2016 and the Clean Province Action Plan in 2017.

For plastic waste, the roadmap estimates that the annual amount of plastic waste generated is 1.93 million tons, of which 0.39 million tons (20.2%) is recycled and 1.54 million tons (79.8%) is final disposal and/or unknown. The roadmap also sets a goal of reducing 0.78 million tons (40%) of waste plastic by 2030.

On the other hand, with regard to municipal solid waste, according to the data collected in 2018, out of 27.8 million tons/year generated, 34% is reused and recycled, 39% is proper final disposal, and 27% is improper final disposal. The amount of plastic waste generated is 2 million tons/year[63].

(3) Situation of Plastic Litter Recycling Promotion

Informal collection was mainly relied upon not only for plastic waste, but also for recycling general waste, but formal collection is also being carried out in various places through the above measures. In the Bangkok metropolitan area, the former Onnut final disposal site is used as a transfer station, and a large-scale compost plant (1,700 tons/day) is operating to reduce the final disposal amount. There is a sorting line for pretreatment, and workers in the informal sector are employed to separate aluminum cans, PET bottles, metal, and other things from the mixed waste.

In addition, under the "Alternative Energy Development Plan (2015-2036)", general and industrial wastes are positioned as bioenergy sources and a waste-to-energy plant is also being promoted. Against this backdrop, RPF is also being used as fuel for the WtE plant and raw material for a cement plant.

(4) Measures to Prevent the Release of Plastic Litter into the Ocean

Since the blockage of rivers and canals is one of the main causes of flooding, waste in rivers and waterways has been removed by local governments. In the case of the Bangkok Metropolitan Area (BMA), 198 pump stations are installed in 1600 waterways, and river waste is driven onto a screen using water level difference to collect the waste. It is important not to discharge waste into the water area, but there are still many people living on the water and areas where waste and sewage are discarded in the river.

Debris is regularly cleaned out of large-scale rivers such as the Chao Phraya River, which are managed by the Bangkok Department of Environment, and from small drainage canals, which are managed by the Department of Drainage and Sewerage Department of the BMA.

Composition analysis of waste that has flowed into waterways has also been conducted. In the BMA in 2018, 5,200 tons of waste was collected from waterways, of which 50% was aquatic plants, 7% was municipal waste containing plastics, and 3% was timber.

4.2.3 Vietnam

(1) Policy and Organizations Related to the Marine Plastic Litter Issue

In Vietnam, the Ministry of Natural Resources and Environment (MONRE) was responsible for overall regulation, the Ministry of Construction (MOC) for municipal solid waste in terms of implementation, MONRE for hazardous waste, the Ministry of Health for medical waste, and the Ministry of Agriculture and Rural Development for agricultural waste. This division of responsibility had been causing confusion and inefficiency.

[63] Booklet on Thailand State of Pollution 2018, PCD, 2018

In practice, the shortage of final disposal capacity is one of the largest concerns. The Nam Son final disposal site in Hanoi Capital receives 5,000-6,000 tons of waste every day and it is difficult to secure enough space for future disposal.

Considering such administrative and practical problems, Prime Minister's Resolution No. 9 (NQ-CP dated March 2, 2019) was issued in February 2019. It states that MONRE is the main organization for administering solid waste management as a whole. At MONRE, the Vietnam Environment Agency (VEA) is in charge of land-based solid waste, while the Vietnam Administration of Sea and Islands (VASI) is in charge of solid waste in the ocean and coastal area. The same applies to plastic litter: land-based plastic waste is under VEA, while sea-based plastic waste under VASI. The following is the organization chart for MONRE.

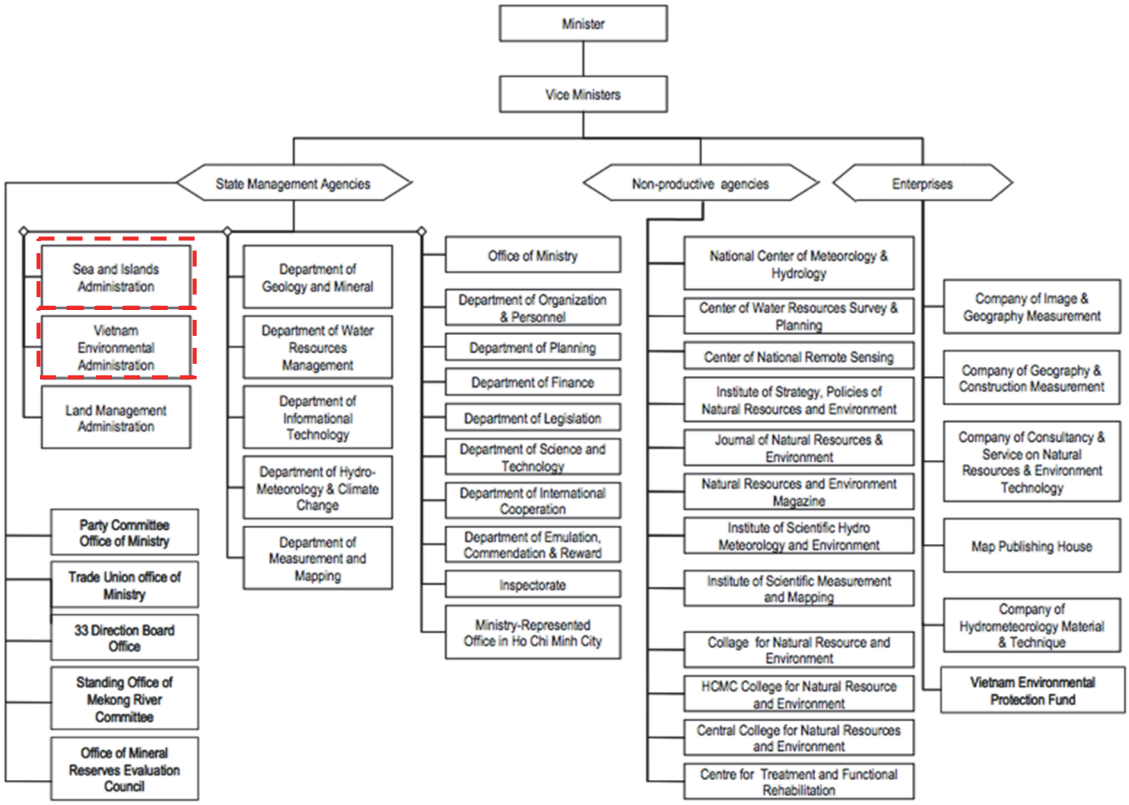


Figure 4-2 Organization Structure of MONRE, Vietnam

At the Sixth Assembly of the Global Environment Facility held in Da Nang in June 2018, MONRE declared its intention to be a pioneer in marine plastic litter reduction and knowledge sharing. Also in June 2019, the Prime Minister stated that the government would work on marine plastic reduction and that national and local government agencies, the private sector, and the general public should work together to tackle the marine plastic litter issue.

VASI, with support from the Canadian government, developed a "National Action Plan on Marine Plastic Debris" and submitted its first draft to the Prime Minister in early 2019[64]. After the Osaka G20 summit, the Prime Minister asked VASI to reinforce the content of the Action Plan at the time of the

[64] From an interview with UNDP on August 1, 2019.

field survey in August 2019, VASI was updating it with consultants hired by UNDP, aiming to finalize it by the end of 2019 and publicize it in June 2020[65].

On the other hand, VEA, which is responsible for land-based waste management, had to develop a "National Action Program on Plastics" by the end of 2019 and submit it to the Prime Minister[66]. VEA started to work on the program in August 2019 and was exploring study methodology, including a method for obtaining numerical data[67].

In December 2019, the Prime Minister's Decision No.1746 regarding the National Action Plan on the Management of Ocean Plastic Waste toward 2030 was issued, although it is not known whether this decision was the result of the integration of VASI's revision of the action plan and VEA's attempt of action program development. The targets, planned tasks and implementation bodies stipulated in the Presidential Decision are shown below.

Table 4-6. Targets in the National Action Plan on the Management of Ocean Plastic Waste of Vietnam

Item	2025	2030
Reduction of plastic waste in the ocean	50%	75%
Collection of lost or discarded fishing equipment	50%	100%
Tourist service places in coastal areas not using disposable plastic products and persistent plastic bags	80%	100%
Campaigns to clean beaches nationwide	Twice a year	-
Marine conservation areas free of plastic waste	80%	100%

Table 4-7. Tasks and Main Implementation Organizations in the National Action Plan on the Management of Ocean Plastic Waste of Vietnam

Planned Tasks	Main Implementation Organizations
1. Propagating, raising awareness, changing behavior and the way to handle with plastic products and ocean plastic waste	MONRE, Ministry of Information and Communication, Mass Media (Voice of Vietnam, Vietnam Television, and other governmental agencies), People's Committees in the coastal areas.
1. Collecting, separating, storing, transporting and treating of plastic waste and waste generated from activities in coastal area and on the sea.	People's Committees in the coastal areas, MONRE
2. Controlling plastic waste at source	Ministry of Culture, Sports and Tourism, Ministry of Industry and Trade, Ministry of Agriculture and Rural Development, MONRE
3. International cooperation, research, application, development, transfer treatment technology for ocean plastic waste	MONRE, Ministry of Foreign Affairs
4. Investigating, surveying, reviewing, researching for the development of ocean plastic waste management mechanism to ensure the consistency, uniformity, effectiveness and efficiency	MONRE, Ministry of Agriculture and Rural Development, Ministry of Transportation

[65] From an interview with VASI on July 31, 2019.
[66] From an interview with VEA on July 31, 2019.
[67] MOC had been responsible for on-land solid waste management until its jurisdiction was transferred to VEA of MONRE due to the Prime Minister's decision in February 2019. It seems that VEA's human resources in solid waste management are not sufficient.

As shown in Table 4-7, in regard to the management of land-based solid waste, the policy seems to be directed to plastic free society. The decision does not apparently address the countermeasures for the manufacturing stage such as the substitution of plastic material with others or biodegradable plastics. On the other hand, in regard to sea-based waste management, it lays out clear targets unlike the action plan of Indonesia or the roadmap of Thailand.

(2) Situation of Plastic Litter Reduction

In Vietnam, the waste collection rate is about 80-90% in urban areas, while it is as low as 40% in rural areas[68]. Therefore the improvement of the collection rate is an urgent national concern. Targets are 90% and 70% for urban and rural areas, respectively[69].

According to the national domestic waste flow for 2015, formulated with support from JICA[70], the waste collection amount was 15,618 thousand tons/year, of which 4,513 thousand tons/year (28.9%) were intermediately treated and 12,110 thousand tons/year (77.5%) the final disposal amount. Intermediate treatment refers to composting and incineration and contributed to the reduction of 3,508 thousand tons/year (22.5%) of collected waste.

At composting facilities, it is assumed that waste plastic is removed as foreign matter and that some high-quality portions are recycled, while the rest is disposed of.

There are not many regulations regarding the reduction of plastic waste generation, but the Prime Minister's Decision No. 491 (No. 491/QD-TTg) stipulates that the disposable plastic shopping bags presently used at commercial facilities should be replaced with environmentally-friendly bags by 2025. Furthermore, the national capital of Hanoi issued Plan No. 232 (No. 232/KH-UBND) regarding plastic waste reduction by 2020. It states, for example, that governmental or public institutions should avoid using persistent or non-biodegradable single-use plastics, plastic package production should be minimized, and that the private companies are encouraged to take action for plastic waste reduction.

