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Plastic Waste Management in Asia Pacific Region : Issues and Challenges

Annes Elsa Francis, Sunil Herat

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ABSTRACT

Rapidly growing plastic usage and its subsequent release into the natural environment significantly increase the amounts of plastics entering oceans and require urgent action on a global scale. As the world's fastest-growing economies, Asia-Pacific countries have a very high material footprint as well as a plastic footprint. Massive urbanization, rapid industrialization and changing production and consumption practices made many countries in the region as the world's most significant contributors of plastic litter. According to studies, around 60% of the total mismanaged plastic waste is coming from the region. In this paper, a few common challenges faced by these countries inadequately managing their plastic waste are identified. This includes inefficient waste management systems, high rates of informal waste picking and treatment and insufficient waste legislations. It is also found that the primary cause of marine plastic pollution is unsustainable human activities and the significant pathways of land-based plastic litter to the oceans are rivers.

Keywords: Marine litter, Marine plastics, Asia-Pacific region, Plastic waste management, Plastic leakage.

INTRODUCTION

Despite their high significance, oceans are now encountering various persisting and wide-reaching threats. Among this, the most pressing problem is marine litter arising from both land and sea-based sources. Marine debris consists of all objects that do not naturally present in the coastal environments such as the shorelines, seabed, water column and water surface but are nevertheless found there (UN Environment Program 2019). If not adequately managed, any human-made material that does not deteriorate naturally within a short period can become a source of marine litter (Grida.no 2016). Studies show that the most significant producers of marine debris are humans. Human activities like intentional or unintentional dumping of waste in freshwater sources and

Annes Elsa Francis
Postgraduate Student, School of Engineering and Built Environment, Griffith University, Queensland 4111, Australia
Email : anneselsa.francis@griffithuni.edu.au

Sunil Herat*
Associate Professor, School of Engineering and Built Environment, Griffith University, Queensland 4111, Australia
Email : s.herat@griffith.edu.au
*Corresponding author

coastal environments and leaving unwanted materials in seashores and on beaches during recreational activities are considered as the principal causes of rising marine pollution. The abundance of consumer items like plastic food wrappers, plastic bags and bottles, straws, stirrers, cigarette butts, rubber thongs and cosmetic products in the marine environments prove the massive involvement of humans in the generation and accumulation of marine litter (United Nations Sustainable Development 2016).

Plastics and plastic related materials constitute more than 80% of the total marine litter present in the environment today and according to the UN, seven out of the top ten marine litter items are made of plastic polymers (United Nations Sustainable Development 2016, Carney Almroth and Eggert 2019).

It is expected that, by 2025, oceans might carry one tonne of plastic waste for every three tonnes of fish. Hence, if not carefully managed and no proper preventive measures are taken immediately, within five years, there will be more plastics in oceans than fish by weight, which will cause severe ecological, economic, cultural and health impacts worldwide (Www3.weforum.org 2016). Besides, since the effects of plastic litter often occur in places that are far away from the points of its source, marine plastic pollution is becoming more sophisticated and unpredictable with each day.

Rapid population growth, fast urbanization, quick industrialization and changing lifestyles significantly increase the consumption of resources in the region, which in turn leads to enormous amounts of waste, mainly plastic waste. With the region's plastic waste production is expected to reach 140 million tonnes by 2030, Asia-Pacific is facing numerous challenges in managing their increasing amounts of plastic waste (UNCRD 2019).

Most of the region's plastic waste except for developed countries like Australia, Japan and Singapore, is not adequately managed. It is thus threatening to the land and coastal environments with linkages to livelihood problems. This mismanaged plastic is the primary source of global ocean plastic pollution and its scale is a reason for serious concerns. More than 70% of the global mismanaged waste is coming from the Asia-Pacific region, with the top eleven countries in which mismanage plastic waste is from the region. Besides, eight of the top ten litter contributing rivers are in Asia (Gray 2018, UNCRD 2019). All of these factors make the region the center for marine plastic pollution. Hence, it is of fundamental importance to form systematized and well-coordinated strategies and measures to manage and prevent the production, consumption and disposal of plastics in the Asia-Pacific countries. According to studies, by reducing 65% of plastic leakage from just five Asia-Pacific countries: China, Indonesia, Philippines, Thailand and Vietnam can reduce total global plastic leakage by approximately 45% by 2025 (McKinsey and Company 2017, Shuker and Cadman 2018).

