



Prediction of What Would Occur if Plastic Pollution Continues and Strategies for Reducing It

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Abstract. Plastic pollution has risen to the top of the list of environmental concerns. As of 2017, there have been more than 7,800 million metric tonnes (MMT) of plastic resin and fibers produced since 1950. Experts also predict that by the year 2050, plastics will exceed fish in the ocean. Among the effects plastic pollution has on our environments are land, air, and marine. Single-use plastics are likely to also affect the country's manufacturing sector with implications for indirect and direct economic losses. The various techniques of plastic waste recycling have been done as a contribution to plastic solid waste management. The solutions encompass liquid refuse-derived fuel conversion, gasification of waste plastic, microbial degradation of plastics, and ESG practice (environmental, social, and governance). This article summarises the current body of knowledge on this topic, drawing on previously published papers and research findings, to predict what will happen if things continue as they are and provide suggestions on how to avoid things becoming worse.

Keywords: plastic pollution · ecosystem · economy · recycling technology · ESG practice

1 Introduction

Plastic pollution has risen to the top of the list of environmental concerns, as the world's capacity to cope with the ever-increasing output of single-use plastic goods is being exceeded. Plastic's popularity has grown exponentially since the 1950s, thanks to its advantages in terms of public health, safety, and energy efficiency [1]. However, the growing usage of plastics has led to an epidemic of unmanaged trash because of their extended lifespan and resistance to breakdown. As of 2017, there have been more than 7,800 million metric tonnes (MMT) of plastic resin and fibres produced since 1950 [2]. Experts also predict that by the year 2050, plastics will exceed fish in the ocean [3], with up to 10% of all litter created ending up in the ocean [4].

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The Coronavirus Disease 2019 (COVID-19) initially occurred in Wuhan, Hubei Province, China, toward the end of December 2019. World Health Organization (WHO) on January 30, 2020, declared the outbreak to be a Public Health Emergency of International Concern (PHEIC). The virus quickly spread over the globe after its appearance. On March 11, 2020, the World Health Organization (WHO) announced COVID-19 as a pandemic [5]. Furthermore, the environmental sustainability of our planet is threatened by COVID-19 [6–8]. One of the epidemic's most damaging effects on the environment is the unexpected rise in demand for plastic items.

Plastic pollution has grown during the COVID-19 pandemic. There are various ways in which COVID-19 may spread, including direct transmission between humans and indirect air transmission [9, 10], and it is exceedingly infectious. Personal protective equipment (PPE) like masks and gloves, which contain huge quantities of plastic, is advised based on these ways to prevent the virus from spreading [11], resulting in an increase in plastic waste [12–14].

Plastics are both cheap and long-lasting. As a result of these factors, human beings produce an enormous amount of plastic, and the market for that material continues to grow. Natural ecosystems and human life are both at risk from human activity.

When plastics such as plastic bottles, plastic containers, etc. are used for packaging, it is discovered that they are thrown away carelessly and without regard for the environmental impact. When these plastic wastes aren't properly dumped or disposed of, they end up all over the place, harming animals, habitats, and people, as well as causing choking and a foul smell. As a result, plastic pollution may have a negative impact on land, water, and the seas.

In general, most plastics have a chemical structure that makes them very resistant to many natural processes of deterioration and as a consequence, they take a long time to decompose. People's health has been badly affected by these circumstances, which have led to a large amount of plastic pollution in the environment. As the human population expands dramatically, so does the desire for plastic without considering the effects when wasted or disposed of. People's rubbish production continues to rise, and this population continues to expand. The accumulation of these throwaway items, such as bottles of water, soda cans, and plastic bags, has led to a rise in plastic pollution throughout the nation.

Scholars are increasingly focusing on plastic pollution studies in response to the present situation. Because of that, this article summarises the current body of knowledge in this topic, drawing on previously published papers and research findings, in order to predict what will happen if things continue as they are and provide suggestions on how to avoid things becoming worse. This article's viewpoint may be simply used and more realistic for both the marketer and the customer in their efforts to reduce plastic pollution and rescue this planet.

