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Micro Plastic Pollution in South Asia: The Impact of Plastic Pollution over the Unsustainable Development Goals

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Abstract. One of the most pressing environmental issues facing the world right now is plastic waste. Once in the environment, plastics continuously degrade into microplastics, which are fragments of plastic. There are more national and international promises to reduce microplastic pollution as the world's plastic production rises. National governments are increasingly banning single-use plastic products or imposing taxes on them. Consider the UN Sustainable Development Goals, the UN Environment Assembly Resolutions on Marine Litter and Microplastics, and Addressing Single-Use Plastic Products Pollution as examples of these commitments. In 2015, the UN announced the adoption of 17 Sustainable Development Goals (SDGs). In an effort to increase their sustainability, the SDGs have been extensively adopted by governments and businesses. There are 17 SDGs, comprising 169 targets, which are measurable against 247 unique indicators but there is only one indicator under Goal 14, specifically related to reducing impacts from microplastics. There are various international and regional legal policies which have provisions that indicate plastic pollution but none of them have mentioned microplastic pollution. There are some recent national legislations regarding microplastic pollution. This paper briefly discusses the concept of microplastics and the situation of microplastics pollution in selected South Asian countries including India, Bangladesh, Maldives, Sri Lanka and Pakistan. There is a brief overview of international and regional legal policies along with litigations are cultivated in this paper. The paper also analyzes the impact of plastic pollution over The Un Sustainable Development Goals.

Keywords: Microplastic, pollution, plastic debris, sustainable development goals.

Abstrak. *Salah satu masalah lingkungan paling mendesak yang dihadapi dunia saat ini adalah sampah plastik. Begitu berada di lingkungan, plastik terus terdegradasi menjadi mikroplastik, yang merupakan pecahan plastik. Ada lebih banyak janji nasional dan internasional untuk mengurangi polusi mikroplastik saat produksi plastik dunia meningkat. Pemerintah nasional semakin melarang produk plastik sekali pakai atau mengenakan pajak pada mereka. Pertimbangkan Tujuan Pembangunan Berkelanjutan PBB, Resolusi Majelis Lingkungan PBB tentang Sampah Laut dan Mikroplastik, dan Mengatasi Polusi Produk Plastik Sekali Pakai sebagai contoh dari komitmen ini. Pada 2015, PBB mengumumkan adopsi 17 Tujuan Pembangunan Berkelanjutan (SDGs). Dalam upaya meningkatkan keberlanjutannya, SDGs telah diadopsi secara luas oleh pemerintah dan bisnis. Ada 17 SDGs, yang terdiri dari 169 target, yang dapat diukur dengan 247 indikator unik, tetapi hanya ada satu indikator di bawah Tujuan 14, khususnya terkait pengurangan dampak mikroplastik. Terdapat berbagai kebijakan hukum internasional dan regional yang memiliki ketentuan yang mengindikasikan pencemaran plastik namun belum ada satupun yang menyebutkan pencemaran mikroplastik. Ada beberapa undang-undang nasional baru-baru ini*

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mengenai polusi mikroplastik. Makalah ini membahas secara singkat konsep mikroplastik dan situasi polusi mikroplastik di negara-negara Asia Selatan tertentu termasuk India, Bangladesh, Maladewa, Sri Lanka, dan Pakistan. Ada gambaran singkat tentang kebijakan hukum internasional dan regional beserta litigasi yang digarap dalam tulisan ini. Makalah ini juga menganalisis dampak polusi plastik terhadap Tujuan Pembangunan Berkelanjutan PBB.

Kata kunci: *Mikroplastik, polusi, sampah plastik, tujuan pembangunan berkelanjutan.*

1. Introduction

One of the most pressing environmental issues today is plastic pollution, since the world's capability to cope with the rapidly increasing production of throwaway plastic items is becoming overwhelmed. Despite the fact that the first commercial application and large-scale manufacture of plastic dates back to the 1950s, it has since become an indispensable aspect of human growth[1]. Cellulose, coal, natural gas, salt, and crude oil are used as the basic ingredients for making plastic, while petrochemicals are used to create the majority of industrial plastics[2].

Microplastics are very fine bits of plastic that originate from the deterioration of larger plastics as well as the creation of commercial products. Microplastics (MPs), which can be primary or secondary in origin, are defined as plastic particles that are smaller than 5 mm. The destiny of these small plastic particles, which float on the waters and are suspended in the atmosphere, is a subject of great concern. Microplastic contamination and its impacts across the world have been the subject of much research over the past 20 years[3]. South Asian countries such as India, Bangladesh, Maldives, Sri Lanka have taken many policies and steps regarding micro plastic pollutions.

In an effort to enhance sustainability, the UN Sustainable Development Goals (SDGs) were announced in 2015 and have since been widely adopted by many governments and corporations. The 169 targets that make up the 17 SDGs may be measured against 247 different indicators. There is just one indicator under Goal 14 that is directly connected to decreasing effects from microplastics, despite the fact that microplastic pollution is a widespread global problem[4].

Against this backdrop, the paper discusses micro plastic pollution in South Asian countries and analyzes the implementations of development strategies and key challenges to achieving sustainable development in South Asia towards SDG achievement.

2. Literature review

As a pressing issue, the world is facing a major outback regarding microplastic pollution. Though there is a lack of awareness regarding microplastic pollution, there are some studies done regarding this context. The Sustainable Development Goals (SDGs) of the United Nations (UN) have been adopted by many governments and businesses as an attempt to increase sustainability, although only one indicator is particularly dedicated to mitigating the effects of microplastics. There are twelve goals somehow related with plastic

[1] Hosler, Dorothy, Sandra L. Burkett, and Michael J. Tarkanian. "Prehistoric polymers: rubber processing in ancient Mesoamerica." *Science* 284, no. 5422 (1999): 1988-1991.

[2] Md Hyat, U. S. "Plastic Recycling in Bangladesh." *What needs to be done* (2015).;

[3] Amrutha, K., Vishnu Unnikrishnan, Sachin Shajikumar, and Anish Kumar Warrier. "Current state of microplastics research in SAARC Countries—a review." *Microplastic Pollution* (2021): 27-63.

[4] Walker, Tony R. "(Micro) plastics and the UN sustainable development goals." *Current Opinion in Green and Sustainable Chemistry* 30 (2021): 100497.

pollution but there is only one Goal that directly addresses plastics but does not address microplastics.

There are many studies that show how microplastic pollution is harming the global environment. Kumar, Chen and others did an analytical review and showed how micro and nano plastics are an emerging threat to the global environment.[5] Ali, Cheng, Ding and others showed in a review the occurrence, detection, characterisation and toxicity of micro and nano plastic in the environment.[6] Amrutha, Unnikrishnan, Shajikumar and Warrier showed the current research state of microplastics in SAARC countries[7].

Plastic and microplastic pollution came into limelight as a marine pollutant. Boucher and Friot evaluated the sources of Primary microplastics in Ocean[8], On the other hand Gasperi, Wright, Dris, Collardand others showed how microplastics are in the air we breathe in[9].

Perumal and Muthuramalingam showed recent studies of microplastics pollution in India[10]. A report of Environment and Social Development Association (ESDO) OF Bangladesh unfolds the health risk and environmental impact of microbeads[11].

Ghosh, Akter and others showed microplastic contamination in marine fishes of Bay of Bengal[12]. There are some other studies related to the South Asian countries' microplastics situation. Cowburn, Moritz, Birrell, Grimsditch and Abdulla assessed the environmental impact upon coral reefs in Maldives[13] where he partially mentioned

[5] Kumar, Manish, Hongyu Chen, Surendra Sarsaiya, Shiyi Qin, Huimin Liu, Mukesh Kumar Awasthi, Sunil Kumar et al. "Current research trends on micro-and nano-plastics as an emerging threat to global environment: a review." *Journal of Hazardous Materials* 409 (2021): 124967.

[6] Ali, Imran, Qianhui Cheng, Tengda Ding, Qian Yiguang, Zhang Yuechao, Huibin Sun, Changsheng Peng, Iffat Naz, Juying Li, and Jingfu Liu. "Micro-and nanoplastics in the environment: Occurrence, detection, characterization and toxicity–A critical review." *Journal of Cleaner Production* 313 (2021): 127863.