This paper aims to assess the production, consumption and management of plastic in the Asia-Pacific region to find out the common issues faced by the region's plastic waste management sector by analyzing a few countries.

Plastic production and consumption

In 2019, annual global plastic production surpassed 380 million tons, almost the same as the weight of the entire human population (Plasticseurope.org 2019, Ritchie and Roser 2019). So far, a total of 8.3 billion tons of virgin plastics have been produced in the world using 4 to 8% of the world's total oil production and among this, around 6300 metric tons came out as plastic waste since 2015. If the current trends and methods of production and waste management continue, the amount of plastic waste will reach almost 12,000 metric tons by 2050 and consumes 20% of the world's oil production (Geyer *et al.* 2017).

Two types of plastics run the plastic industry; Thermoplastics and Thermosets and the global plastic production is dominated by thermoplastics such as polypropylene (PP), low -and linear low-density polyethylene (LDPE and LLDPE), high-density polyethylene (HDPE), polyvinyl chloride (PVC), polystyrene (PS) and polyethylene terephthalate (PET) mainly due to its reversible characteristics. These are also the major types of plastics used in the packaging industry

Table 1. Plastic waste in the World's Oceans (Gray 2018).

Ocean	Count (trillion)	Weight (tons)
North Pacific	1.990	964.0
South Pacific	0.491	210.2
North Atlantic	0.930	564.7
South Atlantic	0.297	127.8
Indian Ocean	1.300	591.3

and therefore, they are produced abundantly and consequently, making them the most likely ones to end up in the oceans (Andrady 2011, Hahladakis *et al.* 2018).

Only 14% of the total plastic packaging is recycled every year and only 5% of their material value is kept for future use after sorting and reprocessing. This results in a loss of 80 to 120 billion USD each year to the economy. Besides, the rest of the packaging materials can end up in our natural environments and oceans as pollutants (Ellen MacArthur Foundation 2017).

Marine plastic litter

Leakage of plastics into the natural environment can happen at any stage of its production-use-disposal cycle; however, it can reach oceans mainly through weak solid waste management systems and inadequate wastewater treatment processes (UNEP 2016). Three-fourths of the total plastic leakage comes from land-based sources and originates from uncollected rubbish, while the rest originates from within the waste collection systems itself (McKinsey and Company and Ocean Conservancy 2015). Table 1 shows the marine plastic litter distribution in world oceans.

As per the World Economic Forum, between 4.8 and 12.7 million metric tons of plastics reach oceans every year, making a current total of more than 150 million metric tons. This amount is equal to disposing of the rubbish of one garbage truck each minute into the ocean. Without proper action, this is expected to increase furthermore in the coming future as two per minute by 2030 and four per minute by 2050 (Ellen MacArthur Foundation 2017).

In marine environments, plastics can undergo different types of degradation processes due to the combined action of atmospheric oxygen, sunlight and seawater. These degradation processes can be of five kinds: Thermooxidative degradation, hydrolytic degradation, biodegradation, mechanical degradation and photodegradation. Among this, photodegradation is the most prevalent in coastal environments due to UV radiation's presence. However, degradation processes are slower within water due to a fall in temperatures and limited UV penetration, which leads to the accumulation of plastic debris in ocean depths (Niaounakis 2017). However, the processes mentioned above disintegrate plastic waste into varying sizes, namely: Macro, meso, micro and nano plastics and among these, the most common ones are microplastics. It can be of two types, primary and secondary. Primary microplastics are those which are produced as microbeads, capsules, or fibers and commonly found in hygiene or cosmetic products or as plastic pellets that used as raw materials in the plastic industry or air-blasting media whereas the fragmentation of more abundant materials through the processes mentioned above produces secondary microplastics (Cole *et al.* 2011, Thompson *et al*. 2016).