(3) Situation of Plastic Litter Recycling Promotion

The informal sector plays a main role in waste recycling, including plastic waste recycling. Valuable waste plastic is mostly collected by waste pickers before primary collection and neither waste collection companies nor local governments have any policies or measures for plastic waste collection. Waste pickers also collect plastic waste at final disposal sites. At the Nam Son disposal site, about 500 waste pickers collect valuable waste late at night or early in the morning, when heavy machinery is not in operation[71].

It is said that there are 1,500 craft villages in Vietnam, where collected recyclable waste is processed for recycling, with collected plastic waste gathered in craft villages that deal exclusively with plastic waste. At small factories located in these plastic villages, plastic waste is crushed, washed, melted and pelletized to be sold as recycled pellets. Without any wastewater or exhaust gas treatment equipment, the plastic recycling industry is regarded as a serious source of pollution. The Prime Minister's Decision

[68] From an interview with MOC on July 31, 2019.
[69] Prime Minister's Decision No. 2149/QD-TTg 2009.
[70] Project for Capacity Development on Integrated Management of Municipal Solid Waste in Vietnam, Sep 2017.
[71] From an interview with Hanoi URENCO on July 30, 2019.

No. 2149 (No: 2149/QD-TTg) set a policy goal of 80% by 2020 and 100% by 2025 for the collection and treatment of solid waste from craft villages in an environmentally-friendly manner.

(4) Measures to Prevent the Release of Plastic Litter into the Ocean

As Vietnam has a long coastline of about 3,000 km from north to south, it is thought that the risk of the country releasing plastic waste into the ocean due to improper waste management is high[72]. In urban areas, waste collection has improved and intermediate treatment or final disposal facilities are being developed, while in rural areas, marine litter generation risk is high as waste collection rate is low and self-disposal or inappropriate disposal are often practiced.

A study to estimate the plastic waste amount along the coastline and in rivers has started with the assistance of UNDP, and VASI and VEA are drafting national action plans to prevent marine plastic litter generation. After they have been approved, specific actions will be carried out.

4.2.4 Philippines

(1) Policy and Organizations Related to the Marine Plastic Litter Issue

In the Philippines, the National Solid Waste Management Commission (NSWMC) was organized to promote ecological solid waste management based on the Ecological Solid Waste Management Act (RA 9003), which was promulgated and executed in 2001. A commission chaired by DENR, consisting of fourteen public institutions and three private organizations, is responsible for the marine plastic litter issue as well as terrestrial waste management. Under the working group of DENR, the "National Action Program for Marine Plastic" was being formulated at the time of field visit in July 2019 basically by government officials with partial advisory involvement of international authorities such as UNDP and GIZ. The public consultation is planned in March 2020 and official publication in April 2020. The plan, according to the plan outline as of February 2020, has seven chapters as follows.

1. Context
2. Baseline Information
3. International and Local Policies and Plans
4. Issues, Gains, and Remaining Gaps
5. Action Plan
6. Thematic Strategies
7. Other Considerations

Chapter 5, Action Plan, consists of three components: (i) Preventing and Reducing Marine Litter from Land-based Sources, (ii) Preventing and Reducing Marine Litter from Sea-based Sources and (iii) Management of the Amount and Impact of Accumulated Marine. Chapter 6, Thematic Strategies, includes (i) Monitoring and Assessment of Marine Litter and (ii) Activities Supporting the Implementation of the Action Plan and other International Agreements and Regional Initiatives.

[72] From an interview with Hanoi URENCO on July 30, 2019.

(2) Situation of Plastic Litter Reduction

The "Ecological Solid Waste Management Act" (RA 9003) of 2001 assigns priorities on solid waste management, including plastic, in the order of generation control, discharge reduction, reuse, recycling, and proper disposal. Each responsible organization implements proper waste management based on this principle. As for plastic containers and packaging, a Technical Committee, set up by NSWMC Resolution No. 9, is reviewing a phased-in ban because of their substitutability and environmental burden.

As regulations on the use of plastic products are being developed at the local government level, restrictions for providing plastic bags and straws are increasing around the capital region. For example, Malabon City has banned the distribution of plastic bags and straws absent a customer request every Friday as a "Plastic Free Day". In addition, they recover recyclable plastic waste such as PET bottles, HDPE, and PVC pipe from residents, in cooperation with the Plastic Industry Association, every third Thursday of the month.

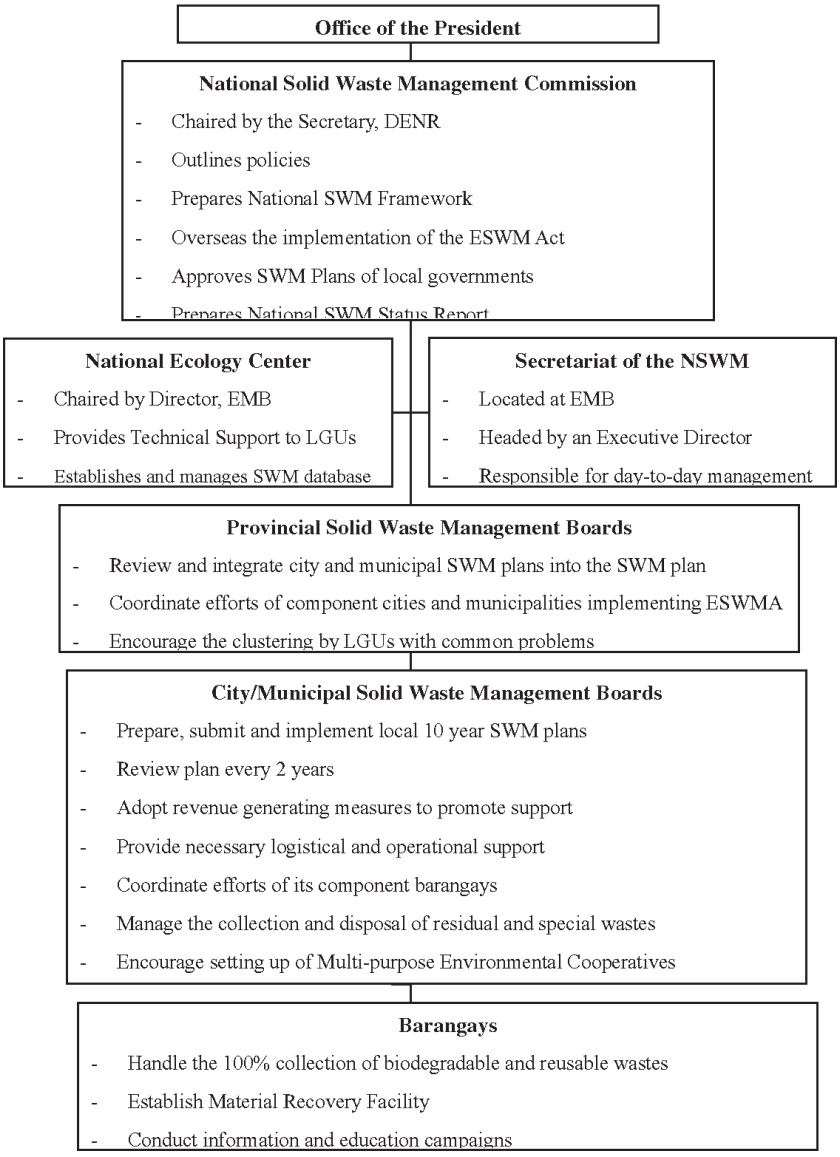


Figure 4-3 Solid Waste Management System Stipulated in RA9003

Source World Bank 2001

(3) Situation of Plastic Litter Recycling Promotion

According to the "National Solid Waste Management Status Report (2008 – 2018)"[73] issued by NSWMC, it is estimated that 27.8% of municipal waste is recyclable, of which 38% comes from plastic containers and packaging. RA 9003 stipulates that each barangay should conduct segregation and collection of biodegradable, compostable, and recyclable waste under the responsibility of the municipality to which the barangay belongs. Based on this law, local governments have established and operated recovery facilities for efficient waste collection and recycling promotion.

In the collection of recyclable waste, the informal sector, including waste pickers at disposal sites, still account for a large proportion and play an important role. Therefore, some local governments are seeking to strengthen cooperation with them through the systematization of the informal sector in order to promote efficient waste collection. At the ministry level, the use of recycled materials with eco-labeling and tax exemptions for companies which construct and operate recovery facilities are being promoted.

Based on the idea of upcycling, the Plastic Industry Association, which consists of plastic manufacturers, resin pellet suppliers and petrochemical companies, is boosting business activities and technological development to enhance the value of plastics and promote recycling. For example, they manufacture products such as plastic chairs and trash bins from recycled material that has been processed from small packaging bags (sachets) that originally contained coffee or shampoo and are purchased from residents.

As for WtE plants, although deep-rooted opposition still remains among residents and environmental groups, in 2002 the Supreme Court stated an opinion that the Clean Air Act does not ban incineration plants that have complied with emission regulations. Especially in large cities, momentum for introducing incineration technology is increasing because of the difficulty of securing a final disposal site.

(4) Measures to Prevent the Release of Plastic Litter into the Ocean

The "Manila Bay Clean Up Program" has been implemented for the purpose of beautification and environmental rehabilitation, based on the "Operational Plan for the Manila Bay Coastal Strategy 2017-2022" in and around Manila Bay, located in the west of the capital Manila. Thirteen public agencies, including DENR, PCG (Philippine Coast Guard) and MMDA (Metropolitan Manila Development Authority), engage in this program, which has the following three phases.

- Phase 1 - Cleanup/Water Quality Improvement
- Phase 2 - Rehabilitation and Resettlement
- Phase 3 - Education and Sustainment

The activities are expected to prevent plastic waste from outflowing into the marine environment, since these cover not only coastal cleanup but also solid waste management, sewerage development and awareness raising for coastal residents.

[73] https://emb.gov.ph/wp-content/uploads/2019/08/National-Solid-Waste-Management-Status-Report-2008-2018.pdf

Other efforts include the regular collection of drifting waste by some local governments, using waste collection boats with simple equipment.

4.3 Proposed Assistance Projects

Considering the current situation in the four priority countries in Southeast Asia and the information organized to study the JICA support policy in Chapter 3, eight assistant projects, listed below from a. to h., are proposed.

As mentioned before, in order to realize the "Osaka Blue Ocean Vision" advocated at the G20 Summit, Japan's aid policy is to support developing countries' efforts including their capacity building and infrastructure development in the area of waste management. Specifically, assistance will be extended focusing on appropriate waste management, marine plastic recovery, innovative technology introduction and human resources empowerment[74].

In addition to this, considering the progress of formulation of action plan on marine plastic debris and condition of waste management in coastal area in four target countries, project a. to d., which aim to improve waste management, should be given priority consideration.

On the other hand, taking into consideration the content of the action plans currently under preparation (in Thailand and the Philippines), the capacities of counterparts in terms of project implementation and trends in support from other donors, the other four projects will also be taken up flexibly.