[7] Amrutha, K., Vishnu Unnikrishnan, Sachin Shajikumar, and Anish Kumar Warrier. "Current state of microplastics research in SAARC Countries—a review." *Microplastic Pollution* (2021): 27-63.

[8] Boucher, Julien, and Damien Friot. *Primary microplastics in the oceans: a global evaluation of sources*. Vol. 10. Gland, Switzerland: Iucn, 2017.

[9] Gasperi, Johnny, Stephanie L. Wright, Rachid Dris, France Collard, Corinne Mandin, Mohamed Guerrouache, Valérie Langlois, Frank J. Kelly, and Bruno Tassin. "Microplastics in air: are we breathing it in?." *Current Opinion in Environmental Science & Health* 1 (2018): 1-5.

[10] Perumal, Karthikeyan, and Subagunasekar Muthuramalingam. "Microplastics pollution studies in India: a recent review of sources abundances and research perspectives." *Research Square; http://doi. org/10.21203/rs. 3. rs-535083/v1* (2021).

[11] ESDO (Environment and Social Development Association). Study Report: Microbeads! Unfold Health Risk and Environmental Pollutant. 2016. [cited 2022 August 5]. Available from: http://esdo.org/wp-content/uploads/Microbeads-final-report-10.11.16-1.pdf

[12] Ghosh, Gopal C., Shamima M. Akter, Rashidul M. Islam, Ahsan Habib, Tapos K. Chakraborty, Samina Zaman, AHM Enamul Kabir, Oleg V. Shipin, and Marfiah A. Wahid. "Microplastics contamination in commercial marine fish from the Bay of Bengal." *Regional Studies in Marine Science* 44 (2021): 101728.

[13] Cowburn, Benjamin, Charlotte Moritz, Chico Birrell, Gabriel Grimsditch, and Ameer Abdulla. "Can luxury and environmental sustainability co-exist? Assessing the environmental

microplastics. A report from Sustainability Times shows that Maldives is engulfed with microplastics[14]. Moreover, Handunnetti shows that microplastic wastes fouls up beaches in Sri lanka[15] And Mukheed and Alisha showed the environmental and health impact of plastic pollution in Pakistan[16].

Only Walker.T showed the connection between microplastic pollution and UN Sustainable Development Goals[17] where he mentioned 12 goals related to microplastic pollution.

The majority of scholarly articles summarized in the aforementioned literature review, have discussed microplastic pollution in the context of marine pollution, air pollution, environmental impact including human and animal health impact, impact over fish, coral reef and so on. Very little academic and research work has been done regarding Microplastic pollution and its impact over the sustainable development goals but not specifically over South Asian countries. So, this research will be a very progressive one in this regard whereas this is specifically done over some selected south asian countries.

3. Research Methodology

This Dissertation is multidisciplinary in nature. The research has been accomplished mainly by adhering to Doctrinal and qualitative research methods has been piloted based on library-based study. For the purpose of obtaining effective research outcome, data have been gathered from the legal journals. In addition, several international documents including many UN reports,articles and related books, newspaper articles, websites, Concluding Observations etc. have also been used due to their addressing the research gaps raised in the research questions.

4. Micro Plastics and Properties

Microplastics are increasingly acknowledged to be a serious worldwide pollutant. Microplastics materials may linger in the environment for centuries and eventually break

impact of resort tourism on coral reefs in the Maldives." *Ocean & coastal management* 158 (2018): 120-127.

[14] The Maldives is becoming engulfed with microplastics. (2020, August 7). *Sustainability Times*. Retrieved August 5, 2022, from https://www.sustainability-times.com/environmental-protection/the-maldives-is-becoming-engulfed-by-microplastic s/

[15] Handunnetti, D. (2019, August 20). Microplastic waste fouls up beaches on Sri Lanka's southern tourism coast. *Mongabay Environmental News*. Retrieved August 5, 2022, from https://news.mongabay.com/2019/07/microplastic-waste-fouls-up-beaches-on-sri-lankas-southern-tourism-coast/

[16] Mukheed, M., and K. Alisha. "Plastic pollution in Pakistan: environmental and health Implications." *J. Pollut. Effects Contr* 4 (2020): 251-258.

[17] Walker, Tony R. "(Micro) plastics and the UN sustainable development goals." *Current Opinion in Green and Sustainable Chemistry* 30 (2021): 100497.

down into smaller bits known as micro and nanoparticles, invading the ecosystem and harming marine life. Microplastics are distinguished from bigger plastic trash, including plastic bottles, by the term macroplastics. Microplastics, which develop in the environment as a result of plastic pollution, are tiny bits of plastic smaller than 5 mm (0.2 inch) in length. Cosmetics, synthetic garments, plastic bottles and bags, as well as cosmetics, contain microplastics. Many of these items easily pollute the environment when used in garbage[18].

Microplastics can be found in a variety of places, including bigger plastic waste that breaks down into ever-tinier fragments. Additionally, microbeads, a subset of microplastic, are little bits of synthetic polyethylene plastic that are added as exfoliants to several health and beauty products. These particles effortlessly bypass water filtering systems, where they end out in the environment and ocean[19]. When microplastics are discharged into the environment, several chemical additives seep out of the plastics, including phthalates, polybrominated diphenyl ethers (PBDEs), and tetrabromobisphenol A (TBBPA)[20].

Two types of microplastics are found in the environment. They are called primary and secondary microplastic. Microfibers shed from clothes and other fabrics, such as fishing nets, as well as microscopic particles made for commercial purpose, such as those found in cosmetics, constitute primary microplastics[21]. They may also result from the abrasion of big plastic items during production, usage, or maintenance, such the erosion of tires during use or the washing of synthetic fabrics[22].

When larger plastics like water bottles break down, secondary microplastics also referred to as microscopic plastics are created. The main environmental factors that cause this dissolution are sunlight and ocean waves[23]. This occurs as a result of photodegradation and other weathering processes that affect improperly disposed of garbage, such as plastic bags, or accidental losses, such as fishing nets. It is challenging to effectively estimate how much of the figures of macroplastics have now transformed to microplastics because of the difficulty in tracing the origins of secondary microplastics due to their breakdown[24].

[18] Rogers, K. (2022,April 5). microplastics. Encyclopedia Britannica. https://www.britannica.com/technology/microplastic

[19] US Department of Commerce, N. O. and A. A. (2016, April 13). What are microplastics? NOAA's National Ocean Service. RetrievedAugust 2, 2022, from https://oceanservice.noaa.gov/facts/microplastics.html

[20] Walker, Tony R. "(Micro) plastics and the UN sustainable development goals." *Current Opinion in Green and Sustainable Chemistry* 30 (2021): 100497.

[21] *Microplastics | National Geographic Society*. (n.d.). National Geographic. Retrieved August 2, 2022, from https://education.nationalgeographic.org/resource/microplastics/

[22] Boucher, Julien, and Damien Friot. *Primary microplastics in the oceans: a global evaluation of sources*. Vol. 10. Gland, Switzerland: Iucn, 2017.

[23] Lim, XiaoZhi. "Microplastics are everywhere—but are they harmful." *Nature* 593, no. 7857 (2021): 22-25.

[24] Boucher, Julien, and Damien Friot. *Primary microplastics in the oceans: a global evaluation of sources*. Vol. 10. Gland, Switzerland: Iucn, 2017.

5. Micro Plastic Pollution in South Asia: An Overview

Plastic has evolved into a necessary component of modern life. However, it has its own unique set of environmental issues, mostly as a result of its inability to biodegrade. Microplastics are the tiny (5 mm) plastic trash. They are common in our surroundings and have been found in all five spheres of our globe[25]. Studies have shown that the South Asian nations account for nearly a quarter of the world's population, contributing a significant amount of plastic waste to global plastic pollution. Therefore, it is crucial to have a good understanding of microplastic contamination in these nations so that appropriate legal actions may be planned and implemented to protect the environment. The microplastic study is extremely pertinent given that the UN has unveiled a program called "Transforming our World: the 2030 Agenda for Sustainable Development."[26].