The size of microplastics are varying between studies, however many authors and the National Oceanic and Atmospheric Administration (NOAA) have defined it as particles smaller than 5 mm diameter (Barboza and Gimenez 2015, Van Cauwenberghe *et al.* 2013,Thompson *et al.* 2016, Nguyen *et al.* 2019). This smaller size gives it a high surface area for sorption of contaminants and the potential to translocate in the bodies of organisms (Grida.no 2016, Nguyen *et al.* 2019). Its small size makes it challenging to identify and separate them from the environment and hence, to understand its quantity, environmental prevalence and potential threats became complicated. Therefore, plastics can remain in the oceans for hundreds or sometimes thousands of years in their original form and can persist even longer as disintegrated fragments and can go unnoticed (Grida.no 2016).

Impacts of plastic litter on marine animals and other aquatic life

Marine debris is not only aesthetically undesirable but also harmful to virtually all marine species and ecosystems. In a broader context, potential impacts of marine plastics can be categorized in three major areas; injury

or death to marine life, harm to the coastal and marine environment and dangerous to human health and economy (Agamuthu *et al.* 2019) The first two are relevant in this paper and hence discussed in detail here.

Impacts of plastic litter on marine life and the ecosystem are determined by type, size, quantity and frequency of occurrence of debris (Rochman *et al.* 2016). However, these effects can be extremely dangerous and wide-reaching and among them, the most noticeable, disturbing and harmful impact are related to ingestion and entanglement (Gall and Thompson 2015, IUCN.org-Issues Brief - Marine Plastic 2018). Globally, more than 800 marine species,including seabirds, marine turtles, whales, fishes and other reptiles are affected through the ingestion and entanglement of marine litter (Csiro.au 2019, United Nations Sustainable Development 2016). According to data, the very first incident of entanglement was reported in Cojimar Bay in Habana Harbour in 1931, where a shark was seen entangled in a rubber automobile tire (Gudger 1931, van Truong and beiPing 2019). Since plastic and other synthetic materials became common in fishing equipment as well as in beach recreation activities, entanglement of marine animals in ALDFG, ghost fishing and single-use plastic products became a huge issue. Entanglement can restrict the mobility of marine animals which will lead to smothering, interruptions in feeding, starvation and eventually drowning. It can also result in physical trauma and infections in animals as the gear cut into their flesh, causing life-threatening injuries and ultimately death (NOAA 2014, NOAA Fisheries 2017).

Plastics that are highly persistent in marine conditions, particularly in the form of micro- and nano plasticscan be ingested by marine life, especially seabirds and fishes and can travel throughout the food chain. These plastic materials which contain many harmful chemicals like persistent organic pollutants and endocrine disruptors, can cause serious harm to marine animals (Gallo *et al.* 2018). Accumulation of microplastic particles in marine animals can cause health issues such as blockages in the digestive system, starvation and physical deterioration, which eventually results into a lack of reproductive fitness, weakness in feeding ability, reduced predator avoidance and even drowning (Wright *et al.* 2013). In addition to the internal accumulation of debris, external adsorption of plastic particles, specifically nanoparticles may obstruct algal photosynthesis by physically blocking air and sunlight while increasing reactive oxygen species production. Microplastics can also lead to reduced availability of nutrients in microalgae (Bhattacharya *et al*. 2010, Prata *et al.* 2019).

Moreover, plastic debris can promote the spreading of nonindigenous species by supporting its growth by being a new safe habitat for them to survive. The distribution, characteristics and life span of plastics are different from that of the natural substrate like wood and microalgae, helping invasive species to develop, persist and even breed in them. Later these plastic debris items can act as a medium of transport by taking flora and fauna attached to it into faraway places where it is foreign and can become aggressive and harm the local ecosystem (Garcia-Vazquez *et al*. 2018, GESAMP 2016).