Table 4-8 Proposed Assistance Projects

No	Project	ODA Scheme	Target Country	Policy/Regulation/ Planning Aspect		Technical Aspect		Monitoring	
				By National/ Local Gov'ts	By Private Sector Voluntarily	Production Stage	Post-use Stage	Material Flow	Under-standing of Marine Plastic
a	Project for the Appropriate Management of Municipal Waste Towards the Implementation of National Marine Litter Action Plan	Technical Cooperation Project	Indonesia	✓✓			✓✓	✓	
b	Provision of Technical Advisory Services for the Implementation of Plastic Litter Management Action Plan	Dispatch of Experts	Thailand	✓✓			✓✓	✓	
c	Project for the Appropriate Management of Municipal Waste in Urban Coastal Area Towards the Implementation of National Marine Litter Action Plan	Technical Cooperation Project	Vietnam	✓✓			✓✓	✓	
d	Project for the Formulation of Marine Plastic Litter Action Plan for Provincial Cities	Technical Cooperation Project	Philippines	✓✓			✓✓	✓	

[74] https://www.mofa.go.jp/files/000493728.pdf

e	Project for Recycling Industry Promotion	Technical Cooperation Project	Philippines	✓✓	✓		✓✓		
f	Provision of Technical Advisory Service to Plastic Product Reduction and Restriction	Dispatch of Experts	All	✓✓	✓	✓✓			
g	Project for Plastic Material Flow Development	Dispatch of Experts	All		✓✓			✓✓	
h	Project for Floating Waste Collection Including Marine Plastic Litter	Grant Aid/ Technical Cooperation Project	All	✓✓			✓✓		✓✓

✓✓ Main area, ✓ Secondary area

The outline of each project is shown below.

a. Project for the Appropriate Management of Municipal Waste Towards the Implementation of National Marine Litter Action Plan

Scheme Category	Technical Cooperation Project
Target Country	Indonesia
Target Area	A watershed or coastal area with high risk of releasing plastic litter to the sea.
Counterpart	Coordinating Ministry of Maritime Affairs Ministry of Environment and Forestry Ministry of Public Works and Housing
Project Period	2 – 3 years (National policy is to reduce marine litter by 70% by 2025.)
Project Outline	Indonesia aims at 70% reduction of marine plastic by 2025, and for this target a National Plan of Action for 2018 to 2025 was issued as a presidential decree. The national action plan has five strategies, namely 1) awareness raising among stakeholders, 2) management of land-based waste, 3) waste management in the ocean and on the coast, 4) financing, institutional strengthening, monitoring and law enforcement and 5) research and development. This project, aiming at appropriate waste management in local cities, is in line with Strategy 2, which should respond to the assistance needs of the Indonesian government. As Waste-to-Energy (WtE) has been promoted in the major cities due to a presidential decree, it is thought that appropriate management of waste, including low quality and dirty plastic, will progress, which will in turn reduce the risk of plastic pollution. On the other hand, in other regions, particularly near rivers or the sea, there seems to be areas which have a high risk of marine plastic litter generation because of low waste collection rates and inadequate final disposal management. Therefore, as a current proposal for an aid project, a technical cooperation project is being considered for the appropriate management of waste including plastic litter in such local cities to promote land-based proper waste management and to contribute to Strategy 2. 1. Selection of target cities 2. Current situation analysis from waste generation to final disposal 3. Development of waste flow (including plastic waste) 4. Assistance for the formulation of municipal solid waste improvement action plan (including WtE) 5. Design and planning of pilot projects 6. Implementation of the pilot projects

	7. Review of the pilot projects and updating of the action plan
Input by the Japanese Side	Short-term Experts 1. Project Manager (Solid Waste Management) 2. Waste Collection and Transportation 3. Waste Treatment (Recycling, WtE included) 4. Waste Final Disposal 5. Economic and Financial Analysis 6. Marine Litter Monitoring
Notes	➢ Target cities will be selected based on discussion with Indonesian authorities placing priority on areas which are prone to marine plastic pollution due to proximity to the ocean and inadequate waste collection and final disposal. ➢ This will contribute Activity 43 in Table 4-3. ➢ For facility development such as WtE, where "economy of scale" can work, the action plan will be made covering two or more cities, with the provincial government as a main actor. ➢ It should be ensured that there is no overlap with the activities of other donors (WB, UNDP, ADB, GIZ, etc.).

b. Provision of Technical Advisory Services for the Implementation of Plastic Litter Management Action Plan

Scheme Category	Dispatch of Experts
Target Country	Thailand
Target Area	-
Counterpart	Pollution Control Department (PCD) Department of Environment Promotion (DEQP)
Project Period	2-3 years
Project Outline	In April 2018, the Thai Cabinet decided to tackle the plastic litter issue and to make every effort to conserve the environment. In response, MONRE established a sub-committee on plastic litter under the National Environment Board, appointing the MONRE Secretary General as a chair and PCD, DEQP and DMCR as secretariat. PCD formulated the Plastic Waste Management Roadmap (2018-2030), which was approved by the Cabinet in April 2019. In this roadmap, Target 1 is set to ban the use of three types of plastics by 2019 and four types of plastics by 2021. Target 2 aims at 100% recycling (including energy recovery) of specific waste plastics by 2027 At present, an action plan to implement this roadmap is under preparation and is expected to be approved during this fiscal year. After the confirmation of the content of the action plan, assistance projects should be proposed in line with the needs of the Thai government. Nevertheless, the following project activities can be proposed at this point. 1. For Target 1, advisory service regarding the development and introduction of alternative products for prohibited plastic products 2. For Target 2, advisory service regarding recycling promotion of target products. These activities can be carried out by short-term experts dispatched by JICA.
Input by the Japanese Side	Two Short-term Experts 1. Expert with background in material development in material industry 2. Expert in waste treatment and recycling
Notes	➢ It should be ensured that there is no overlap with the activities of other donors (WB, UNDP, ADB, GIZ, etc.). ➢ The counterpart agencies will need to be re-examined based on the action plan. ➢ The development of alternatives to plastic products or the development of recycling technology can be also assisted by SATREPS.

c. Project for the Appropriate Management of Municipal Waste in Urban Coastal Area Towards the Implementation of National Marine Litter Action Plan

Scheme Category	Technical Cooperation Project
Target Country	Vietnam
Target Area	Urban coastal area especially cities with a large marine tourism sector
Counterpart	Vietnam Environmental Administration (VEA) Vietnam Administration of Seas and Islands (VASI) Ministry of Construction Local Government
Project Period	2-3 years
Project Outline	In Vietnam, the Ministry of Natural Resources and Environment (MONRE) was responsible for overall regulation, while the Ministry of Construction (MOC) was responsible for municipal solid waste in terms of implementation. Due to the issuance of the Prime Minister's Decision No. 9 in February 2019, MONRE became the main organization for administering solid waste management as a whole. In MONRE, the Vietnam Environment Agency (VEA) is in charge of land-based solid waste while the Vietnam Administration of Sea and Islands (VASI) is in charge of solid waste in the ocean and coastal area. In December 2019, Vietnam issued the National Action Plan for Marine Plastic Waste Management. It aims the reduction of marine plastics, the minimization of single-use plastics at marine tourism facilities, and others. In view of this action plan, the assistance proposed here is a project for solid waste management improvement in coastal cities, especially cities with large tourism industry in the coastal zone. In cities in Vietnam, In Vietnam, the waste collection rate in urban areas is about 80-90% and facilities such as transfer stations and final disposal sites are being developed, but because of the large population, it is considered that the risk of generating marine plastic litter is still high. The project includes the following activities. 1. Selection of target area 2. Current situation analysis from waste generation to final disposal 3. Development of waste flow (including plastic waste) 4. Assistance for the formulation of municipal waste management action plan 5. Selection of villages for pilot projects 6. Design and planning of pilot projects 7. Implementation of the pilot projects 8. Review of the pilot projects and updating of the action plan
Input by the Japanese Side	Short-term experts 1. Project Manager (Solid Waste Management) 2. Waste Collection and Transportation 3. Waste Treatment 4. Waste Final Disposal 5. Waste Management at Source/Environmental Education/Awareness Raising 6. Marine Litter Monitoring
Notes	➢ Target area will be selected based on discussion with Vietnamese authorities placing priority on areas which are prone to marine plastic pollution. ➢ The National Action Plan of Vietnam covers both land-based and marine-based waste. When the project is planned, target waste of the project should be clearly defined. ➢ It should be ensured that there is no overlap with the activities of other donors (WB, UNDP, ADB, GIZ, etc.).

d. Project for the Formulation of Marine Plastic Litter Action Plan for Provincial Cities

Scheme Category	Technical Cooperation Project
Target Country	The Philippines
Target Area	Provincial cities in a watershed or coastal area with high risk of releasing plastic litter to the sea.
Counterpart	National Solid Waste Management Committee Local Governments
Project Period	2-3 years
Project Outline	In the Philippines, the National Solid Waste Management Commission (NSWMC) was organized to promote ecological solid waste management based on the Ecological Solid Waste Management Act (RA 9003) which was promulgated and executed in 2001. The commission chaired by DENR is responsible for the marine plastic litter issue as well as terrestrial waste management. Under the working group of DENR, the National Action Program for Marine Plastic is currently being formulated and the NSWMC will be consulted in November 2019. Assistance projects should contribute to the implementation of the action plan and be in line with the needs of Philippine government. An assistance project that can be considered at present is a project for solid waste management improvement in provincial cities. 1. Selection of target cities 2. Current situation analysis from waste generation to final disposal 3. Development of waste flow (including plastic waste) 4. Assistance for the formulation of municipal solid waste improvement action plan (including WtE) 5. Design and planning of pilot projects 6. Implementation of the pilot projects 7. Review of the pilot projects and updating of the action plan
Input by the Japanese Side	Short-term Experts 1. Project Manager (Solid Waste Management) 2. Waste Collection and Transportation 3. Waste Treatment (Recycling, WtE included) 4. Waste Final Disposal 5. Marine Litter Monitoring
Notes	➢ The condition of final disposal sites near the coast or rivers should be carefully examined. ➢ In the Philippines, there are many facilities which are operated by the private sector, but it is necessary to consider support for areas where it is difficult to attract private investment. ➢ The local governments should be placed in the core of the project implementation as they bear practical responsibility for waste management. The target local governments must be carefully chosen taking account of their administrative execution capacities and clear commitment of their political leaders. ➢ It should be ensured that there is no overlap with the activities of other donors (WB, UNDP, ADB, GIZ, etc.).

e. Project for Recycling Industry Promotion

Scheme Category	Technical Cooperation Project
Target Country	The Philippines
Target Area	—
Counterpart	Department of Trade and Industry
Project Period	2-3 years
Project Outline	In the Philippines, the National Solid Waste Management Commission (NSWMC)

	was organized to promote ecological solid waste management based on the Ecological Solid Waste Management Act (RA 9003) which was promulgated and executed in 2001. The commission chaired by DENR is responsible for the marine plastic litter issue as well as terrestrial waste management. Under the working group of DENR, the National Action Program for Marine Plastic is currently being formulated and the NSWMC will be consulted in November 2019. Assistance projects should contribute to the implementation of the action plan and be in line with the needs of Philippine government. It also has to be noted that one of the major concerns of the country is a lack of information about the real condition of waste plastic treatment. Plastic waste recycling, in particular, is not well understood and numerical data about it is not organized. Therefore, this project aims to understand and promote the plastic recycling industry. The project will contain the following. 1. Understanding of the current condition of waste plastic recycling and formulation of plastic waste flow 2. Understanding of the regulatory and institutional system of the plastic industry 3. Problem analysis of recycling industry promotion 4. Construction of a recycling industry database 5. Formulation of a recycling industry promotion plan 6. Implementation of some activities in the abovementioned plan (pilot projects) 7. Review of the pilot projects and updating of the plan
Input by the Japanese Side	Short-term Experts 1. Project Manager (Recycling Promotion Plan) 2. Waste Plastic Recovery 3. Waste Plastic Mechanical Recycling 4. Waste Plastic Chemical and Thermal Recycling 5. Database 6. Recycling Industrial Policy
Notes	➢ The Philippine side appreciates the prior JICA study, “The Study on Recycling Industry Development in the Republic of the Philippines” and hopes for data from it to be updated. ➢ It should be ensured that there is no overlap with the activities of other donors (WB, UNDP, ADB, GIZ, etc.)

f. Provision of Technical Advisory Service to Plastic Product Reduction and Restriction

Scheme Category	Dispatch of Experts
Target Country	All Countries
Target Area	Capital Cities
Counterpart	Ministries in charge of industry and commerce and ministries in charge of the environment if appropriate.
Project Period	2 years
Project Outline	Countermeasures not only on plastic after it has become waste, but also those on plastic products before being discarded have been taken in many countries and cities. In the upstream of the plastic material flow, private companies in the manufacturing and distributing sector play a leading role and different government agencies, such as ministries in charge of industry and commerce, are also involved as they have jurisdiction over such areas of the private sector. Until now, private Japanese organizations related to the plastics industry have actively conducted voluntary initiatives such as cooperation or opinion exchange with private companies in Southeast Asia. JICA assistance will be able to support or coordinate such private activities.