Microplastics have been found in a variety of places during the past years, including estuaries, rivers, lakes, beaches, the polar region, mangroves, road dust, soils, and even the atmosphere[27]. In terms of their economic capabilities, South Asian countries including India, Bangladesh, Sri Lanka, Pakistan, Nepal, Bhutan, Maldives, and Afghanistan are regarded as developing countries. The amount of plastic pollution has increased in recent decades rapidly. For instance, South Asian countries alone generated 17 to 20 million tonnes (MT) of plastics in 2018. These nations have disposed of about 26.72 MT of plastic garbage during 2016[28].

5.1. India

lobal plastic consumption is rising annually at an exponential rate. According to a study on plastic pollution in the South Juhu Creek in Mumbai, a sizable amount of plastic trash is being transported through connecting water channels from terrestrial habitats to the seas and oceans[29]. In Silver Beach, Southern India, there is an average of 204 pieces per kilogram of plastic waste, with 0.5 to 1 mm being the size range[30]. The Indian Ocean borders India on the south, the Bay of Bengal on the east, and the Arabian Sea on the west. Its almost 7516.6 km (including islands) coastline touches 13 States. Due to the fact that about half of the world's population lives close to the beaches, the coastal zone is regarded as a large microplastic hotspot. The Ganga River is extensively contaminated by plastic waste, including fibers and films. The direct release of plastic garbage into river

[25] Amrutha, K., Vishnu Unnikrishnan, Sachin Shajikumar, and Anish Kumar Warrier. "Current state of microplastics research in SAARC Countries—a review." *Microplastic Pollution* (2021): 27-63

[26] Amrutha, K., Vishnu Unnikrishnan, Sachin Shajikumar, and Anish Kumar Warrier. "Current state of microplastics research in SAARC Countries—a review." *Microplastic Pollution* (2021): 27-63

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[28] Amrutha, K., Vishnu Unnikrishnan, Sachin Shajikumar, and Anish Kumar Warrier. "Current state of microplastics research in SAARC Countries—a review." *Microplastic Pollution* (2021): 27-63

[29] Amrutha, K., Vishnu Unnikrishnan, Sachin Shajikumar, and Anish Kumar Warrier. "Current state of microplastics research in SAARC Countries—a review." *Microplastic Pollution* (2021): 27-63

[30] Jeyasanta, K. Immaculate, Narmatha Sathish, Jamila Patterson, and JK Patterson Edward. "Macro-, meso-and microplastic debris in the beaches of Tuticorin district, Southeast coast of India." *Marine pollution bulletin* 154 (2020): 111055.

sewage is the main cause of this, according to experts[31]. On the biological impacts of Mps on freshwater animals, there is relatively little information. Consumption of fish may be a potential source of microplastics in humans[32]. Airborne MPs have lately become one of the numerous pollutants in the atmosphere that raise concern because MPs in the air have the ability to enter the human body directly and constitute a serious threat to human health[33]. This is a serious threat for India with one of the cities with the worst air quality. Various health conditions might be brought on by MPs and other pollutants in the Indian environment, but the severity of the crisis is unknown due to the severe dearth of study in this area. The presence of MPs has lately been observed in numerous human commodities, seafood, salt, drinking water, and tap water in India, which has drawn the attention of researchers to MP pollution[34].

5.2. Bangladesh

Bangladesh is one of the emerging nations on the rise, where the consumption of plastic goods has increased more than ever before, endangering the environment and biodiversity severely. Microplastics contamination is a recent phenomena in Bangladesh, and neither manufacturers nor consumers are aware of its harmful effects. The Bangladeshi government banned the production, promotion, and use of polyethene packs with a thickness of less than 55 micron in 2002 due to the dangers of plastic contamination . In support of the 2002 prohibition, the government passed a new legislation in 2010 mandating the use of jute fiber as a substitute for polythene bags for bundling goods[35]. However, at the same time, due to the poor enforcement of the law and the lack of affordable, environment friendly alternatives, polythene was constantly produced, traded, and used across the nation. According to statistics, the entire landfill of plastic garbage in the capital city of Dhaka increased from 1.74 percent in 1992 to 6.5 percent in 2014[36]. In Dhaka city alone, plastic waste has gone up more than 3.5 times from 178 tons per day in 2005 to 646 tons per day in 2020. According to estimates from the Environmental Sciences and Technology journal, over 129 billion disposable masks and 65 billion disposable gloves are used globally each month, with the majority of them ending up in our rivers and

[31] Amrutha, K., Vishnu Unnikrishnan, Sachin Shajikumar, and Anish Kumar Warrier. "Current state of microplastics research in SAARC Countries—a review." *Microplastic Pollution* (2021): 27-63

[32] Daniel, Damaris Benny, P. Muhamed Ashraf, and Saly N. Thomas. "Microplastics in the edible and inedible tissues of pelagic fishes sold for human consumption in Kerala, India." *Environmental Pollution* 266 (2020): 115365. https://doi.org/10.1016/j.envpol.2020.115365

[33] Gasperi, Johnny, Stephanie L. Wright, Rachid Dris, France Collard, Corinne Mandin, Mohamed Guerrouache, Valérie Langlois, Frank J. Kelly, and Bruno Tassin. "Microplastics in air: are we breathing it in?." *Current Opinion in Environmental Science & Health* 1 (2018): 1-5.

[34] Vaid, Mansi, Komal Mehra, and Anshu Gupta. "Microplastics as contaminants in Indian environment: a review." *Environmental Science and Pollution Research* (2021): 1-28.

[35] Mandatory Jute PackagingAct. (2010). [cited 2022 August 5].Available from: http://motj.portal.gov.bd/sites/default/files/files/motj.portal.gov.bd/law/de00c47c_82e0_4eca_a5a9_f77cbd6c92ec/2 5september13.pdf

[36] Waste Concern. (2014). [cited 2022August5].Available from: http://wasteconcern.org/wpcontent/uploads/2016/05/Waste-Data-Base_2014_Draft-Final.pdf

oceans[37]. The Environment and Social Development Organization (ESDO), a pioneer in Bangladesh's anti-plastic movement and plastic ban, took the ground-breaking step of conducting a primary study on the degree of microplastics pollution in the country's three most notable urban areas (Dhaka, Chittagong, and Sylhet) in 2015[38]. The research on microplastic contamination in Bangladesh, found that 60 of the most popular and widely used cosmetics and cleaning items in the country—including face wash, body wash, detergent, nail polish, toothpaste, and face and body scrub—contain microbeads. According to the study, Dhaka, Sylhet and Chittagong, are the three notable metropolitan towns that emit the most microbeads into the surrounding water bodies and wastelands each month which is about 200 billion.

According to the ESDO team the microplastics pollution scenario in personal care products and environment of the three major cities of Bangladesh were as follows:

1. The majority of users of microbead-containing products are females between the ages of 20 and 29 and Face washes were determined to be the most frequently used product.
2. About 95% of customers were unaware of the negative effects that microbeads have on human health and the environment whereas about 92% of the retailers were ignorant about this micro-pollutant.
3. In the instance of water pollution, roughly 100 fish samples of the following four species—Catfish, Tilapia, Pangash, and Sarpunti—were gathered from various water bodies in the cities of Sylhet, Chittagong, and Dhaka. According to the study, larger fish like Catfish were more likely to have microplastics than smaller fish like Sarpunti. The quantity of microplastic particles in fish was found to be highest in fish from the city of Dhaka and lowest in the city of Sylhet. Fish from lakes and ponds within Dhaka City were more contaminated than fish from the city's neighboring rivers.

[37] Zhongming, Zhu, Lu Linong, Yao Xiaona, and Liu Wei. "Tackling plastic pollution for green growth in Bangladesh." (2021).