Why it is important to tackle marine plastic litter

Covering almost 72% of the earth's surface, oceans regulate earth's temperature and climate patterns, generate much of the oxygen we breathe and provide food for more than three billion people in the world (UNEP (n.d.) 2016). While keeping people all around the globe connected and apart, oceans stay as the foundation for most of the world's largest economies (UNEP - UN Environment Program 2019). However, the increasing amount of ocean litter and other unsustainable human activities taking place in marine environments prevent oceans from providing the above-said services. With more than 8 million tonnes of plastic reaching oceans every year, plastic litter cause irreversible damage to ocean life and marine ecosystems. Due to its durability, abundance and persistence, plastic litter has become a major environmental problem and a public health concern of our century. The volume of plastic coming into the sea are expected to increase in the coming years if countries around the world failed to take adequate measures to manage their growing rate of waste (Alpizar *et al*. 2020, Tibbetts 2015). This will result in economic, cultural, aesthetic, environmental and health impacts world-

wide, including degradation of marine and coastal habitats and ecosystems, which will cause substantial socio-economic losses in maritime nations and marine industries (Unenvironment.org (COBSEA) 2018).

Marine plastics in Asia-Pacific region

According to studies, the top eleven countries which mismanage plastic waste comes from the Asia-Pacific region and are China, Indonesia, Philippines, Vietnam, Sri Lanka, Thailand, Malaysia, Bangladesh, India, Pakistan and Myanmar. Mismanagement and resulting leakage of plastic waste into more extensive environments create immense pressure on the finite natural resources of the region, including aquatic and marine ecosystems (UNCRD 2018, UNESCAP 2019).

During 2014, Asia-Pacific's total annual municipal solid waste (MSW) generation was 870 million tonnes, with an average of 1.4 kg per person per day. This accounts for almost 43% of the total global MSW production and within this plastic waste constitutes 8-12% (UNCRD 2019). The entire MSW generation of the region is expected to reach 1.4 billion tonnes a year by 2030 with 1.6 kg per capita per day and the subsequent plastic waste generation is assumed to reach 140 million tonnes (UNCRD 2019). Within the region, East Asia and the Pacific countries are the biggest generators of waste in the world by producing 468 million tonnes of waste in 2016, at an average per capita rate of 0.56 kg per day. At the same time, South Asia generated 334 million tonnes of waste at an average of .52 kg per person per day. Almost half of the total global plastic is produced by Asia and is recognized as the world's largest waste-producing continent. Within Asia, China and Japan lead the plastic production with a rate of 29.4% and 3.9% of total plastic production, respectively and the rest of Asia produces 16.8 % of global plastics (UNCRD 2019). It is estimated that 1.7 to 4.9% of plastic waste generated on land becomes marine litter. If this rate continues by 2030, 2.3 to 6.4 million tonnes of plastic waste will reach the oceans from the Asia-Pacific region alone (UNCRD 2019).

According to studies, reducing 65% of leakage from five focus countries: China, Indonesia, Philippines, Thailand and Vietnam can reduce total global plastic leakage by approximately 45% by 2025 (McKinsey and Company 2017, Shuker and Cadman 2018). Table 2 shows the contribution made to marine litter by top plastic generating countries in the Asia-Pacific region.

Plastic waste management inselected countries
Indonesia

Plastic production in Indonesia is rising at an annual rate of 4% and has increased from 2.3 million tonnes in 2013 to 2.9 million tonnes in 2017. At the same time, yearly plastic consumption showed a growth rate of 6% and has risen from 4 million tonnes in 2013 to 4.9 million tonnes in 2017 (UNCRD 2019). The 40% of Indonesia's total plastic demand is met by importing plastic from foreign countries and the major plastic consuming sectors of the country are packaging, which accounts for 49%, followed by construction and automotive industries (UNCRD 2019).