	The assistance project will specifically include the following. 1 Advisory service to ministries in charge of industry or commerce regarding policy, regulation and plans of plastic products, such as: 1.1 Restriction of material use or specifications of plastic product manufacturing 1.2 Fees on plastic products (such as shopping bags) 1.3 Standardization of material labelling 1.4 Extension of lifetime of products 1.5 Improvement of recyclability 2 Assistance for ministries in charge of industry or commerce in promoting private voluntary activities such as the following (to be coordinated with cooperation activities in the private sector). 1.1 Introduction of alternate material 1.2 Weight reduction of packages 1.3 Reduction of shopping bag provision 1.4 Restriction of the use of microbeads 1.5 Prevention of release of resin pellet
Input by the Japanese Side	Short-term Experts 1. Advisor for plastic reduction (with experience in material development) 2. Advisor for plastic reduction policy (with experience in policy development)
Notes	➢ In Japan, there are private organizations with members from the manufacturing and distributing sectors such as CLOMA and JaIME. Their expertise should be utilized. ➢ Other donors (UNEP, GIZ, etc.) have also planned assistance to the upstream area. Their activities should be confirmed. ➢ As mentioned earlier, a Road Map of Waste Reduction by Manufacturers has been issued in Indonesia, the project above can be considered to assist the manufacturers to implement the road map. In this case, as the road map is stipulated in the Ministerial Decree of the MOEF, it need to be carefully considered how the MOEF and the MOI are involved in the project.

g. Project for the Plastic Material Flow Development

Scheme Category	Dispatch of Experts
Target Country	All Countries
Target Area	Capital Cities
Counterpart	Association of plastic industry of each country, research institutions in the field of environment
Project Period	3 years
Project Outline	Process control at all stages including raw material input, production, distribution, waste discharge, collection, transportation, treatment and final disposal can contribute to plastic waste reduction. In order to make sure that each process is properly controlled, it is important to quantitatively understand all the processes from raw material input to final disposal. In Japan, the Plastic Waste Management Institute has been carrying out data collection and analysis for nearly twenty years and developing and publicizing plastic material flows which have not been seen in other countries. Expecting the application of the material flow in monitoring and evaluating marine plastic litter reduction policy, support will be provided for its formulation and revision. [Plastic Material Flow Formulation] 1. Confirmation of data availability and acquisition method 2. Implementation of sampling study 3. Statistical data analysis 4. Formulation of plastic material flow

Input by the Japanese Side	Short-term Experts 1. Training of Material Flow Formulation 2. Statistical Data Acquisition 3. Statistical Data Analysis 4. Project Coordinator
Notes	➢ JaIME has a plan to provide training on material flow formulation in Japan in February 2020, but this training is planned only once. The proposed project intends to continue such activity in recipient countries. ➢ In Thailand, the first version of the plastic material flow was developed in 2017 with a support of the Plastic Waste Management Institute of Japan. ➢ Taking account of the Japan-ASEAN Technical Cooperation Agreement, the project can be considered to be carried out for personnel from ASEAN countries as part of the program of RC3S established in Bali by Indonesian government. ➢ In Indonesia, both CMMA, a leading organization of the National Action Plan, and MOEF, a secretariat of the national coordinating team, are responsible to manage the progress of the plan and are seeking a tool to monitor marine debris reduction. MOEF is currently assisted by UNDP for the enhancement of its secretariat function, but there is a desire to receive another assistance for the application of the material flow, which will be more advanced than the one to be assisted by the project above, to marine debris reduction monitoring. CMMA also expressed its expectation for the utilization of the material flow in a monitoring purpose.[75]

h. Project for Floating Waste Collection including Marine Plastic Litter

Scheme Category	Grant Aid and/or Technical Cooperation Project
Target Country	All Countries
Target Area	Along rivers and in coastal areas
Counterpart	Governmental agencies related to marine environment, those related to ports, coast guards, local governments with coast, etc.
Project Period	2-3 years
Project Outline	In enclosed sea areas in Japan such as Tokyo Bay, the Ministry of Land, Infrastructure, Transport and Tourism and other agencies regularly collect floating waste including plastic waste in order to ensure navigational safety and environmental conservation. The prevention and reduction of waste released into the sea is of foremost importance, but marine plastic litter generation cannot be totally stopped, as a lot of plastic waste will reach waterbodies in cases of flooding due to heavy rain or other unavoidable occurrences. This project assists waste collection in rivers and coasts before plastic waste is released into the open sea. 1. Selection of target areas 2. Understanding of weather and marine conditions and a survey of floating waste 3. Formulation of a floating waste collection plan 4. Provision of waste collection vessels 5. Technical assistance for effective waste collection using a marine radar system or other methods. 6. Waste collection in pilot areas and analysis of effectiveness 7. Feedback to floating waste collection plan
Input by the Japanese Side	Short-term Expert 1. Expert in marine radar and other measurement technology 2. Expert in analysis of measurement data 3. Procurement Equipment provision (waste collection vessels: several hundred million to one billion yen/vessel)

[75] From an interview with the MOEF on December 11 and the CMMA on December 13, 2019.

Notes	➢ The scale of assistance will be determined taking account of past assistance of vessel procurement for coastal guards. ➢ This project, at this point, only focuses on floating waste collection. Prior to its implementation, the agency responsible for floating waste collection must be identified and a system for treatment and final disposal of the collected waste must be established. ➢ The project can be considered to cover the treatment and final disposal of sea-based waste.

Chapter 5 Examination of Plan and Content of Invitation Program to Japan

5.1 Implementation Outline

This invitation program aims to deepen the understanding in Asian countries, which are estimated to be a main source of marine plastic litter, regarding Japan's effort and technologies.

The program was carried out in November 2019 as shown in Table 5-1.

Table 5-1 Invitation Program

Time		Program	Contents
Day 1: Nov 18 (Mon) **Outline and Trend of the Marine Plastic Pollution Issue and Approach by the Acadedmic and Government of Japan**			
9:30-9:40	-	■Briefing	—
9:40-11:10	P-1	■ LCT: "Current Situation of the Marine Plastic Pollution, Possible Future Scenario, Effect of Environment, and Methods of Survey" **Prof. Atsuhiko Isobe**, Kyushu University	Overview of the current issues of marine plastic pollution, future predictions, impacts on ecosystems and human society, and monitoring and research methods to grasp the actual situation.
11:20-12:50	P-2	■"Impact of Marine Plastic Pollution on Ecosystems" **Prof. Hideshige Takada**, Tokyo University of Agriculture and Technology	Impact of marine plastic pollution and microplastics on marine ecosystems.
14:00-15:20	P-3	■ LCT: "Trend of the International Issue of the Marine Plastic Pollution and International Resource Cycle" **Dr. Michikazu Kojima**, Economic Research Institute for ASEAN and East Asia (ERIA)	International regulations and legislation about countermeasures on marine plastic waste pollution, international trends such as treaty negotiations, and international resource circulation including transboundary waste movement.
15:30-16:50	P-4	■ LCT: "Current Status and Technical Trends of the Countermeasures for the Marine Plastic Pollution in Japan" **Ministry of the Environment of Japan**	To introduce the countermeasures for marine plastic pollution in Japan and Japanese technology and approaches such as the Plastics Smart Campaign.
17:00-18:00	P-5	■ LCT: "Approaches and Initiatives by Japanese Industry for the Plastic Resource Recycling" Ministry of Economy, Trade and Industry **(CLOMA)**	To share approaches of Japanese companies about resource recycling, including plastics, and to introduce initiatives such as the Clean Ocean Material Alliance.
Day 2: Nov 19 (Tue) **Approach by Local Municipal Governments for the Waste Management and Resource Circulation**			
10:00-11:30	P-6	■ LCT: "3R, Solid Waste Management and Countermeasure for the Marine Plastic Pollution in Tokyo Metropolitan Government" Mr. Yasuo Furusawa, Bureau of Environment. **Tokyo Metropolitan Government**	Learn about Tokyo as a local municipal government for 3R (Reduce, Reuse and Recycle), regarding waste management and countermeasures for marine plastic pollution.
14:00-15:30	P-7	■ OBS: "Tobuki Clean Center (Plastic Recycling Center /Incineration Plant)" **Hachioji-City**, Tokyo	Site visits to the waste management facilities of local municipal governments that are promoting 3R and plastic recycling in recycling facilities and incineration plants.
Day 3: Nov 20 (Wed) **Method of the Survey for litter and plastic waste, and the Technology for the Proper Recycling**			
9:30-11:20	P-8	■ LCT: "Results and Methods of Survey for Micro Plastic Pollution in the Ocean of Yokohama"; "Discharge Route of Waste Plastic from Land to Ocean, Efforts to Identify the Cause Products" **Pirika Inc**. and Environmental Planning Bureau, **City of Yokohama**	To share the results and methods of the survey for the microplastic pollution in the ocean by Yokohama City and to grasp the discharge route of waste plastic from land to ocean, as well as introduce efforts to identify the products that are causes.
11:30-12:00	P-9	■ OBS: "Projects for the Plastic Resource Collection and Promotion for Anti-littering by AI and SNS in Yokohama" Resources and Waste Recycling Bureau, **City of Yokohama** / **Pirika Inc**.	The advanced approach of local governments for plastic resource circulation, and litter investigation in the city by Artificial Intelligence (AI) and Geographic Information System (GIS) by public-private partnership.
14:00-15:00	P-10	■ OBS: "Kanazawa Wastewater Treatment Plant" Environmental Planning Bureau, **City of Yokohama**	The importance of the proper wastewater treatment to prevent the micro plastic pollution through observation of a wastewater treatment plant in Yokohama City.
15:30-17:30	P-11	■ OBS: "Fluff Fuel Plant Technology Derived from Waste Plastics" **GUUN Co. Ltd.**	Site visit to observe the fluff fuel plant technology derived from waste plastics and to share a good example of what have been introduced as appropriate technology through JICA project in Philippines.