[38] ESDO (Environment and Social DevelopmentAssociation). Study Report: Microbeads! Unfold Health Risk and Environmental Pollutant. 2016. [cited 2022August 5].Available from: http://esdo.org/wp-content/uploads/Microbeads-final-report-10.11.16-1.pdf

The presence of MPs was also documented in Bangladesh from sea salt[39] , fish species[40], and the beach sediment of Cox's Bazar[41]. However, none of those studies specifically addressed the risks associated with MPs; instead, they provided a general overview of how often MPs occur. In the sample of Cox's Bazar, MPs of eight distinct varieties were found. The majority of the MP were fibers. This research was the first to quantify and characterize MPs in the sediments of the longest sea beach in the world, and it showed a modest abundance of MPs in comparison to other sandy beaches from around the globe[42]. A different study's findings supported the discovery of several MP varieties (fibers, microbeads, pieces, etc.) and polymer forms (PET, PE, and PP) in beach sand samples from Kuakata, North Bay of Bengal, Bangladesh[43].

5.3. Maldives

The Maldives are renowned for their stunning turquoise waters, which have led to their reputation as a true beach paradise on earth. However, a danger that is virtually undetectable to the naked eye is microplastics, which are present below the surface. A small island nation like the Republic of the Maldives is an example of one that has problems with its waste management systems. Over the past ten years, the amount of garbage produced per person on local islands has increased by 58%. The best waste management option right now is to transport waste to Thilafushi, an artificial island built as a municipal landfill, where 500 tons of trash are deposited every day[44]. The Maldives were rated as the fourth-largest producer of improperly managed garbage (waste that is

[39] Parvin, Fahmida, Jayasree Nath, Tamanna Hannan, and Shafi M. Tareq. "Proliferation of microplastics in commercial sea salts from the world longest sea beach of Bangladesh." *Environmental Advances* 7 (2022): 100173.

[40] Ghosh, Gopal C., Shamima M. Akter, Rashidul M. Islam, Ahsan Habib, Tapos K. Chakraborty, Samina Zaman, AHM Enamul Kabir, Oleg V. Shipin, and Marfiah A. Wahid. "Microplastics contamination in commercial marine fish from the Bay of Bengal." *Regional Studies in Marine Science* 44 (2021): 101728. Hossain, M. Shahadat, Faisal Sobhan, Mohammad Nasir Uddin, S. M. Sharifuzzaman, Sayedur Rahman Chowdhury, Subrata Sarker, and M. Shah Nawaz Chowdhury. "Microplastics in fishes from the Northern Bay of Bengal." *Science of the Total Environment* 690 (2019): 821-830.

[41] Hossain, M. Belal, Partho Banik, As-Ad Ujjaman Nur, and Turabur Rahman. "Abundance and characteristics of microplastics in sediments from the world's longest natural beach, Cox's Bazar, Bangladesh." *Marine Pollution Bulletin* 163 (2021): 111956.

[42] Ghosh, Gopal C., Shamima M. Akter, Rashidul M. Islam, Ahsan Habib, Tapos K. Chakraborty, Samina Zaman, AHM Enamul Kabir, Oleg V. Shipin, and Marfiah A. Wahid. "Microplastics contamination in commercial marine fish from the Bay of Bengal." *Regional Studies in Marine Science* 44 (2021): 101728.

[43] Banik, Partho, M. Belal Hossain, As-Ad Ujjaman Nur, Tasrina Rabia Choudhury, Samia Islam Liba, Jimmy Yu, Md Abu Noman, and Jun Sun. "Microplastics in sediment of Kuakata Beach, Bangladesh: occurrence, spatial distribution, and risk assessment." *Plastics in Aquatic Systems: from Transport and Fate to Impacts and Management Perspectives* (2022).

[44] Stevens, Guy MW, and Niv Froman. "The Maldives Archipelago." In *World seas: an environmental evaluation*, pp. 211-236. Academic Press, 2019.

disposed of in an unregulated manner) per capita in the world in 2019[45]. This level of pollution may significantly harm both the economy and the environment[46], as well as the ecology of the region. A variety of marine species may be found in the Maldives, which also is home to 3.1% of the world's coral biomass[47]. However, one of the current pressures harming this coral reef system is plastic pollution, which also causes coral bleaching incidents[48], disease outbreaks[49], and corallivorous predators[50]. Specifically, the concentration of microplastics at Naifaru is between 55 and 1127.5 microplastics per kilogram, which is much higher then the rate documented at Tamil Nadu in India (3-611 microplastics/kg). On other islands in the Maldives, both inhabited and unoccupied, a similar concentration was seen. Yet another contributing factor is the Maldives' poor waste management. Rubbish Island, a man-made island, was already brimming with trash ten years ago, primarily produced by neighboring luxury hotels[51].

5.4. Sri Lanka

Popular resorts and beaches can be found throughout Sri Lanka's southern coastline, but the catastrophe of global plastic trash hasn't spared this once-pristine region. While recreational beaches had significant levels of MPs, researchers also discovered that fishing ports and more rural beaches had high levels of microplastic pollution and plastic debris[52].

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[45] Barnes, Stuart J. "Understanding plastics pollution: The role of economic development and technological research." *Environmental pollution* 249 (2019): 812-821.

[46] Cowburn, Benjamin, Charlotte Moritz, Chico Birrell, Gabriel Grimsditch, and Ameer Abdulla. "Can luxury and environmental sustainability co-exist? Assessing the environmental impact of resort tourism on coral reefs in the Maldives." *Ocean & coastal management* 158 (2018): 120-127.

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[49] Montano, Simone, Giovanni Strona, Davide Seveso, Davide Maggioni, and Paolo Galli. "Widespread occurrence of coral diseases in the central Maldives." *Marine and Freshwater Research* 67, no. 8 (2015): 1253-1262.

Montano, S., Giorgi, A., Monti, M., Seveso, D., & Galli, P. (2016). Spatial variability in distribution and prevalence of skeletal eroding band and brown band disease in Faafu Atoll, Maldives. *Biodiversity and Conservation*, *25*(9), 1625-1636.

[50] Montalbetti, Enrico, Luca Saponari, Simone Montano, Davide Maggioni, Inga Dehnert, Paolo Galli, and Davide Seveso. "New insights into the ecology and corallivory of Culcita sp.(Echinodermata: Asteroidea) in the Republic of Maldives." *Hydrobiologia* 827 (2019): 353-365.

[51] The Maldives is becoming engulfed with microplastics. (2020,August 7). Sustainability Times. Retrieved August 5, 2022, from

https://www.sustainability-times.com/environmental-protection/the-maldives-is-becoming-engulfed-by-microplastic s/

[52] Handunnetti, D. (2019,August 20). Microplastic waste fouls up beaches on Sri Lanka's southern tourism coast. *Mongabay Environmental News*. RetrievedAugust 5, 2022, from

The popular and crowded recreational beaches appeared to have more microplastic trash when sediments were examined. Weligama's crowded public beach was the most filthy both in terms of weight (157 microplastic pieces per square meter) and count (5.98 grams per square meter)[53]. Significant levels of gear handling and other operations, as well as the fishing ports in Dondra and Ambalangoda, demonstrated a high concentration of MPs by count and weight in the surface water[54]. The south of Sri Lanka has seen a boom in tourism, but proper waste management techniques have not been implemented. According to a study commissioned by the National Aquatic Resources Agency (NARA) and funded by the Norwegian Institute of Marine Research (IMR) identified that nearly four-fifths of small pieces of the plastic debris in Sri Lanka's territorial waters arrived through rivers and canals[55]. Using a visual and spectroscopic combination technique, a study only evaluated commercial salt products and raw salts from Sri Lanka for MPs and the results showed MP contamination of all tested samples. Given the fact that salt is a crucial component of the human diet, a worrisome discovery is that raw salt had the greatest concentration of MPs, followed by food-grade table salt and crystal salt[56].