2 Method

We thoroughly searched the literature for studies that examined the impact of plastic pollution and its potential solutions. Using Web of Knowledge (all databases), we conducted a literature search using the keywords "plastic pollution." The material we

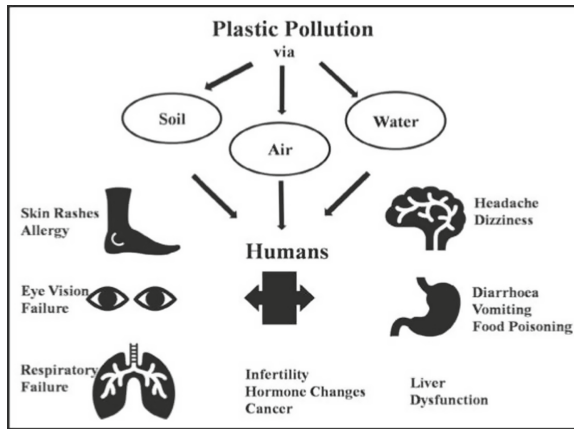


Fig. 1. Pollution Impacts on Human

gathered as a consequence of our study covers the ecology, economics, technology, and ESG practise. In our research, we included all peer-reviewed articles that addressed the impact of plastic pollution and potential solutions.

3 Results and Discussion

3.1 Effect of Plastic Pollution

Ecosystem

Potentially harmful and obnoxious contamination caused by plastics has been troubling our ecosystem for centuries. Plastic has the potential to cause important harm to people, animals, and plants. Global production currently exceeds 320 million tonnes (Mt) per year, over 40% of which is used as single-use packaging, resulting in plastic waste [15] plastics are associated with high levels of waste and leakage to the environment. This is the result of single-use plastics applications, inadequate end-of-life treatment, low recyclability and reusability rates and high potential of disintegration into microplastics [2]. The distribution of plastic debris varies due to some factors among which are wind and ocean currents, urban areas, coastline geography, and trade routes. Among the effects plastic pollution has on our environments are land, air, and marine. A summarized picture of recent impacts on human health is shown in Fig. 1. Since microplastics can adversely impact various organisms, the risk of humans getting affected by microplastics cannot be overlooked [16].

Land Pollution

Plastics have proven to have a harmful effect on the environment, causing issues for plants, animals, and even people. This frequently entails destroying plant life and endangering nearby animals. Although plastic is an extraordinarily useful material, it is also

constructed of harmful substances that are known to cause illness and is not biodegradable because it is designed to be durable. In landfills, plastic waste mixes with water to create dangerous compounds. These substances harm the quality of the water as they seep underneath. Plastic is spread out by the wind, which also deposits it in new locations. It may also get caught on nearby objects like poles, traffic lights, trees, fences, towers, and animals, suffocating them to death. Global plastic production has reached unprecedented levels, with 322 million tonnes of plastics produced globally in 2015 [17]. In 2015, 6,300 million tonnes of plastic waste were generated, 9% of which was recycled, 12% incinerated and the remaining 79% sent to landfills or leaked to the environment. The accumulation of plastics in the environment is a global issue which will increase if current production, consumption and waste management practices remain unchanged. An estimated 12,000 million tonnes of plastics waste are expected to accumulate in landfills or in the environment by 2050 if action is not taken [2].

Air Pollution

Today, air pollution is a global problem; areas far from the polluting source may be adversely affected as atmospheric circulation moves pollutants freely without regard to political boundaries [18]. Environmental contamination results from the discharge of poisonous/toxic compounds during the burning of plastics in open spaces, landfills, or incinerators. Burning of plastic waste increases the risk of heart disease, aggravates respiratory ailments such as asthma and emphysema and causes rashes, nausea or headaches, and damages the nervous system. These vapors can damage eyes and mucous membranes. Additives used as heat stabilizers, frequently contain heavy metals such as barium, lead and cadmium, sometimes in combinations. Lead and cadmium are the most serious environmental pollutants and have an effect on human health depending on their concentration [19].