Day 4: Nov 21 (Thu) **Countermeasures for the Marine Plastic Pollution by Japanese Companies**			
9:30-11:00	P-12	■LCT: "Countermeasure for the Marine Plastic Waste and the Development of the Biodegradable Plastic by the Japanese Chemical Industry" Mr. Kotaro Kishimura, The **Japan Plastics Industry Federation**	The several activities to prevent the leakage of plastic waste into rivers and ocean and the development and utilization of biodegradable plastics by Japanese chemical industries
11:00-12:00	P-13	■ LCT: "Approach of the Countermeasure of Marine Plastic Pollution by Japanese Consumer Goods Manufacturers" Mr. Manabu Shibata, **Kao Corporation**	The innovative approaches of Japanese consumer goods manufacturers, such using as refillable containers and recycled containers
15:00–16:30	P-14	■ OBS: "Technology of Mechanical Recycling of Plastic Bottles" **Kyoei Industry Co. Ltd.**	The mechanical recycling technology that manufactures recycled plastic bottles (MR-PET) without adding oil resources as an example of advanced resource recycling in Japan.
Day 5: Nov 22 (Fri) **Collaboration for the Marine Plastic Pollution by Nonprofit Organizations, NGO and Citizens.**			
9:30-10:30	P-15	■ LCT: "Approach and Future Outlook by the "Change For the Blue" that be Cooperated with Industry, Government, Academia and Citizens" Mr. Takayasu Udagawa, **The Nippon Foundation**	The approach and knowledge of Change For the Blue, which over 7,000 organizations participate in, in cooperation between industry, government, academia and citizens, to connect to international collaboration.
10:40-11:40	P-16	■OBS: "Approach of the Plastic Recycling on Retail Stores through the Automatic Plastic Bottle Collection Machines" **Seven-Eleven Japan Co. Ltd.**	Site visit to experience the approach to plastic recycling through auto plastic (PHT) bottle collection machines at Japanese convenience stores with citizens.
13:00-14:30	P-17	■ LCT: "Circular Economy and Society through the Countermeasure for the Marine Plastic Pollution and Extended Producer Responsibility and the Role of Citizen" **Prof. Masanobu Ishikawa**, Kobe University, Japan	To understand the current situation and the importance of Extended Producer Responsibility (EPR) for the marine plastic pollution in cooperation with citizens and NPOs to promote the circular economy and society.
14:30-15:00	-	■Wrap up	Simple Questionnaire Survey

In order to nominate the participants of the program, the consultant team confirmed the intention to participate of organizations relevant to the marine plastic litter problem during its visits to the four countries. After that, JICA sent invitation letters to those organizations and they nominated the participants, who are shown in Table 5-2 .

The invitation program was carried out as planned. Based on the opinions from participants and answers to the questionnaires, the effect of the program, lessons learned, and proposals for training program planning will be examined and reported in the final report.

Table 5-2 Participants of Invitation Program

No.	Name		Country	Organization	Position
(1)	Mr.	Ujang Solihin Sidik	Indonesia	Ministry of Environment and Forestry (MOEF) Solid Waste Management	Deputy Director for Goods and Packaging
(2)	Mr.	Mahesa Putra	Indonesia	Coordinating Ministry of Maritime Affairs (CMMA)	Deputy for Human Resources, Science & Technology, and Maritime Culture Affairs, Junior Policy Analyst at Director of Maritime Education and Training
(3)	Ms.	Uning Sabiqah Sumarsono	Indonesia	Coordinating Ministry for Maritime Affairs (CMMA)	Deputy for Human Resources, Science & Technology, and Maritime Culture Affairs, Data and Information Analyst At Director Of Maritime Science and Technology Utilization

(4)	Mr.	Cherdsukjai Phaothep	Thailand	Ministry of Natural Resources and Environment (MONRE) Department of Marine and Coastal Resources (DMCR)	Marine and Coastal Resources Research & Development Institute Fisheries Biologist, Practitioner level
(5)	Mr.	Juisiri Chaiyo	Thailand	Ministry of Natural Resources and Environment (MONRE) Pollution Control Department (PCD)	Director of Inland Water Sub division
(6)	Ms.	Ruanglek Vasimon	Thailand	The Federation of Thai Industries (FTI) SCG Chemicals	International Innovative Alliance Manager
(7)	Ms.	Elizabeth Gutierrez	Philippines	Local Government Unit (LGU) of Malabon City	Senior Environment Management Specialist/Head of Environmental Management Division
(8)	Ms.	Raquel B. Echague	Philippines	Department of Trade and Industry (DTI) – Board of Investment (BOI)	Officer-in-Charge, Office of the Director, Investment Policy and Planning Service, BOI
(9)	Ms.	Valdez Maria Delia Cristina Marino	Philippines	Department of Environment and Natural Resources (DENR)	Senior Environment Management Specialist
(10)	Mr.	Dinh Minh Tri	Vietnam	Hanoi Department of Construction (HDC)	Officer, Technical Infrastructure Department
(11)	Ms.	Nguyen Hue An	Vietnam	Vietnam Administration of sea and island (VASI)	Official, Dept. of Science, Technology and International Cooperation
(12)	Mr.	Tran Thanh Liem	Vietnam	Ministry of Natural Resources and Environment (MONRE)	Official, Waste Management Department, Vietnam Environment Administration

5.2 Outcome of the Invitation Program and Analysis of Lessons Learned

5.2.1 Analysis of Effectiveness of the Invitation Program (Achievement of Goal) and Outcome

The goal of the invitation program is “for the participants to be able to understand the importance and necessity of countermeasures in their own countries by learning Japan's public and private countermeasures for marine litter through site visits, and to gain knowledge for the implementation of countermeasures in their own countries”.

Accordingly, after the implementation of a comprehensive learning on the current state of Japanese public and private sector countermeasures for marine litter, a survey (twelve questions) was conducted using questionnaires for program participants to assess their degree of achievement on ‘understanding the importance and necessity of marine litter measures in their own countries’ and ‘acquisition of knowledge for implementation of marine litter measures’.

As described below, the lectures by representative researchers from Japan and the efforts of Japanese consumer goods manufacturers were given the highest evaluation in response to the question of whether the program was interesting and attractive to the organization/institution to which the visitors belonged. In addition, Japanese venture companies and the chemical industry were likewise given the highest

evaluation in response to the question about whether policies/systems/technologies, etc. are actually applicable or likely to be applied to the work of the organization to which the invitees belonged. Therefore, great potential is anticipated for the development of cooperation in this field through the utilization of Japanese technology.

(1) Understanding the Importance and Necessity of Marine Litter Measures in Their Own Countries

Participants were asked, “Is the content of lectures and inspections in each program of the invitation program interesting and attractive for your organization/institution?” In response, the participants evaluated the program in question using a scale of five ratings, from “Strongly Agree” to “Strongly Disagree”. As a result, the average evaluation of program content was 4.51 as a whole — between “Strongly Agree: 5” and “Agree: 4”. The current status of Japanese public-private countermeasures on marine litter was shared. Further, the active questioning and discussion at each lecture showed that understanding of the importance and necessity of countermeasures in their own countries had deepened. It can be considered a great achievement that interest in Japan's efforts and technologies in marine plastic waste control has increased and that their importance and necessity has been understood as well.

Table 5-3 shows the evaluation results of each program by all participants. Among the seventeen programs, the highest rating (average 4.8) was given to three lectures: 1) “Current Situation of Marine Plastic Pollution, Possible Future Scenarios, the Effects on the Environment, and Survey Methods”, by Professor Atsuhiko Isobe of Kyushu University; 2) “Impact of Marine Plastic Pollution on Ecosystems,” by Professor Hideshige Takada, Tokyo University of Agriculture and Technology; and 3) “Approaches to Countermeasures on Plastic Pollution by Japanese Consumer Goods Manufacturers ” by Mr. Manabu Shibata, Kao Corporation's Manager for ESG Activities.

Table 5-3 Evaluation by the Visitors (Understanding/Interest)

No.	Program	Modality	Is it interesting for yourself and your organization?
P-1	**“Current Situation of the Marine Plastic Pollution, Possible Future Scenario, the Effect of Environment, and Methods of Survey” (Prof. Atsuhiko Isobe, Kyushu University)**	**Lecture**	**4.8**
P-2	**“Impact of Marine Plastic Pollution on Ecosystems” (Prof. Hideshige Takada, Tokyo University of Agriculture and Technology)**	**Lecture**	**4.8**
P-3	“Marine Plastic Litter: Global Trend and International Trade of Recyclable Waste” (Mr. Michikazu Kojima, Economic Research Institute for ASEAN and East Asia (ERIA))	Lecture	4.7
P-4	“Countermeasures in Marine Plastic Pollution: Current State and Technical Trends in Japan” (Ministry of the Environment, Japan)	Lecture	4.4
P-5	“Approaches and Initiatives by Japanese Industry for Plastic Resource Recycling" (Japan Clean Ocean Material Alliance)	Lecture	4.6
P-6	“3R, Solid Waste Management, and Countermeasures for Marine Plastic Pollution in the Tokyo Metropolitan Government” (Mr. Yasuo Furusawa, Bureau of Environment, Tokyo Metropolitan Government)	Lecture	4.4

P-7	“Tobuki Clean Center (Plastic Recycling Center/Incineration Plant)” (Hachioji City)	Site visit	4.3
P-8	“An Investigation of the Discharge Route of Microplastic from Land to Ocean” (Mr. Fujio Kojima, Pirika Inc.)	Lecture	4.5
P-9	“Projects for Plastic Resource Collection and the Promotion of Anti-Littering by AI and SNS in Yokohama” (Resources and Waste Recycling Bureau, City of Yokohama/Pirika Inc.)	Lecture. training	4.4
P-10	“Hokubu Wastewater Treatment Plant” (Environmental Planning Bureau, City of Yokohama)	Site visit	4.2
P-11	“Fluff Fuel Plant Technology Derived from Waste Plastics” (GUUN Co Ltd)	Site visit	4.1
P-12	“Countermeasure for Marine Plastic Waste and the Development of Biodegradable Plastic by the Japanese Chemical Industry” (Mr. Kotaro Kishimura, The Japan Plastics Industry Federation)	Lecture	4.7
P-13	**“Countermeasures for Marine Plastic Pollution by Japanese Consumer Goods Manufacturers” (Mr. Manabu Shibata, Kao Corporation)**	**Lecture**	**4.8**
P-14	“Technology of Mechanical Recycling of Plastic Bottles” (Kyoei Industry Co Ltd)	Site visit	4.6
P-15	“The ‘Change For the Blue’ Cooperative Effort Between Industry, Government, Academia, and Citizens: Approach and Outlook” (Mr. Takayasu Udagawa, The Nippon Foundation)	Lecture	4.3
P-16	“Plastic Recycling at Retail Stores by Automatic Plastic Bottle Collection Machines” (Seven-Eleven Japan Co Ltd)	Site visit	4.4
P-17	“Circular Economy and Society Through Countermeasures for Marine Plastic Pollution and Extended Producer Responsibility and the Role of Citizens” Prof. Masanobu Ishikawa, Gomi-Japan	Lecture	4.7

Professor Isobe's lecture in particular was evaluated highly (average rating of 5) by participants from Thailand (three persons) and Vietnam (three persons). Breaking these ratings down by organization/ institutions, high evaluations (institutions average rating of 5) were given by participants from local governments (two persons) and private organizations (one person). By field, similarly high evaluations (an average rating of 5) were received from participants from industry (two persons). Participants’ interest was attracted by the outflow situation of plastic waste into the ocean, including for microplastics, and predictions about the future situation, and by scientific research and analysis methods. These contributed to the participants’ understanding of the current state of the issue with scientific evidence. The initiatives and prospects of a SATREPS Project, “Establishing a Base for Marine Plastic Pollution Research in Southeast Asian Seas” (Kyushu University and Chulalongkorn University), launched in Thailand in 2019, were introduced. The importance of reducing plastic consumption in a sustainable manner was shared, as was the importance of gaining a more accurate grasp of the spill situation and formulating an action plan based on scientific knowledge.