5.5. Pakistan

Microplastics' recent development in aquatic systems has increased these dangers, especially in developing nations. In Pakistan, residents of the coastal areas and the Indus River have dumped almost 0.2 million tons of plastic waste into the Arabian Sea. In Pakistan, 6,000 producers are responsible for the production of 0.6 million tons of plastic. Unfortunately, plastics constitute 65% of all trash in Pakistan, and a 15% increase is expected annually. It is difficult to predict the future plastic load that will likely be deposited into the marine environment in the case of a developing nation. Due to the Karachi metropolis, Pakistan has experienced severe issues managing urban trash. But by 2050, more plastic is expected to be deposited in the ocean. In South Asia, Pakistan has the highest proportion of improperly managed plastic. The use of plastic bags has officially been outlawed in a number of nations, including Bangladesh, France, and Rwanda. Pakistan has issued a (Statutory Regulatory Order) SRO to ban the use of plastic bags in

https://news.mongabay.com/2019/07/microplastic-waste-fouls-up-beaches-on-sri-lankas-southern-tourism-coast/

[53] Handunnetti, D. (2019,August 20). Microplastic waste fouls up beaches on Sri Lanka's southern tourism coast. *Mongabay Environmental News*. RetrievedAugust 5, 2022, from https://news.mongabay.com/2019/07/microplastic-waste-fouls-up-beaches-on-sri-lankas-southern-tourism-coast/

[54] Koongolla, J. Bimali, A. L. Andrady, PB Terney Pradeep Kumara, and C. S. Gangabadage. "Evidence of microplastics pollution in coastal beaches and waters in southern Sri Lanka." *Marine pollution bulletin* 137 (2018): 277-284..

[55] Handunnetti, D. (2019,August 20). Microplastic waste fouls up beaches on Sri Lanka's southern tourism coast. *Mongabay Environmental News*. RetrievedAugust 5, 2022, from https://news.mongabay.com/2019/07/microplastic-waste-fouls-up-beaches-on-sri-lankas-southern-tourism-coast/

[56] Kapukotuwa, R. W. M. G. K., N. Jayasena, K. C. Weerakoon, C. L. Abayasekara, and R. S. Rajakaruna. "High levels of microplastics in commercial salt and industrial salterns in Sri Lanka." *Marine pollution bulletin* 174 (2022): 113239.

the Federal Capital Islamabad and other towns, such as Lahore and Hunza, after taking note from these nations' actions. At present, there is no federal or provincial policy framework in place that addresses the issues of single-use plastics and plastic waste management on a wider scale[57].

6. International Regulatory Instruments and Initiatives

Microplastics pollution control has received more and more attention in recent years from policymakers in OECD nations. Key components of environmental policy objectives in OECD nations, as well as ambitions for the Sustainable Development Goals, include achieving resource productivity, managing plastics sustainably, limiting leakage to the environment, and maintaining water quality. Restrictions on single-use plastics and microbeads in rinse-off cosmetics, as well as improved waste management techniques, are recent regulatory changes that may help reduce certain plastic usage and reduce environmental leakage[58].

Commonly referred to as a "Constitution for the Oceans," the United Nations Convention on the Law of the Sea (UNCLOS) 1982[59] represented an unprecedented attempt to regulate "all aspects of the resources of the sea and uses of the ocean, and thus bring a stable order to mankind's very source of life." It did not contain any special restrictions about plastic pollution, but rather treated plastic as potentially detrimental for the maritime environment together with all other pollutants.

A worldwide agenda has been formed during the past decade in collaboration between the United Nations Environment Program (UNEP) and the Marine Debris Program (MDP) of the United States National Oceanic and Atmospheric Administration (NOAA). The study outlines potential countermeasures to the growing problem of marine litter, with an emphasis on "preventing, minimizing and abating the ecological, human health and economic implications of marine debris globally"[60]. At the Nairobi (Kenya) United Nations Environment Assembly, a draft resolution on marine litter and microplastics was approved. In addition, it urges all nations and other stakeholders to use plastic responsibly while working to eliminate needless usage, and to support research into and use of ecologically friendly alternatives. The concern of marine plastic pollution has also received attention from the Group of 7 (G7) and the Group of 20 (G20). There have been developed action plans from these two groups.

[57] Mukheed, M., and K. Alisha. "Plastic pollution in Pakistan: environmental and health Implications." *J. Pollut. Effects Contr* 4 (2020): 251-258.

[58] Buzzi, Elena. *Policies to Reduce Microplastics Pollution in Water: Focus on Textiles and Tyres*. OECD Publishing, 2021.

[59] United Nations (1982). *United Nations Convention on the Law of the Sea, in 31363*. Jamaica: UN General Assembly.

[60] Shevealy, Seba, Kitty Courtney, and John E. Parks. "The Honolulu Strategy: A global framework for prevention and management of marine debris." (2012).

7. Regional Regulatory Instruments and Initiatives

The Directive on the reduction of the environmental impact of certain plastic products became effective in the European Union (EU) in June 2019[61]. This directive mandates that all member states "ensure environmentally sound waste management to prevent and reduce marine litter from both sea and land sources." The Commission for the Conservation of Antarctic Marine Resources (CCAMLR) was founded in the Southern Hemisphere, specifically in Antarctica, in 1982 under the sponsorship of the Food and Agriculture Organization of the United Nations' Fisheries and Aquaculture Department[62] . Given the documented presence and apparent buildup of microplastics in the Antarctic area, this convention provides sets of conservation rules that govern the use of aquatic living resources there. In September 1994, Japan, China, the Republic of Korea, and the Russian Federation agreed an Action Plan for the Protection, Management, and Development of the Marine and Coastal Environment of the Northwest Pacific Region (NOWPAP), which was also a component of UNEP's Regional Seas Program. The conservation of biodiversity and active monitoring of marine pollutants, including plastic litter, are included in the medium-term strategy (2018-2023) envisioned in NOWPAP[63].

8. Litigations

Plaintiffs, however, are bringing lawsuits against consumers and producers of plastics under pre-existing legal theories rather than waiting for the establishment of microplastics regulations. The production and use of plastics are being seriously impacted by these cases. There are provisions in numerous federal environmental statutes that permit individuals and groups to sue accused polluters. These citizen-suit provisions permit monetary fines, injunctive remedies, and the recovery of attorneys' fees for plaintiffs but not the recovery of damages. These citizen-suit provisions have been used by environmental organizations to target plastic producers in recent years[64].

8.1. The Citizen Suit Against Formosa Plastics

In this recent case of *San Antonio Bay Estuarine Waterkeeper v. Formosa Plastics Corp.*, the plaintiff claimed that defendant Formosa Corp., a major producer of resins and

[61] Council, E. "Directive (EU) 2019/904 of the European Parliament and of the Council of 5 June 2019 on the Reduction of the Impact of Certain Plastic Products on the Environment." *European Union: Maastricht, The Netherlands* (2019)

[62] FAO (2013). *Regional Fishery Bodies Summary Descriptions. Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR). Fishery Governance Fact Sheets.* Rome: FAO.

[63] Kim, Suk Kyoon. "Marine pollution response in Northeast Asia and the NOWPAP regime." *Ocean Development & International Law* 46, no. 1 (2015): 17-32.

[64] Baroni, M. B., & Henke, R. H. (2022, January 20). MicroplasticsAre in the News, and ManufacturersAre Seeing Lawsuits. Industry Week. RetrievedAugust 29, 2022, from https://www.industryweek.com/leadership/corporate-finance/article/21214602/microplastics-are-in-the-news-and-ma nufacturers-are-seeing-lawsuits

petrochemicals, had violated the terms of its U.S. Clean Water Act (CWA) discharge permit by dumping plastic pellets and PVC powder into a surface water body. The permit forbade the "discharge of floating materials or visible foam in amounts greater than trace amounts." In order to prove that Formosa had violated the law, the plaintiff investigated Formosa's activities and provided the court with photographic, video, and water sample evidence. Formosa responded by contending that since the permit requirement did not specify a weight or concentration for the discharge in question, it was not in violation. The court disagreed, labeling Formosa a "serial offender" and concluding that Formosa discharged plastics in breach of its permission on 736 distinct days. Following the court's ruling, the parties agreed to a consent decree to end the lawsuit. Formosa was ordered to pay $50 million to fund environmental programs in order to make up for the environmental damage it had caused, as well as over $3 million in legal costs for the plaintiffs, as part of the consent decree [65].

8.2. Frontier Logistics Case

Plaintiffs have sued plastics manufacturers by utilizing the federal Resource Conservation and Recovery Act, which governs solid and hazardous waste. In Charleston Riverkeeper et al. v. Frontier Logistics, plaintiffs accused plastics transporter Frontier Logistics of discharging plastic pellets that lingered in and around several surface water bodies. The plaintiffs claimed that Frontier violated the Clean Water Act and that, by releasing this solid waste, Frontier put human health and the environment in "imminent and substantial endangerment," invoking a cause of action under the RCRA. Before trial, Frontier reached a settlement and promised to pay $1 million to support canal cleanup programs. Frontier also paid the plaintiffs' attorneys' expenses in the amount of $225,000[66].