Marine Pollution

Plastic debris ends up in the ocean in a variety of ways, it consists Litter, which is swept down storm drains into local waterways, working down rivers into the ocean; Plastic products, fishing nets, lost or thrown overboard at sea; Illegal dumping or poor waste management of trash on beaches around the globe; Microplastics from cosmetic and hygiene products, or clothing in our washing machines going down the drain; Industrial by-products from improperly conducted or managed production processes. Almost 700 aquatic species in the world were adversely affected by the introduction of microplastics, including sea turtles, penguins, and other crustaceans [20]. As humans are the ultimate consumers of sea foods [21] which are highly affected by microplastics, there is a high chance of microplastic transfer to humans [22]. Presence of microplastics in tap water [23], sea salt [24] and bottled water [25] are proven studies on how many ways they can reach the human body.

Economy

Plastics pollution is a crucial problem across regions of this world at the moment. The governance should be concerned with the rising of plastics debris confronted by the economic development. Worldwide plastics consumption is skyrocketing, reaching approximately 400 million tons on a yearly basis by 2025 [26]. Single-use plastics are likely to

also affect the country's manufacturing sector with implications for indirect and direct economic losses.

The one of direct economic consequences is derived from fisheries sector. It includes the cost of repairing damaged fishing vessels and aquaculture facilities in which the plastics break the machine. Besides, the damage is mostly ascribable to plastic debris either blocking cooling systems or entangling propellers. Then, the repairing cost is considered to be high that make loss for the company. For the example, the cost of repairing damaged fishing vessels added up to \$40 million in 1985, which is 0.3% of the country's total annual fishing revenue. In the European Union, the total repairing cost amounted to \$65.7 million, representing 0.9% of the yearly fishing income [26]. In South Sulawesi which is one of the Indonesia's province showed that the total loss of the vessels were about 193 million IDR and fishing gears were about 156 million IDR each year [27].

On top of that, the indirect economic impact of marine plastic pollution on fishing and aquaculture derives from the decrease of fisheries resources due to ghost fishing. Aquatic commercial target species amongst other marine organisms get caught, injured or even killed by abandoned, lost or discarded fishing equipment, leading to calamitous effects on the conservation of susceptible marine fauna and the economy. If consumers evaluate the presence of microplastics in seafood to be consumed as important, taking into consideration the risks involved, and leading to reduction in seafood consumption. It is evident that this could diminish the development opportunities of the seafood industry. It is proven that profit from fishing and aquaculture is also affected by direct and indirect plastic marine pollution.

Other than that sector, tourism sector become one of the victims from plastic pollution impact. In particular, touristic places interrupted by marine debris were piled up, the plastic debris is also disturbing tourism activities such as swimming or enjoying the beach view. The decrease in the number of coastal visitors, hence, leads to losses of revenue, which in turn has a negative impact on the regional economy. For example, on the island of Geoje in South Korea, the existence of marine debris after an enormous rainstorm in 2011 have resulted in revenue losses of between \$29 and \$37 million, as a result of a decrease of 560,228 visitors [28]. The annual loss induced by marine debris in the marine tourism sector in the Asia Pacific region is USD 622 million and the loss rate is 0.3% [29]. Plastic and cans on the beach occupy more space and have a greater impact on cleanliness. The result confirms that this theoretical prediction that environmental pollution can reduce tourists' length of stay [30].