The lecture given by Professor Takada was evaluated highly by three Indonesian participants (with an average of 4.7). In terms of organizations/institutions, high ratings (an average of 4.9) were received from participants from the central government (nine persons); and field-wise, particularly high ratings (an average of 5) were given by participants in marine-related fields (five persons). It is thought that participants may have benefitted from the latest knowledge of the impact of plastics and microplastics on marine ecosystems and organisms as well as the scientific analysis of social impacts and possible effective countermeasures. In addition, risks and considerations for incineration and the use of biodegradable plastics and bioplastics were shared based on Japan's policy situation and their impact on ecosystems and society.

Lectures by Mr. Manabu Shibata, a manager from Kao Corporation — a leading consumer goods manufacturer in Japan — were also evaluated highly by Indonesian participants (three persons for an average of 4.7). In terms of organizations/institutions, high ratings were given by participants from the central government (nine persons for an average of 4.9), and in terms of fields, particularly high ratings were given by participants from marine fields (five persons for an average rating of 5). Three kinds of activities were introduced in the lecture: 1) 4R initiatives (Reduce, Reuse, Recycle, Replace) based on Kao's 2019 statement, "Our Philosophy & Action on Plastic Packaging"; 2) the reduction of plastic consumption due to design changes for refill products and packaging containers; and 3) "RecyCreation" activities in collaboration with local governments, through which packaging containers are collected, recycled and processed into blocks, then utilized in the local community. The participants expressed their keen interest in introducing those initiatives in their own countries.

(2) Acquisition of Knowledge for Implementation of Marine Litter Measures

In order to measure the degree of acquisition of knowledge for the implementation of marine litter countermeasures in each program of the invitation plan, an evaluation was conducted in which it was asked whether such countermeasures are actually applicable or likely to be adopted; specifically, it was requested that the participants evaluate on a scale of five to one, from "Strongly Agree" to "Strongly Disagree", on the following: "The topic is interesting and attractive for your organization". As a result, the evaluation of the program contents was 4.11 on average, exceeding "Agree: 4". It can be said that the program helped the participants gain new knowledge for the creation of marine litter countermeasures. It can also be considered a great achievement that the Japanese government and the private sector's measures and technologies for marine plastic waste management can be applied in each country.

Table 5-4 shows the participants' evaluation results for each program. Out of seventeen programs, the following five were evaluated highly. P-2 (Professor Hideshige Takada, Tokyo University of Agriculture and Technology), P-3 (Mr. Michikazu Kojima, a researcher for ERIA), P-8 (Pirika Co., Ltd. Department of Resources and Recycling), P-12 (Japan Plastics Industry Federation, Managing Director Kotaro Kishimura) and P-17 (NPO Gomi-Japan).

Table 5-4 Program Evaluation by All Participants (Applicability)

No.	Program	modality	Is it interesting for yourself and your organization?

P-1	"Current Situation of the Marine Plastic Pollution, Possible Future Scenario, the Effect of Environment, and Methods of Survey" (Prof. Atsuhiko Isobe, Kyushu University)	Lecture	4.2
P-2	**"Impact of Marine Plastic Pollution on Ecosystems" (Prof. Hideshige Takada, Tokyo University of Agriculture and Technology)**	**Lecture**	**4.3**
P-3	**"Marine Plastic Litter: Global Trend and International Trade of Recyclable Waste" (Mr. Michikazu Kojima, Economic Research Institute for ASEAN and East Asia (ERIA))**	**Lecture**	**4.3**
P-4	"Countermeasures in Marine Plastic Pollution: Current State and Technical Trends in Japan" (Ministry of the Environment, Japan)	Lecture	3.9
P-5	"Approaches and Initiatives by Japanese Industry for Plastic Resource Recycling" (Japan Clean Ocean Material Alliance)	Lecture	4.1
P-6	"3R, Solid Waste Management, and Countermeasures for Marine Plastic Pollution in the Tokyo Metropolitan Government" (Mr. Yasuo Furusawa, Bureau of Environment, Tokyo Metropolitan Government)	Lecture	4.1
P-7	"Tobuki Clean Center (Plastic Recycling Center/Incineration Plant)" (Hachioji City)	Site visit	4.0
P-8	**"An Investigation of the Discharge Route of Microplastic from Land to Ocean" (Mr. Fujio Kojima, Pirika Inc.)**	**Lecture**	**4.3**
P-9	"Projects for Plastic Resource Collection and the Promotion of Anti-Littering by AI and SNS in Yokohama" (Resources and Waste Recycling Bureau, City of Yokohama/Pirika Inc.)	Lecture. training	4.0
P-10	"Hokubu Wastewater Treatment Plant" (Environmental Planning Bureau, City of Yokohama)	Site visit	3.7
P-11	"Fluff Fuel Plant Technology Derived from Waste Plastics" (GUUN Co Ltd)	Site visit	3.8
P-12	**"Countermeasure for Marine Plastic Waste and the Development of Biodegradable Plastic by the Japanese Chemical Industry" (Mr. Kotaro Kishimura, The Japan Plastics Industry Federation)**	**Lecture**	**4.3**
P-13	"Countermeasures for Marine Plastic Pollution by Japanese Consumer Goods Manufacturers" (Mr. Manabu Shibata, Kao Corporation)	Lecture	4.2
P-14	"Technology of Mechanical Recycling of Plastic Bottles" (Kyoei Industry Co Ltd)	Site visit	4.2
P-15	"The 'Change For the Blue' Cooperative Effort Between Industry, Government, Academia, and Citizens: Approach and Outlook" (Mr. Takayasu Udagawa, The Nippon Foundation)	Lecture	4.1
P-16	"Plastic Recycling at Retail Stores by Automatic Plastic Bottle Collection Machines" (Seven-Eleven Japan Co Ltd)	Site visit	4.1

P-17	**"Circular Economy and Society Through Countermeasures for Marine Plastic Pollution and Extended Producer Responsibility and the Role of Citizens" Prof. Masanobu Ishikawa, Gomi-Japan**	Lecture	4.3

The lecture given by Professor Takada was evaluated highly by three Indonesian participants (an average of 4.7). The ratings of the central government (nine persons and an average of 4.4) and the participants from local government (two persons and an average of 4.7) were high. The lecture was also evaluated highly by participants from the waste management field (five persons and an average of 4.4). Professor Takada is also a member of the Plastic Resource Recycling Strategy Subcommittee of the Ministry of Environment, which has been discussing the Plastic Resource Recycling Strategy formulated last May. Scientific views on current marine plastic waste management policies in Japan were also discussed by him. It is thought that the participants gained useful and specific knowledge in considering the impact of their own policies on environmental load, natural ecosystems and society.

The lecture given by Dr. Kojima of ERIA was evaluated highly by Vietnamese participants (three persons and an average of 4.7). For organizations/institutions, high ratings were given by participants from local governments (two persons and an average of 4.7), and fields-wise, evaluations from the marine fields (five persons, average of 4.6) and waste management (five persons, average of 4.4) were high. The lecture shared the current status of international resource recycling and recycling in Asia, including the 2017 China embargo on waste plastics, and the current status, economic impact, and prospects of international treaties and regulations such as the Basel Convention. The participants asked for advice for their own countries' policies.

The lecture by President Kojima of Pirika was evaluated highly by Indonesian participants (three persons, average of 4.7). Breaking things down by organizations/institutions, high ratings were also given by participants from the central government (nine people, average of 4.4) and the participation of private organizations (one person and a ranking of 5). A particularly high rating was obtained from participants in the industrial field (two people, average of 5). Pirika's initiatives with advanced technologies such as image recognition using artificial intelligence (AI), smartphone applications, and drones have been utilized in the decision-making and evaluation of local governments in Japan. Since efforts to understand the source of plastic litter, including the utilization of plastic items and outflow status, have been demonstrated in developing countries through projects such as those of the United Nations Environment Program (UNEP), it is thought that the participants became interested in these technologies as being appropriate and easily adopted in their own countries.

The lecture given by Managing Director Kishimura of the Japan Plastics Industry Federation was highly evaluated by participants from Indonesia (three persons, average of 4.7) and the Philippines (three persons, average of 5). For organizations/institutions, high ratings were given by participants from the central government (nine persons, average of 4.4) and private organizations (one person and a rating of 5). As for fields, participants from industry (two persons, average of 5) and waste management (five persons, average of 4.4) gave high evaluations. Mr. Kishimura is also a member of the Plastic Resources Recycling Strategy Subcommittee of the Ministry of Environment. In addition to sharing information on the latest initiatives and technological trends such as plastic spill deterrence efforts, recycling and biodegradable plastic development and utilization technologies by companies and organizations of the

Japan Chemical Industry Association, the feasibility of such activities and cooperation/coordination with the government attracted a great deal of interest from the participants.

The lecture given by Professor Ishikawa, the representative of the NPO Gomi-Japan, was evaluated highly by participants from Indonesia and Thailand (three persons for each country and an average of 4.7). By affiliation, both participants from local governments (two persons, 4.5 on average) and private organizations (one person, rating of 5) gave high evaluations. Professor Ishikawa is also a member of the Ministry of Environment's Plastic Resources Recycling Strategy Subcommittee. He provided new perspectives to the participants, such as on the handling of plastic products and containers and packaging from the perspective of life cycle assessment (LCA); environmental impact, including on the ocean, and economic impact; on the governmental establishment of laws and regulations, as well as the possible roles of multinational corporations and the private sector; and on Extended Producer Responsibility (EPR) and the responsibilities and initiatives of consumers.

5.2.2 Lessons Learned from Invitation Program

This invitation program was intended for manager-level participants and was planned on a limited schedule. A wide range of industry-government-academia-public initiatives related to the marine plastic waste problem led to the inclusion of many lectures and visits, resulting in a tight schedule. The participants said they were satisfied with the content, although they thought that each program was short. In every lecture, all of the participants actively asked questions, one after another; often, questions and answers had to be rounded up in order to remain on schedule for the next program (questions that could not be answered in time were sent to the lecturer by email at a later date, and answers were shared with the participants). On the other hand, as for the contents of the questions, each participant had a high level of expertise in their own organizations and fields; thus, when they gained an understanding of the technology and systems, their questions took on a greater depth. Each lecturer handled these questions in a courteous and respectful manner.

In addition, although it was possible to conduct an hour tour from the northern part of the Yokohama City sewerage center, some were of the opinion that it was better to take a little more time to fully explain the function of the facility and the history of the city's sewerage system.