8.3. Environmental Litigation

Plastics manufacturers are being sued for their claimed role in global plastics pollution. The non-profit Earth Island Institute, based in Berkeley, California, is suing a number of businesses. Earth Island Institute has filed three separate lawsuits against producers of plastic goods. It started suing Coca-Cola, Pepsi, Nestlé, and other big businesses in 2020 for causing a "nuisance" of plastic pollution. The next year, Earth Island Institute filed a second complaint against Coke and BlueTriton Brands (formerly Nestlé Waters North America), alleging that both companies marketed themselves as being eco sustainable while actually being big producers of plastic pollution. The lawsuit Earth Island Institute v. Crystal Geyser Water Co., et al. alleges violations of consumer protection laws as well

[65] Baroni, M. B., & Henke, R. H. (2022, January 20). MicroplasticsAre in the News, and ManufacturersAre Seeing Lawsuits. *Industry Week*. RetrievedAugust 29, 2022, from https://www.industryweek.com/leadership/corporate-finance/article/21214602/microplastics-are-in-the-news-and-ma nufacturers-are-seeing-lawsuits

[66] Baroni, M. B., & Henke, R. H. (2022, January 20). MicroplasticsAre in the News, and ManufacturersAre Seeing Lawsuits. *Industry Week*. RetrievedAugust 29, 2022, from https://www.industryweek.com/leadership/corporate-finance/article/21214602/microplastics-are-in-the-news-and-ma nufacturers-are-seeing-lawsuits

as common law theories of responsibility such carelessness, nuisance, and breach of contract. It also demands that these businesses stop polluting[67]

9. Impact of Micro Plastic Pollution Over the Un Sustainable Development Goals

The Sustainable Development Goals provide a roadmap for building a better, more sustainable future for everyone. They address issues like poverty, inequality, climate change, environmental degradation, peace, and justice, as well as other worldwide problems we confront[68]. At the 2012 United Nations Conference on Sustainable Development, which took place in Rio de Janeiro, Brazil, the Sustainable Development Goals (SDGs) were created. The aim was to establish a set of global goals pertaining to the political, economic, and environmental concerns that mankind is currently experiencing. In this approach, the UN picked 17 transformative goals in 2015 by a vote, and has pushed them as the world's sustainable development goals for the years 2015–2030. In an effort to solve the world's most pressing issues, the SDGs represent a commitment that is interconnected. They serve as a global call to action to address climate change in a sustainable manner, improve how we manage our limited natural resources, foster inclusive communities, minimize inequality, and advance the growth of economies[69].

Despite there being 17 SDGs, 169 objectives, and 247 distinct indicators, Goal 14 is especially focused on reducing the consequences of plastics in the marine environment. There is no particular reference to targets for eliminating microplastics or to quantify their reduction in any other Goal, where at least 12 UN SDGs were found to be impacted by microplastic contamination, either directly or indirectly, according to a critical review[70].

Goal 1. End poverty in all its forms everywhere

Although there are no plastic targets or indicators associated with this Goal, the plastics industry frequently holds the assumption that increased plastic use will improve the quality of lives of those in less developed countries where potable water may not be available, leading to an increase in the consumption of plastic sachets or bottled water for

[67] Baroni, M. B., & Henke, R. H. (2022, January 20). MicroplasticsAre in the News, and ManufacturersAre Seeing Lawsuits. Industry Week. RetrievedAugust 29, 2022, from https://www.industryweek.com/leadership/corporate-finance/article/21214602/microplastics-are-in-the-news-and-ma nufacturers-are-seeing-lawsuits

[68] *Take Action for the Sustainable Development Goals*. (n.d.). United Nations. RetrievedAugust 6, 2022, from https://www.un.org/sustainabledevelopment/sustainable-development-goals/

[69] *Sustainable Development Goals (SDGs): Our history and close relationship*. (n.d.). Enelamericas.Com. Retrieved August 6, 2022, from https://www.enelamericas.com/en/investors/a202107-sustainable-development-goals-sdgs-our-history-and-close-rela tionship.html

[70] Walker, Tony R. "(Micro) plastics and the UN sustainable development goals." *Current Opinion in Green and Sustainable Chemistry* 30 (2021): 100497.

drinking[71]. One recent opinion article highlights how the overflow of marine plastic has an adverse influence on ecological services, as well as considerable negative economic repercussions for communities, especially in low-income coastal cities. According to the study, plastic pollution costs society up to US $2.5 trillion year, costing up to US $33,000 each ton of plastic garbage in reduced environmental value[72]. Therefore, without proper plastic reduction or monitoring targets, achieving this Goal will be difficult.

Goal 2. End hunger, achieve food security and improved nutrition and promote sustainable agriculture

The health of the soil, ocean, and aquatic ecosystems is crucial for the sustainability of our food systems, yet a growing body of recent data shows that microplastic has accumulated in agricultural soils[73], fruits and vegetables[74], and seafood[75]. According to a recent study, human food consumption contains microplastics from the plastic food packaging itself[76]. These studies, and many others not included here, give compelling evidence that microplastic contamination of soil and seafood might have negative effects on human health, food security, and safety[77].

Goal 3. Ensure healthy lives and promote well-being for all at all ages

Microplastics can aggregate in many organs and have a negative impact on health when they are ingested or inhaled into the body. They can also damage cells or trigger inflammatory and immunological reactions[78]. Our knowledge of the possible health effects of microplastics on human health still has significant gaps. Implementing this Goal to

[71] Anbumani, Sadasivam, and Poonam Kakkar. "Ecotoxicological effects of microplastics on biota: a review." *Environmental Science and Pollution Research* 25 (2018): 14373-14396.

[72] Beaumont, Nicola J., Margrethe Aanesen, Melanie C. Austen, Tobias Börger, James R. Clark, Matthew Cole, Tara Hooper, Penelope K. Lindeque, Christine Pascoe, and Kayleigh J. Wyles. "Global ecological, social and economic impacts of marine plastic." *Marine pollution bulletin* 142 (2019): 189-195.

[73] Kumar, Manish, Hongyu Chen, Surendra Sarsaiya, Shiyi Qin, Huimin Liu, Mukesh Kumar Awasthi, Sunil Kumar et al. "Current research trends on micro-and nano-plastics as an emerging threat to global environment: a review." *Journal of Hazardous Materials* 409 (2021): 124967.

[74] Conti, Gea Oliveri, Margherita Ferrante, Mohamed Banni, Claudia Favara, Ilenia Nicolosi, Antonio Cristaldi, Maria Fiore, and Pietro Zuccarello. "Micro-and nano-plastics in edible fruit and vegetables. The first diet risks assessment for the general population." *Environmental Research* 187 (2020): 109677.

[75] Sequeira, Inês F., Joana C. Prata, João P. da Costa, Armando C. Duarte, and Teresa Rocha-Santos. "Worldwide contamination of fish with microplastics: A brief global overview." *Marine Pollution Bulletin* 160 (2020): 111681.

[76] Sobhani, Zahra, Yongjia Lei, Youhong Tang, Liwei Wu, Xian Zhang, Ravi Naidu, Mallavarapu Megharaj, and Cheng Fang. "Microplastics generated when opening plastic packaging." *Scientific reports* 10, no. 1 (2020): 4841.

[77] Anbumani, Sadasivam, and Poonam Kakkar. "Ecotoxicological effects of microplastics on biota: a review." *Environmental Science and Pollution Research* 25 (2018): 14373-14396.

[78] Vethaak, A. Dick, and Juliette Legler. "Microplastics and human health." *Science* 371, no. 6530 (2021): 672-674.

guarantee healthy lives and promote well-being for all ages will continue to be difficult until these knowledge gaps are fully acknowledged.