Table 2. Estimated quantities of mismanaged plastic waste entering the ocean from the top polluters (UNCRD 2018).

Country	Waste generation rate (kg/person/day)	Coastal population (million)	Mesmanaged waste (%)	Mismanaged plastic waste (million tonnes/ year)	Mismanaged plastic waste (%)	Plastiic Marine debries (million tonnes/ year)
Bangladesh	0.43	70.9	89	0.79	2.5	0.12-0.31
China	1.10	262.9	76	8.82	27.7	1.32-3.53
India	0.34	187.5	87	0.60	1.9	0.09-0.24
Indonesia	0.52	187.2	83	3.22	10.1	0.48-1.29
Malaysia	1.52	22.9	57	0.94	2.9	0.14-0.37
The Philippines	0.5	83.4	83	1.88	5.9	0.28-0.75
Vietnam	0.79	55.9	88	1.83	5.8	0.28-0.73
Thailand	1.2	26.0	75	1.03	3.2	0.15-0.417

Indonesia produces around 5.4 million metric tons of plastic waste every year at a rate of .52 kg per capita per day. Among this, only 39% is collected on average and in rural and remote areas, these rates are as low as 16% (Pandjaitan 2020). Out of the total plastic waste generated every year, around 3.2 million metric tons are mismanaged and approximately 1.29 million metric tonnes are estimated to reach oceans as marine litter making the country the second-largest donor of plastic waste into the oceans (Indonesia-Investments 2019, McCarthy 2020, Syakti *et al.* 2017). Composition of Indonesia's marine debris is found to be influenced by local lifestyles and behavioral patterns and commonly contains synthetic materials like plastic bags, fishing accessories, food wrappers, bottles, cans, footwear, polystyrene, polyethylene and other remains of glass and plastics (Purba *et al.* 2019, Syakti *et al.* 2017). Plastic waste is not only found in Indonesia's oceans, but also its rivers and Indonesia is home to four of the top 20 polluting rivers in the world (Anne Jones 2019,Indonesia-Investments 2019, Purba *et al.* 2019).

China

As the world's largest manufacturing economy and exporter of goods, China is the largest producer of plastics with an average of 60 million tons per year, which accounts for nearly 29.4% of the total global plastics production (Ritchie and Roser 2019, Statista 2020, UNCRD 2019). Plastic production in China was growing at a rate of 7.4% annually and increased from 54.5 to 72.67 million tons between 2013 and 2017 while plastic consumption showed an annual growth rate of 5.1% and increased from 70.2 to 88.12 million tons during the period (Chen *et al.* 2020). In 2015, the nation's total plastic usage reached 1.4 times that of Europe and 2.6 times that of the United States. China recorded its highest material consumption of 35.2 billion metric tons in 2017 (Chen *et al.* 2020, UNCRD 2019).

China is also recognized as the world's largest trash generator by producing more than 15% of the world's total global municipal solid waste volume (Statista 2020, UNCRD 2019). Besides, the country is responsible for producing nearly 30% of global plastic waste (Garcia *et al.* 2019). Growing coastal population, increasing plastic usage and inefficient and under-invested waste recycling sector are the main reasons behind China's growing plastic waste generation. Besides, once the largest importer of plastic waste, studies show that China had imported an aggregate of 45% of the global plastic waste between 1992–2016 (Garcia *et al*.2019, Chen *et al.* 2020). The rapidly growing delivery and takeaway food industry in the country triggers a sudden rise in the nation's plastic usage. The packaging sector uses 42.1% of the total plastic resins. It is estimated that in 2017, the food industry consumed more than 60 million plastic cartons and the food delivery processes used 14.7 billion plastic bags (Chen 2018). The construction sector, with 22.4%, followed this, the automotive industry with 7%, the electrical, electronics and telecom sectors with 6.7% (UNCRD 2019).