Furthermore, the participants requested the following for a better program structure. In the future, when planning task-specific training, it will be desirable to have a program structure that has a relatively flexible schedule that meets these requests (Table 5-5).

Table 5-5 Request for Programs

Requests	Nationality of Respondents (# of persons)
Addition of more practical activities	Vietnam (1 person)
Addition of team building and group work	Vietnam (1 person)
Addition of more site visits	Thailand (1 person)
Shorten program in an effective way	Thailand (1 person)

5.3 Suggestions for Formulation of Future Thematic Training

In the future, the possibility of conducting another training can be considered, which aims to develop the capacities of participants to be able to develop marine plastic waste countermeasures on their own based on their own actual situations and development stages and in cooperation with other countries by sharing the knowledge, experience, and technology of Japan. Based on the opinions and requests from participants obtained from the invitation program, information contributing to the future planning is hereby compiled.

5.3.1 Types of Thematic Training

At present, government officials from each country have a clear awareness of the issue of marine plastic waste. There was a strong need in this invitation program to promote the resolution of issues such as policy formation/improvement, institution building, and the introduction of technology. In addition, since support from various donors is not organized or coordinated in the Southeast Asia region at present, it is necessary to promote international dialogue, including coordination and collaboration among donors

Therefore, among the types of thematic training (Table 5-6), it is desirable to set project goals and select trainees assuming the implementation of either “problem solving promotion type training” or “international dialogue type training”, or both types.

Table 5-6 Types of Thematic Training and Their Goals

Type	Basic Form of Program Goal	Trainees
Core human resource development type	Aims to improve the training participants' individual skills (general knowledge and the skills necessary to bring about change)	・ Decision-makers of central organizations such as national and regional governments ・Persons engaged in tasks that require a high degree of expertise
Human resource development type	Training of Trainers (TOT), which aims to change the organization and the group. It aims to train master trainers within the organization or to train and develop human resource personnel who are outside the organization.	・Mid-level job types with many employees engaged in similar tasks, such as teachers, nurses, and extension instructors
Problem solving promotion type	Aim to promote the resolution of organizational and social issues, such as organizational operational improvement, policy formation, and institution building	・ Decision-makers of central organizations such as regional and regional governments
International dialogue type	Japan will play a leading role in promoting international dialogue and networking on important issues.	・ Decision-makers of central organizations such as regional and regional governments

Source: Drafted based on JICA’s “Thematic Training Evaluation Manual” (April, 2008) (in Japanese)

5.3.2 Target for Training

Targeted trainees should be from countries where plastic waste emissions into the ocean are estimated to be at higher levels and where there is sufficient awareness of marine plastic issues, as described in Section 3.3 of Chapter 3.

In addition, the marine plastics problem involves various ministries and stakeholders in the national and local governments, such as environmental and resource recycling-related ministries, maritime-related ministries, and industrial-related ministries, as well as private chemical-related trade associations in each country. There are exceptional cases, such as in Indonesia, where a cross-ministerial coordinating team and a working group for issues are formed, with a secretariat and ministry in charge of donor agencies created. However, other countries are still in the process of development. Therefore, as in the invitation program, it is possible that cross-government initiatives may be promoted through training by allowing several participants from multiple ministries from each country.

For the selection of the training participants, it is desirable to select national and municipal government officials who are as close to policy decisions as possible, as well as those involved in private and business associations that influence government measures on this issue. Moreover, trainee candidates should be selected from among those who are leading or can be leaders in these tasks in each country, assuming that they can be points of contact for future regional cooperation and coordination among donors over a wide area.

5.3.3 Preparation

As mentioned above, the marine plastic waste problem involves a wide variety of stakeholders. For this reason, a questionnaire is distributed to the trainee candidates prior to the training to collect information on the status of plastic garbage outflow from their own country, the status of plastic material flow development, the presence/absence of a national action plan, the status of development, legal systems and regulations, budgetary measures, and support from other donors so that they can prepare a country report. A request is also made to the participants for a draft of an action plan to be implemented after the training at their organization.

In addition, for as long as it is possible, relevant ministries, stakeholders, and staff of overseas offices related to the issues will gather at the overseas offices in each country to hold a pre-training debriefing session. As a result, it is desirable that country reports, action plan proposals, and training targets be shared and coordinated among the trainee affiliations, stakeholders, and overseas offices.

5.3.4 Content of the Training

At the training in Japan, participants will give a presentation on marine plastic waste problems faced by their countries and their countermeasures based on country reports. They will also share their action plans. Moreover, through lectures, inspections, and practical training in Japan, participants will be asked to give input about Japanese public-private initiatives, technology, and knowledge. Finally, they will discuss and fine tune the action plan of each country/affiliation in a workshop format, presenting and sharing in its entirety.

(1) Challenges for Participating Countries

The following summarizes issues related to marine plastic waste management in each country (Indonesia, Thailand, Vietnam, and the Philippines), from information received from participants of this invitation program, to be used as a reference in considering future programs, such as thematic training.

The issues raised were categorized into the following four areas. (1) Waste Management Capacity: 14 cases; (2) Marine Litter (Marine Plastic Waste): 9 cases; (3) Plastic Recycling: 7 cases; (4) Industry: 2 cases (multiple answers allowed) (Figure 5-1).

Waste Management Capacity and Marine Litter have been raised as issues in all four countries; it is desirable that they be included as training themes in the future. On the other hand, Plastic Recycling is recognized only in Thailand and Vietnam, and the issues related to Industry are recognized only in Indonesia. It is possible for participants to choose between these, depending on the participants' countries and the type of organization to which they belong.

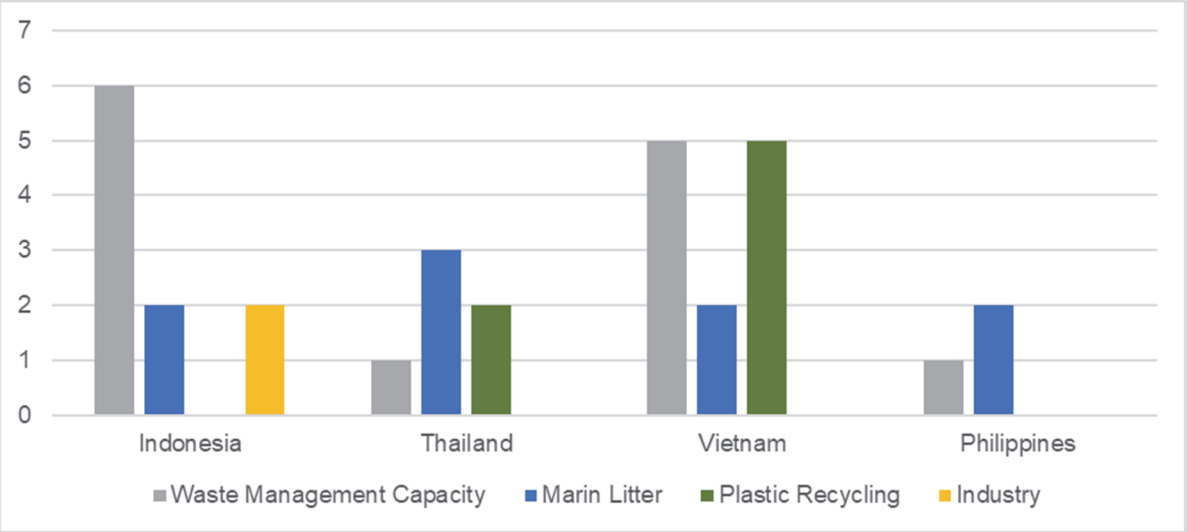


Figure 5-1 Issues Related to Marine Plastic Waste in Each Country as Considered by Participants in the Invitation Program

1) Waste Management Capacity

The largest number of issues were in the category of Waste Management Capacity, for which there were thirteen issues of six types raised from all four countries. Above all, four issues from three countries, Thailand, Vietnam and the Philippines, were cited as “Waste Sorting”.

In particular, local governments and the divisions within ministries in charge of environmental quality are required to promote plastic waste sorting, sorting at households, and separation guidance given by local governments.

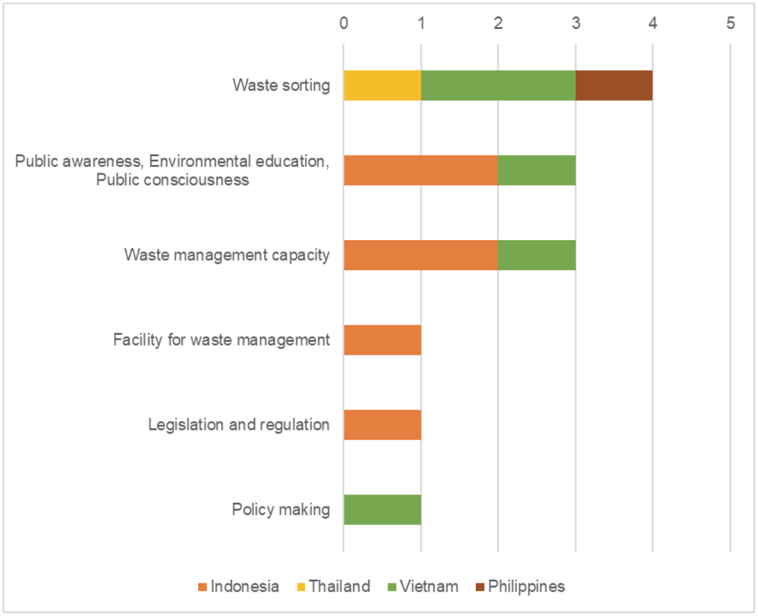


Figure 5-2 Issues in Waste Management Capacity

2) Marine Litter (Marine Plastic Litter)

The category with the next largest number of issues was Marine Litter (Marine Plastic Litter), for which nine were raised, of four types from all four countries. In particular, with regard to “Lack of Data, Assessment and Monitoring”, four issues were raised in three countries as challenges. It is considered necessary to gain a grasp of amount, source, type, manner of emission, and the state of disposable plastic after it has been discharged.

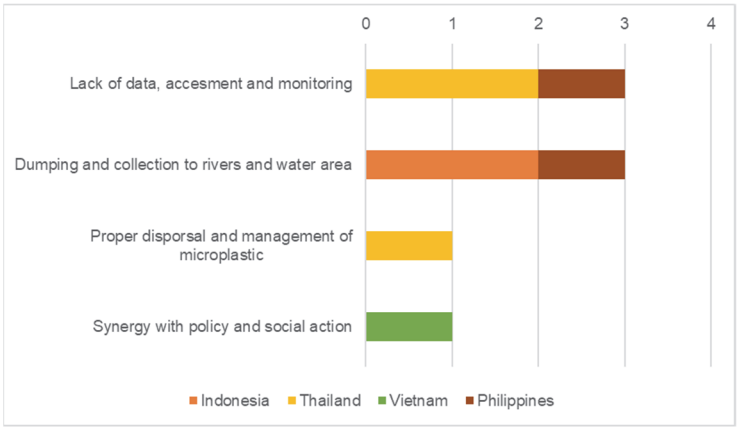


Figure 5-3 Issues in Marine Litter (Marine Plastic Litter)

3) Plastic Recycling

There were seven issues of five types in the area of Plastic Recycling, raised by two countries, Thailand and Vietnam. "Plastic Materials Unsuitable for Recycling" and "Development of Recycling System" have been identified as issues by both countries.