Goal 4. Ensure availability and sustainable management of water and sanitation for all

The World Health Organization has acknowledged the existence of microplastics in tap water and bottled water as well as their potential risks. However, the amount of microplastics in drinking water from treatment facilities can range greatly from undetectable to >900 particles/L and is heavily influenced by the water sources, plant layout, and analytical techniques[79]. Despite the high rates of microplastic removal from wastewater effluent, implementing sustainable management of water and sanitation for all is still hampered by the sheer volume of microplastic particles entering wastewater treatment plants from sources like polypropylene microfiber shedding from clothing, microplastics in exfoliating products, and other sources[80].

Goal 5. Ensure access to affordable, reliable, sustainable, and modern energy for all

Due to the release of greenhouse gas (GHG) emissions, the utilization of plastic trash for energy recovery has received a lot of criticism recently[81]. According to one research, which used a cradle to grave analysis, worldwide GHG emissions from plastics would reach 1.34 gigatons per year by 2030 and 2.8 gigatons per year by 2050[82]. This indicates that utilising plastic trash for energy recovery is incompatible with the goal of reaching Goal 7.

Goal 6. Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation

To accomplish this Goal, the existing linear plastics economy must undergo a significant change. To support the development of a circular economy, innovation is needed to shift away from the use of unsustainable plastics derived from fossil fuels and toward sustainable bio-based plastic alternatives[83].Unquestionably, the effects of plastic manufacture and waste derived from fossil fuels gravely endanger the achievement of

[79] Barchiesi, Margherita, Agostina Chiavola, Camilla Di Marcantonio, and Maria Rosaria Boni. "Presence and fate of microplastics in the water sources: focus on the role of wastewater and drinking water treatment plants." *Journal of Water Process Engineering* 40 (2021): 101787.

[80] Prata, Joana Correia. "Microplastics in wastewater: State of the knowledge on sources, fate and solutions." *Marine pollution bulletin* 129, no. 1 (2018): 262-265.

[81] Chen, Ying-Chu. "Evaluating greenhouse gas emissions and energy recovery from municipal and industrial solid waste using waste-to-energy technology." *Journal of Cleaner Production* 192 (2018): 262-269.

[82] Shen, Maocai, Wei Huang, Ming Chen, Biao Song, Guangming Zeng, and Yaxin Zhang. "(Micro) plastic crisis: un-ignorable contribution to global greenhouse gas emissions and climate change." *Journal of Cleaner Production* 254 (2020): 120138.

[83] RameshKumar, Saranya, P. Shaiju, and Kevin E. O'Connor. "Bio-based and biodegradable polymers-State-of-the-art, challenges and emerging trends." *Current Opinion in Green and Sustainable Chemistry* 21 (2020): 75-81.

numerous UN SDGs. Plastics have a variety of physical qualities that make them suitable for use in a variety of building applications. For instance, flexible low-density polyethylene is more suited for use in bricks and blocks in construction than stiff high-density polyethylene, which is best suited for usage in plastic lumber, tables, and chairs. Asphalt and cement composites frequently utilize hard and flexible polymers like polypropylene and polyethylene terephthalate[84].

Goal 7. Reduce inequality within and among countries

The global plastic waste trade has been the recycling model used by several nations for decades[85]. Additionally, it has drawn heavy criticism for being a method of plastic pollution transfer from developed to underdeveloped nations[86]. Due to this, the world's plastic exports changed significantly, shifting mostly to neighboring Southeast Asian nations, which rapidly became overwhelmed with plastic trash[87]. All of these possibilities are unsustainable and increase the gap between developed and developing nations.

Goal 8. Make cities inclusive, safe, resilient, and sustainable

Similar to Goal 10, Uncontrolled plastic waste disposal is clogging vital urban infrastructure, such as drains and sewers, in nations with insufficient waste management systems, which results in pervasive and unsustainable plastic pollution in urban areas[88]. Until governments, businesses, and consumers adequately address plastic production, use, and mismanagement, achieving this goal will remain a significant problem.

Goal 9. Ensure sustainable consumption and production patterns

An estimated 8300 Mt of virgin plastics, of which 6300 Mt are now garbage, as of 2015. Only 9% of it has been recycled, 12% of it has been burned, and 79% of it is currently in landfills or the environment[89]. The projected annual worldwide plastics output is close to 360 Mt, and it is expected to double within 20 years[90]. To guarantee environmentally

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[84] Awoyera, P. O., and Adeyemi Adesina. "Plastic wastes to construction products: Status, limitations and future perspective." *Case Studies in Construction Materials* 12 (2020): e00330.

[85] Liu, Zhe, Michelle Adams, and Tony R. Walker. "Are exports of recyclables from developed to developing countries waste pollution transfer or part of the global circular economy?." *Resources, Conservation and Recycling* 136 (2018): 22-23.

[86] Law, Kara Lavender, Natalie Starr, Theodore R. Siegler, Jenna R. Jambeck, Nicholas J. Mallos, and George H. Leonard. "The United States' contribution of plastic waste to land and ocean." *Science advances* 6, no. 44 (2020): eabd0288.

[87] Law, Kara Lavender, Natalie Starr, Theodore R. Siegler, Jenna R. Jambeck, Nicholas J. Mallos, and George H. Leonard. "The United States' contribution of plastic waste to land and ocean." *Science advances* 6, no. 44 (2020): eabd0288.

[88] Borrelle, Stephanie B., Jeremy Ringma, Kara Lavender Law, Cole C. Monnahan, Laurent Lebreton, Alexis McGivern, Erin Murphy et al. "Predicted growth in plastic waste exceeds efforts to mitigate plastic pollution." *Science* 369, no. 6510 (2020): 1515-1518.

[89] Geyer, Roland, Jenna R. Jambeck, and Kara Lavender Law. "Production, use, and fate of all plastics ever made." *Science advances* 3, no. 7 (2017): e1700782.

[90] Lebreton, Laurent, and Anthony Andrady. "Future scenarios of global plastic waste generation and disposal." *Palgrave Communications* 5, no. 1 (2019): 1-11.

friendly consumption, manufacturing, and microplastic waste reduction, the international community must make extraordinary efforts to fulfill this Goal[91].

Goal 10. Take urgent action to combat climate change and its impacts

Every phase of the plastic life cycle, including manufacture, transportation, and garbage disposal, is closely linked to GHG emissions, which result in climate change[92], and undermines the capability of the global community to accomplish this Goal.

Goal 11. Conserve and sustainably use the oceans, seas, and marine resources for sustainable development

As seen by indication 14.1.1b's reference to plastic waste density, this is the only Goal that expressly targets plastics while excluding microplastics. Despite the fact that almost every marine and freshwater ecosystem in the world is being negatively impacted by microplastic pollution[93], there is presently no worldwide agreement or standardization of methods for measuring this parameter. Currently, visual observations are the primary method for quantifying floating plastic marine waste.[94]. Recent research, however, has suggested using citizen scientists to quantify floating debris by taking part in marine debris clean-ups led by groups like Marine Debris NOAA, International Coastal Cleanup (ICC), or Litter intelligence[95]. Although using citizen scientists to measure and track trends is positive for this Goal, the issue from microplastic contamination is still not taken into account by this Goal.

Goal 12. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss

The majority of marine microplastic contamination comes from land-based sources, though until recently, the majority of microplastics research was concentrated on aquatic

[91] Walker, Tony R. "(Micro) plastics and the UN sustainable development goals." *Current Opinion in Green and Sustainable Chemistry* 30 (2021): 100497.

[92] Benavides, Pahola Thathiana, Uisung Lee, and Omid Zarè-Mehrjerdi. "Life cycle greenhouse gas emissions and energy use of polylactic acid, bio-derived polyethylene, and fossil-derived polyethylene." *Journal of Cleaner Production* 277 (2020): 124010.

[93] Walker, Tony R. "(Micro) plastics and the UN sustainable development goals." *Current Opinion in Green and Sustainable Chemistry* 30 (2021): 100497.

[94] Ambrose, Kristal K., Carolynn Box, James Boxall, Annabelle Brooks, Marcus Eriksen, Joan Fabres, Georgios Fylakis, and Tony R. Walker. "Spatial trends and drivers of marine debris accumulation on shorelines in South Eleuthera, The Bahamas using citizen science." *Marine pollution bulletin* 142 (2019): 145-154.