3.2 Strategies for Reducing Plastic Pollution

Plastic Waste Recycling Technologies

Most plastic can be recycled, and the parts that are taken out can be used again. Still, this design is not used to its full potential because it is hard to collect and sort plastic waste. Some developing countries and some developed countries don't have good waste management systems, so plastics and other trash are often thrown carelessly into rivers and other bodies of water. Recycling is the best way to get rid of plastic waste, but it depends a lot on how well people know about it, how well the economy is doing, and how

well public infrastructures are put in place [31]. Plastic waste material can be recycled by making waste plastic into gas. This is a vertical fixed bed gasification system. It uses a thermochemical process to turn carbon-based materials into gases like carbon monoxide, carbon dioxide, methane gas and hydrogen, which can be used to make heat or electricity [32].

ESG Practices

ESG (environmental, social, and governance) is a framework which shows the performance of a company or certain industry. Unlike financial accounting statements, ESG measurements indicate a wider range of spectrum of the value and the qualifications a company holds [33]. ESG metrics cover various indicators of environmental, social, and also governance practices such as carbon footprint, human resources management, and also policies and strategies involving governance. It can be concluded that ESG is a highly essential measurement for the public and investor to assess a company's performance in order to make certain decisions. A study found that companies which have strong ESG performance tend to be more sustainable when compared to their competitors. Companies with these traits have a deep understanding of their industry scope and capabilities, causing them to take precautionary measures by managing long-term goals. Therefore, industries which produce unsustainable products such as the plastic industry are ought to follow the guidelines of ESG metrics. In the inducing process of ESG metrics, there are several major points to highlight:

Environmental Practice

Environment is an important aspect to be considered in strategies and policies making. Companies are responsible for ensuring the sustainability of materials and resources used in the manufacturing process. If possible, advanced technologies are urged to be used to decrease the waste and toxic released to the environment. Environmental-friendly ingredients are also highly recommended to prevent extensive environmental cost. If a business performs a green economy, it improves the value of the firm, resulting in additional stakeholders to invest [34]. Companies hold keys to business sustainability as companies are responsible for creating new trends and markets, as well as encouraging their consumers to move forward with green principles.

Social Practice

Social practice is linked to several points, such as relationships between local communities, employees and employers, diversity, health, and safety. In business operations, companies should be socially responsible by conducting several possible strategies in certain dimensions [35]. Corporate social responsibility represents economic, ethical, and legal measures, corporate social responsiveness measures companies' action and strategies such as defence and proactive mechanisms towards various situations, while social issues measure the capability of a business to be responsible in handling consumers, employee rights, product safety, and green environmental practices. An example of an applicable solution towards this practice is to conduct a training management program for employees to ensure their work performance and maximize their learning output.

Governance Practice

Governance metric measures the responsibility level a company conducts such as ESG

reporting, external assurance, board diversity and incentivized pay. This system controls how a company works and oversees the value of a firm to its stakeholders and shareholders. Companies with clear regulations have extraordinary internal control, leadership, and fair stakeholder rights. They conduct an efficient supervising and monitoring system to run the operation of the business [36]. This metric also serves as a tool for investors in assessing a company's business risk and mitigation. Corporate governance disclosure will give businesses incentives to develop the best corporate governance systems, boosting stakeholder confidence in the business.

4 Conclusion

Plastic does not decompose, and therefore is not recyclable. Breaking it down is practically difficult. When compared to other types of rubbish, it may last up to 1,000 times longer. Plastic is almost everywhere. Most of the plastic pollution is a result of improper recycling, landfill dumping, or natural decomposition of domestic garbage. They are transported by the wind and rain into drains, streams, rivers, and eventually the seas by the force of gravity.

It's becoming more and more apparent that plastic waste may be reduced with the advancement of technology. However, humans who are charged with protecting the environment must do their part to limit the amount of plastic garbage generated. It might be as easy as not buying with plastic bags or not using plastic packaging. Everyone may help contribute to the environment by minimizing plastic pollution, which has a long-term negative impact on the ecosystem and cannot be reversed. Instead of using single-use plastic bags, go for a reusable bag. The authors of this study advocate for the widespread use of product made from recycled materials.

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