In China, rivers act as the significant pathways of plastic to oceans as regions near to estuaries with substantial river runoff and highly populated watersheds are major plastic litter hotspots. China's Yangtze River catchment is recognized as the most polluting river catchment in the world and marine litter frequencies, rated as "extremely dirty" in the Yangtze Estuary, were almost 100% (Alkalay *et al*. 2007, Chen *et al.* 2020). Microplastics forms of polymers such as polyethylene, polyesters, polyethylene terephthalate and polystyrene are the most abundant types of plastics seen in China's marine waters (Qiu *et al.* 2015). According to the beach cleanliness assessment conducted by the Ministry of the Environment, Marine and Coastal Environment Division of Israel in 2018, almost half of China's beaches can be named as "extremely dirty beaches" and the ratio of it to "immaculate beaches" was only 8.5% (Alkalay *et al.* 2007).

Japan

Japan is the second-largest plastic producing country in Asia by providing 3.9% of total global plastic production (UNCRD 2019). In 2018, approximately 5.88 million tonnes of plastic products were produced in Japan. The major categories of processed plastics production are films and sheets, including bags, packaging and sheeting for construction and building materials (Statista 2019a-d,Yolin 2015).

Japanese total resin production in 2018 was 10,670-kilo tonnes, while domestic plastics consumption was 10,290-kilo tonnes. Complete plastic waste created during the same year was 8,910-kilo tonnes, with 4,290-kilo tonnes of household plastic waste and 4620-kilo tonnes of industrial plastic waste. The quantity of plastic waste that was effectively used was 7,500-kilo tonnes making for an effective plastic utilization rate of 84% in the year (Plastic Waste Management Institute 2019). Japan has also been reported previously to export around 1,500-kilo tonnes of plastic waste per year to overseas destinations as a resource with the majority going to China (Plastic Waste Management Institute 2019). Since the plastic import ban by China and other Asian countries, it has become a necessity to create more domestic resource recycling facilities and this leads to many advancements in Japan's plastic waste management system in the last few years (The Sasakawa Peace Foundation 2019).

As an early adopter of the 3Rs (Reduce-Reuse-Recycle), Japan handles most of its waste correctly. The primary recycling method used in Japan is mechanical recycling, which produces new plastic products from plastic waste (UNCRD 2019). The amount of plastic waste used in mechanical recycling as raw materials were 2,080-kilo tonnes in 2018, comprising of 710-kilo tonnes (17%) of domestic plastic waste and 1370-kilo tonnes (30%) of industrial plastic waste (Plastic Waste Management Institute 2019).

Challenges facing Asia-Pacific countries in managing plastic waste

When plastic waste is not effectively managed on land, it may enter natural waterways and can eventually reach oceans. Waste leakage hotspots are mainly found in three land-use types: Beach and recreation areas; human settlements and industrial zones and urban areas. Settlements, particularly with less educated people and the residential regions with drainage channels connected to nearby rivers or canals, are most likely to pollute the water flow followed by illegal discharge from industries. These wastes are carried to the oceans mainly by waterways in the region. For example, the presence of waste leakage hotspots along riverbanks is familiar in countries like China and Indonesia. The Yangtze River of China takes an annual average of 0.33 million tonnes (333,000 tonnes) of plastic waste into the oceans. At the same time, Indonesia is home to four of the top 20 most polluting rivers in the world; Brantas, Solo, Serayu and Progo which respectively emit an average of 38,900, 32,500, 17,100 and 12,800 tonnes of plastic every year to oceans (Anne Jones 2019, Indonesia-Investments 2019, Purba *et al.* 2019). Marine plastic litter can be identified as an essential part of the broader problem of poor waste management. When there is an absence of a proper waste management system in a region, waste reaches the oceans and causes pollution. Many Asia-Pacific countries still lack adequate waste management systems in every stage, from the source of the waste to its final disposal. The significant challenges faced by the waste management systems of these countries are the lack of waste segregation and insufficient collection services. According to data, only 45 to 50% of Indonesia's urban solid waste is collected effectively with significant variations among places, such as 98% collection and transfer in West Jakarta and 15% in South Tangerang. When it comes to plastics, out of the total 5.4 million metric tonnes of plastic waste produced annually, only 39% is collected and in rural and remote areas, these rates are low as 16% (Pandjaitan 2020). Within the collected solid waste, around 81% goes unsorted and another 10% is sorted but will end up remixed, making recycling processes difficult. Therefore, most of the plastic waste in the country, particularly from rural places, goes to landfills or leak into the ocean. Besides, Indonesia's waste management sector is heavily subsidized by local budgets. It receives only below-average funding of 5-6 dollars per capita per year allocations, where the international rates are 15-20 dollars per capita per annum. This limited funding is not enough for the proper strengthening of the waste management systems across the nation. Besides, this can cause a lot of inefficiencies, such as lack of infrastructure, failure to upgrade into modern techniques and much higher operating costs for the available systems. Moreover, the lack of capacity in local governments significantly reduces confidence and increases risks among private investors.