In Vietnam, inexpensive recycling technology in craft villages has been particularly viewed as an "Inappropriate Recycling Technology".

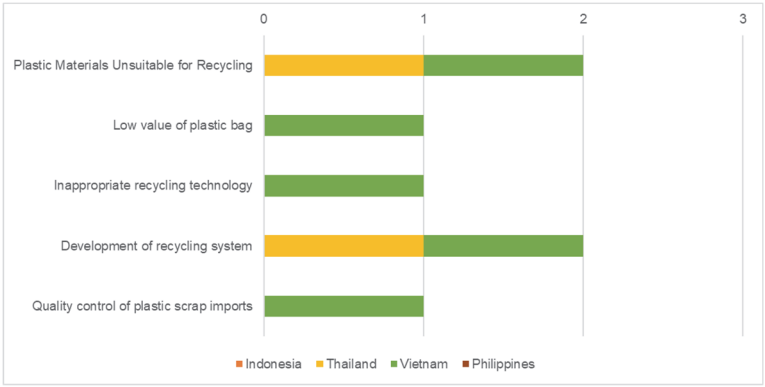


Figure 5-4 Issues in Plastic Recycling

4) Industry

Indonesia raised two issues in the category of Industry. Inadequate implementation of "Extended Producer Responsibility (EPR)" and "Differences of Perspectives" on plastic issues between government and industry.

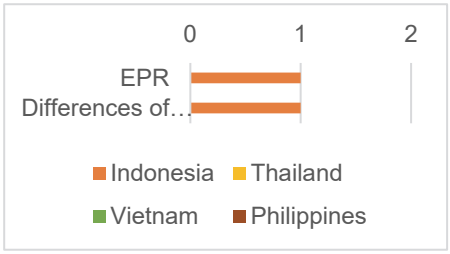


Figure 5-5 Issues in Industry

(2) Possible Contents for Training Program

As mentioned above, program participants evaluated the contents of the invitation program highly. The overall average was 4.11 in the evaluation of "Applicability of policies/systems/technologies to organizations/institutions in each country" (see Table 5-4). It will be more favorable to choose highly evaluated researchers and companies as candidates for lectures and site visit destinations in future thematic training.

On the other hand, the participants were asked in the questionnaire about subjects and contents to be added in order to further enhance the future training programs.

The answers received are classified and summarized as follows (Table 5-7).

Table 5-7 Needs of Additional Subjects and Content Candidates for Future Training Program Candidate Lectures and Site Visits

Needs of Participants	Country	Person	Total
Policies and regulations for marine litter	Indonesia	1	4
	Vietnam	2	
	The Philippines	1	
Activities of municipalities	Indonesia	2	3
	The Philippines	1	
Mobilization of local population (environmental education)	Indonesia	2	3
	Thailand	1	
Data collection and analysis methodology	Thailand	1	2

	The Philippines	1	
Extended Producer Responsibility (EPR)	Indonesia	1	2
	The Philippines	1	
Japanese history of recycling and a business model that enables a recycling-oriented society	Thailand	2	3
	Vietnam	1	
Litter and separation of litter generated from coastal and seafront activities	Thailand	1	2
	Vietnam	1	
Transborder actions	Thailand	1	2
	The Philippines	1	

Based on this classification, in addition to the lectures and site visits in the invitation program of this time, specific candidates for lectures and site visits that are desirable to be added are shown in the Annex F attached to the report in Japanese.

5.3.5 Post Evaluationaa and Follow-up

(1) Holding a Debriefing Session after Training

Upon the return of the trainees to their own countries, it is desirable to hold a debriefing session, inviting relevant ministries, agencies, stakeholders, overseas offices, other donors, etc. related to the marine plastic waste issue to present what was learned in the training and updated action plans. At that time, trainees, their senior managers, and overseas office staff will evaluate the results and effectiveness of the training. Feedback will be given regarding the contents to the Human Resource Department and the Training Center, and will be used for the improvement of the training the next time.

The overseas office regularly monitors the progress of the returnees' action plans, and follows up if necessary while gaining a grasp of barriers, needs, and changes in personnel and organization.

(2) Formation of Returned Trainee Network

As described in Chapter 2, Section 2.1, since marine plastic waste often flows out of international rivers such as the Mekong, Ganges, and Amazon, and drifts across national borders, more regional and international cooperation is required. It is desirable to build a network to deepen cooperation and collaboration among returnees who are working on similar issues, as well as with JICA and Japanese stakeholders, using mailing lists and social media, taking the opportunity provided by thematic training.

Utilizing this network, the returned trainees can monitor the progress of each action plan, share good practices and lessons learned, exchange information on Japanese technology, research, and initiatives by Japanese companies, local governments and civil society. Moreover, they can make inquiries and share information with the Japanese lecturers and experts. In addition, this network is expected to be the foundation of a human network in cooperation with JICA and Japan in the field of marine plastic waste countermeasures. Through this network JICA and Japan will be enabled to quickly identify the needs and projects of each country in the future, to conduct assessments from multiple perspectives including on site, to collaborate with other donors, and to conduct monitoring and evaluation.

Chapter 6 Implementation of Seminars and Publications

6.1 Objectives of Seminars and Implementation Schedules

During the present survey, the following seminars were organized.

Table 6-1 Seminars Organized during the Survey

	Date	Objectives	Target Group
1st Seminar	July 9	• Presentation of interim report 1	• JICA officers (including overseas offices)
2nd Seminar	September 10	• Findings of the field survey in the four countries • Presentation of activities by the major donors • Presentation of the selection result of countries for future assistance consideration • Presentation of proposed assistance for the selected countries • Presentation of the plastic waste management technologies in Japan • Presentation of the organizations from which the participants were to be invited to the invitation programs	• JICA officers (including overseas offices)

6.2 Seminar Materials

The seminar materials (in Japanese) are shown in Annex D attached to the report in Japanese.

6.3 Results of Seminars (Questions and Answers)

6.3.1 The First Seminar

Questions	Answers
■Definition of plastics, synthetic fibers and microplastics, technology for microplastic collection What is the definition of plastics? What kind of materials are included in the plastic waste issue and to what extent?	Plastics refers to resin (synthetic resin in general) and it is called plastic because of its nature of plasticity. Plastics has many kinds such as polypropylene and Polyethylene, and most are made from petroleum.
Some data show that the synthetic fibers are flown out from laundry and some others do not. In fact, what is the percentage of the synthetic fibers to the total marine plastics and to the whole microplastic issue?	There is data indicating that the ratio of synthetic fiber from laundry to microplastics is the second largest, but it is still under research and is estimated data, so there is room for consideration.
Is there any means to collect microplastics form the sea reasonably? Or should we just give up and stop the spill on land?	Since microplastics are so small (smaller than 5 mm) and so dispersed due to the current effect, it is difficult to collect them. The reduction of plastic release on land should be prioritized and realistic, as far as we know.
■Japan's incineration technology and development assistance It was mentioned that Japan has an advantage in incineration technology, but can it be used as an effective tool of development assistance even in	At present, many local governments in Japan have developed a sanitary waste management system, which processes valuable plastics by recycling and laminated and unsanitary plastics by incineration. This consequently contributes to reducing waste plastics flowing into the ocean.

Asian countries, where a large amount of wet waste is generated? Also, if you have any points to consider when providing assistance to developing countries regarding incineration, please let us know.	In Southeast Asia, we feel that the need for incineration has increased considerably due to the difficulty in securing land for new disposal sites and the need for sanitary treatment. As a high-quality environmental infrastructure, the development of waste incineration facilities can be a candidate.
■JICA's assistance in the field of waste management Based on your experience in this field, do you feel any shortcomings in regard to the current JICA's project operation, terms of reference, and other thins?	There is often a focus on 3Rs, but 3Rs do not solve all waste management issues. The marine plastic problem seems to have stemmed from a part that has not been touched up to now. As mentioned earlier, the problem of marine plastics is the problem of stocks already flowing into the ocean and the problem of flows discharged from the terrestrial area, and there is an option to focus on which of these to support. For each option, there will be appropriate approaches that JICA should take.
Marine plastic measures are being promoted as part of Japanese policy. Where are the needs of developing countries and how are they addressing the issues?	Although marine plastic is a hot issue, it is a problem that has emerged suddenly in recent years, so during the field surveys, it is important to first grasp which organization is in charge of marine plastic measures, and to investigate needs and targets in the future. At this time, it is assumed that the organizations relevant to land-based waste management or the marine conservation will be the major targets for assistance. When we visit there, we want to know to what extent the countries need assistance for marine plastic issues and what are their recognition about the marine plastic generation estimates.
■Japan's technology to be introduced during the invitation program It was mentioned that Japan has advanced incineration technology, but I personally do not think that incineration alone is the only answer. I feel that there are things that can be done on the side of users or on the upstream side, so I hope that Japanese advanced technologies of such kinds will be also introduced during the invitation program.	We plant to include various technologies, which includes those in the upstream such as material substitution, in the invitation program, so that it can be more comprehensive.
With the amount of microplastics and waste plastics flowing into the sea and their outflow routes unknown, I feel it is difficult to take countermeasures. There is a wide variety of plastics, some of which are close to our daily life, and plastics are used in a very wide range of products such as PCs, automobiles, and airplanes. I hope that we can carry out a waste management project that can clearly be said to be contributing to marine plastic.	It is imagined that most of the plastic flows from canals and rivers to the sea. It is also assumed that there is a certain amount of waste flowing from low-lying landfills. When it comes to providing some kind of support, I feel that clarifying the spill volume and route is one of the first issues to be dealt with.

6.3.2 The Second Seminar

Questions	Answers
Facing the Mekong River, Laos is considered to be a marine plastic emission country, but why is it not selected as a recipient country? Also, how do you think about the responsibilities of the administration and citizens in the occurrence of ocean plastic?	The Mekong River ranks high as a marine plastic discharging river, but it is thought that the contribution of Laos is not so high because of its small population. Both the government and citizens must play their respective roles.

Regarding assistance project proposals, it is questionable whether it is enough to follow the country's action plans. Also, what is the difference between JICA's conventional waste projects and marine plastic projects?	The projects for marine plastics will focus on the small and medium cities with a big challenge in waste collection, which largely controls whether plastic litter becomes “marine litter” or not.
Can we make a difference from the conventional waste management support? A small city or along the coast is one way to go, but it looks the same as before.	Support for the introduction of eco-design of products, the management of marine-derived waste, and the development of waste reception facilities at ports can be considered.
Environmental pollution in recycling villages is a major problem in Vietnam. It is an area that cannot be easily reached by the government, but is there any clue for support?	In the recycling village, a large amount of microplastic is discharged in the washing water that is used after crushing the plastic, and there is no exhaust gas measure. Recycled plastics are always in price competition with virgin raw materials, so it would be very difficult to spend money on such environmental measures.
In the Philippines, even though a good plan can be made, the local government's ability to implement it is lacking. How other donors are responding to this?	As for the marine litter projects, most are designed regionally and activities towards local governments will be limited to pilot activities.
Can we consider assistance for the ASEAN region?	We will further develop assistance proposals taking it into account.

6.4 Publication Materials

The publication material is drafted as shown in Annex C attached to the report in Japanese.

References

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