[95] Fraisl, D., Campbell, J., See, L., Wehn, U., Wardlaw, J., Gold, M., ... & Fritz, S. (2020). Mapping citizen science contributions to the UN sustainable development goals. *Sustainability Science*, *15*(6), 1735-1751.

and marine environments[96], nonetheless, it is estimated that terrestrial ecosystems get 4-23 times more microplastic trash each year[97]. Poor waste management and the application of biosolids to agricultural soils have been connected to sources of microplastic inputs to terrestrial ecosystems[98], and through atmospheric microplastic deposition, which has been documented in pristine, distant mountainous catchments like the French Pyrenees and protected places in the US Rocky Mountain National Park[99]. This Goal, like many others mentioned in this study, lacks an indicator to track the effects of microplastics, which again reduces the possibility that this Goal will be implemented successfully by 2030.

10. Findings

Microplastics are tiny little plastic fragments developed from plastic pollution. Microplastic is everywhere in the environment, be it water, soil or air. South Asian countries are one of the biggest contributors to the world's plastic pollution which also accounts for microplastic pollution. Microplastics pollution is also a hurdle in the way of achieving the Sustainable Development Goals of the United Nations for the South Asian countries. This research lays out the overview of microplastic pollution and its impact over South Asian countries along with some Legal Frameworks as well as the impact of microplastic pollution over the UN sustainable Development Goals. Some of the lackings found while studying the gaps raised in the research questions over some South Asian countries including India, Bangladesh, Maldives, Sri Lanka and Pakistan are included in this chapter along with some of the proposed recommendations.

1. There are No Specific national and International legislation addressing micro plastic pollution
2. Existing legal policies have no binding effects and they also lack proper implementations
3. Many of the South asian countries still have not Banned single-use plastics and microplastics in personal care and cosmetic products
4. Lack of Effective legislation for microplastics management beyond microbeads in cosmetics
5. Lack of durable systems and solutions for limiting export of microplastics in wastewater from cities and the landscape

[96] Xu, Baile, Fei Liu, Zachary Cryder, Dan Huang, Zhijiang Lu, Yan He, Haizhen Wang et al. "Microplastics in the soil environment: occurrence, risks, interactions and fate–a review." *Critical Reviews in Environmental Science and Technology* 50, no. 21 (2020): 2175-2222.

[97] Conti, Gea Oliveri, Margherita Ferrante, Mohamed Banni, Claudia Favara, Ilenia Nicolosi, Antonio Cristaldi, Maria Fiore, and Pietro Zuccarello. "Micro-and nano-plastics in edible fruit and vegetables. The first diet risks assessment for the general population." *Environmental Research* 187 (2020): 109677.

[98] Crossman, Jill, Rachel R. Hurley, Martyn Futter, and Luca Nizzetto. "Transfer and transport of microplastics from biosolids to agricultural soils and the wider environment." *Science of The Total Environment* 724 (2020): 138334.

[99] Brahney, Janice, Margaret Hallerud, Eric Heim, Maura Hahnenberger, and Suja Sukumaran. "Plastic rain in protected areas of the United States." *Science* 368, no. 6496 (2020): 1257-1260.

6. Plastic pollution management of the countries lacks integrity in making recovery plans
7. Waste management is not a part of the disaster risk management process where unpremeditated plastic waste management leads to a greater disaster in future.
8. Lack of public awareness regarding the context of microplastic and its pollutants
9. Lack of proper studies and research in different variants and contexts of microplastic pollution.

11. Proposed Recommendation

1. Establish Specific national and International legislation– Specific national and regulations regarding microplastics pollution are the most needed at present to mitigate this growing problem.
2. Existing legal policies need binding effects and proper implementations– The existing few legal policies which address plastic pollution are mainly soft laws which practically have very few binding effects. Amendment of these existing policies can be a primary solution until specific legislations are made. Strong binding effects upon signatory countries may boost proper implementations of the policies to reduce this major problem.
3. Bans on single-use plastics and microplastics in personal care and cosmetic products– In certain nations, bans have already been implemented. Campaigns and behavior modification "nudges" can decrease the use of such products. While specific textile patterns might lower the production of microfibers while washing, such products might be expensive. In South Asia, except Bangladesh, no country has taken up such policies which has now become a must.
4. Effective legislation for microplastics management beyond microbeads in cosmetics– Beyond cosmetic microbeads, there is a need for strong regulation to address microplastics. Microfibres have not yet been mentioned in any policy discussions. In order to pay for higher treatment expenses, states need to consider the possibility of enforcing taxes on materials or goods that release a lot of microfibers.
5. Design and adopt solutions to limit the export of microplastics– In order to safeguard water bodies from pollution loads, rehabilitate damaged aquatic ecosystems, and reduce exposure to vulnerable populations, we states should develop and implement solutions that can limit the export of microplastics from cities and the landscape.
6. Integrate plastic pollution management in recovery plans to build back in a green, resilient, and inclusive manner– The majority of South Asian nations have already enacted laws outlawing certain single-use plastics. These bans, however, have not had a substantial impact because there is little enforcement and no funding or other operational support to offer alternatives. Incentivizing fewer emissions and less plastic waste will be essential as governments create programs to assist the business sector in recovering from the COVID-19 shock.
7. Make waste management principles part of disaster risk management– Disaster risk management strategies should include handling hazardous plastic trash. Instead of being restricted to the national level, this can be done on a regional scale under the

collaboration formed through the South Asia Cooperative Environment Programme (SACEP).

8. Accelerate efforts to raise awareness of plastic pollution in the context of microplastics– Without a change in perspective, especially regarding dependence on single-use plastics, the plastic waste problem cannot be handled. During the COVID-19 recovery period, knowledge about plastic substitutes could help consumers make better decisions, potentially reduce waste production, and encourage sustainable businesses, creating local and regional jobs crucial to a circular economy.
9. Initiate funding research projects and institutions– There is a gap of research and studies in the area of microplastic pollution. The governments of the south asian countries shall initiate strategies and fundings to encourage more studies in this area. The more studies available, the more people can find different ways to reduce the impacts of micro plastics.
10. Mass cleanups may be a primary solution– ocean cleanups are the best way to prevent more microplastics from making their way into our planet's waterways. South asian countries with oceans or coastlines have started to create campaigns to clean up the beaches.The target of India's 75-day Swachch Sagar, Surakshit Sagar cleanliness program is to clean up 75 beaches along the nation's coastline. In Bangladesh, Blue Guards, a youth fisher-led beach cleaning initiative, removed 12,068kg non-decomposable pollutants from the sea beaches covering Cox's Bazar Sadar, Moheshkhali, Ramu, Teknaf, Ukhiya and Patuakhali's Kuakata in March-December 2021. The significance of such clean-ups is to spread awareness regarding the intense littering of plastics in the ocean waters, which has become a threat to marine life.

12. Conclusion

In every hemisphere of the world, microplastics have been discovered. The majority of items used in daily life are made of plastic, which is a valuable, practical, and useful material. However, in the modern world, poor management, incautious handling, and abuse of plastics have led to MPs pollution in every edge of the aquatic environment, from the top pelagic layer to sedimentary rocks on the seafloor. An expanding amount of studies shows that MPs are harmful to a variety of environmental components. MPs can have a negative impact on both human and animal health. The use of reduced plastic is growing as a key component of sustainability. The public is becoming progressively aware of and concerned about microplastic pollution. Even though there are 17 SDGs that target the greatest environmental problems, only one of them directly addresses mitigating the negative effects of plastics although there is no explicit reference to targets for reducing microplastics in any other Goal. Due to the pervasiveness of microplastic pollution and its negative effects on the environment, society, and economy, this poses significant challenges for governments and organizations trying to implement accurate reporting and monitoring of other SDGs. At least 12 UNSDGs were found to be affected by microplastic pollution in this study. It is therefore advised that the UNSDGs be updated

in order to gather baseline data against which future monitoring and reporting can be compared in order to address the transboundary threat of microplastics and prevent undermining the successful implementation of the UNSDGs. As a global phenomenon, international and regional legal policies should be adopted and implemented upon the states regarding microplastics to reduce its drastic impacts upon the environment.

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