Consumers play the most significant role in a country's waste management. Even though the

population near coastlines as well as considerable litter hotspots have diverse ethnicity, employment status and duration of residency, communities from lower economic situations usually have poor and inadequate waste management services. Limited waste disposal facilities and services in these areas, together with a lack of knowledge and awareness about proper waste disposal methods among the residents, increase the magnitude of the problem.

Many studies suggest that people with education and with higher environmental attitudes show more robust plastic avoidance. Moreover, the majority of mismanaged plastic comes from household waste and food packaging, including bottles, bags and eating accessories. Therefore, providing consistent public information or campaigning about waste management can help in tackling plastic waste leakage (Heidbreder *et al.* 2019).

Vast quantities of plastic in waterways and oceans indicates that current systems of waste governance are not good enough for the effective management of plastic waste. This failure of governance includes a lack of appropriate legal and regulatory frameworks for waste management, insufficient taxation systems for waste disposal and failed enforcement of available laws and policies. Besides, current strategies and plans show no or very little importance to the waste issues in the upstream sides of pollution, such as river basins, which is the critical pathway for plastic leakage to the oceans. Moreover, current regulations, policies, investments and other waste management measures are distributed among various sectors and stakeholders and lack coherence.

Both formal and informal sectors perform solid waste collection in Asia-Pacific countries; however, the informal collection constitutes the majority. These waste pickers form the foundation of the informal waste management sector in these countries. Unfortunately, the unmanaged waste collection activities performed by people with less knowledge about the consequences of unsafe waste management is a challenge to implement a standardized waste treatment system in these countries. Waste pickers usually sort out the collected trash and left the unwanted materials on landfills, open dumpsites, or sometimes even in the streets, which can leak into drainage systems and other waterways and can reach oceans in the end. Besides, rummaging through the waste without proper safety measures can cause severe health issues in these waste collectors (Zhang *et al.* 2010).

CONCLUSION

Poor and inadequate waste management practices and the failure to appreciate the potential uses of plastic waste as raw materials for new products along with the lack of awareness among the public regarding the consequences of casually discarding plastics in natural environments fuelled the growth of marine plastic pollution in the past few decades. Since plastics are made in various diversities and compositions to last forever, it is more likely to remain as a significant environmental problem for the coming decades. Today, the dangers of ocean plastics are restricted to marine life, or marine ecosystems and the potential threats of plastics are finding its way back to humans through the food chain.

Preventing plastic from entering the natural environments is likely to be far less costly and practical than getting rid of it once they are there. The first step to achieve this is to avoid the overall plastic contamination by reducing the production and use of plastic products followed by reusing and recycling plastic materials as long as possible and developing efficient waste management systems. This requires significant changes in the current production and consumption practices of plastics as well as need enhanced collaboration among different countries, organizations, businesses and individuals.

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