

The Effectiveness of United Nations Environment Programme in Addressing the Problem of Marine Plastic Debris in Mexico

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Abstract

This study examines the role of the United Nations Environment Programme (UNEP) as an environmental organization in addressing the issue of marine plastic debris in Mexico. A descriptive qualitative method is employed, focusing on the depiction and analysis of phenomena based on collected data. The study applies the theory of international organizational effectiveness developed by Frank Biermann and Steffen Bauer, using three contextual variables: output, outcome, and impact to answer the research question. The findings indicate that, in terms of output, UNEP has implemented several initiatives, including *Parley for the Oceans*, the Global Partnership on Marine Litter (GPML), the *Clean Seas* campaign, and policies banning single-use plastics. In terms of outcomes, these efforts have contributed to increased public awareness in Mexico regarding the use of environmentally friendly products, advancements in plastic waste management and recycling through thermal valorization technology, and greater involvement of local communities in coastal clean-up activities. Regarding impact, the period from 2019 to 2022 saw fluctuations in the levels of marine plastic debris in Mexico, with both increases and decreases recorded. Based on the analysis of the three contextual variables output, outcome, and impact it can be concluded that UNEP has been effective in addressing the problem of marine plastic debris in Mexico.

Abstrak

Penelitian ini membahas mengenai United Nations Environment Programme atau UNEP sebagai organisasi yang bergerak di bidang lingkungan hidup dalam mengatasi permasalahan marine plastic debris di Meksiko. Metode penelitian yang digunakan adalah kualitatif deskriptif dengan menggambarkan dan menganalisis suatu fenomena berdasarkan pada data yang dikumpulkan. Penelitian ini menggunakan teori efektivitas organisasi internasional milik Frank Biermann dan Steffen Bauer melalui tiga variabel kontekstual, yakni output, outcome, dan impact untuk menjawab pertanyaan rumusan masalah. Hasil dari penelitian ini adalah dari segi output UNEP telah melakukan program-program seperti *parley for the oceans*, *Global Partnership on Marine Litter (GPML)*, kampanye *Clean Seas*, dan kebijakan larangan plastik sekali pakai. Kemudian, hasil dari segi outcome berupa kesadaran masyarakat Meksiko terhadap penggunaan produk ramah lingkungan, pengelolaan dan daur ulang limbah plastik menggunakan teknologi thermal valorization, dan keterlibatan masyarakat lokal dalam pembersihan pantai dari program-program output. Dari segi impact dari tahun 2019 sampai 2022 Meksiko terjadi peningkatan dan penurunan marine plastic debris. Melalui hasil pemaparan dari tiga variabel kontekstual yakni output, outcome, dan impact dapat disimpulkan UNEP efektif dalam mengatasi masalah marine plastic debris di Meksiko.

Keywords

Effectiveness, Marine Plastic Debris, Mexico, UNEP

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Introduction

Globally, marine plastic debris has become a serious issue in the field of marine environmental protection. Marine plastic debris refers to plastic waste originating from both land-based and ocean-based sources (Defitri, 2022). This waste is categorized into three groups: macroplastics, microplastics, and nanoplastics (Thushari & Senevirathna, 2020) (Noaa, 2024). Marine plastic debris poses significant threats to marine ecosystems, human health, and the economy.

There is a ranking of countries with the highest amounts of marine plastic debris from 2018 to 2022 worldwide. In 2018, 2020, and 2021, China ranked first, generating approximately 3.53 million tons of marine plastic debris. It was followed by Indonesia with 1.29 million tons, the Philippines (0.75 million tons), Vietnam (0.73 million tons), Sri Lanka (0.64 million tons), Thailand (0.41 million tons), Egypt (0.39 million tons), Malaysia (0.37 million tons), Nigeria (0.34 million tons), Bangladesh (0.31 million tons), India (0.27 million tons), Turkey (0.24 million tons), Brazil (0.23 million tons), the United States (0.22 million tons), South Korea (0.21 million tons), Japan (0.20 million tons), Myanmar (0.19 million tons), Pakistan (0.17 million tons), Mexico (0.16 million tons), and Russia (0.15 million tons) (Ritchie et al., 2018).

In contrast, the rankings changed in 2019 and 2022. During these years, the Philippines ranked first, generating 1.01 million tons of marine plastic debris. It was followed by India (0.98 million tons), Malaysia (0.94 million tons), China (0.91 million tons), Indonesia (0.88 million tons), Bangladesh (0.85 million tons), Vietnam (0.82 million tons), Myanmar (0.79 million tons), Brazil (0.76 million tons), Thailand (0.73 million tons), Egypt (0.70 million tons), Nigeria (0.67 million tons), Turkey (0.64 million tons), the United States (0.61 million tons), South Korea (0.58 million tons), Japan (0.55 million tons), Pakistan (0.52 million tons), Mexico (0.49 million tons), Russia (0.46 million tons), and Sri Lanka (0.43 million tons) (UNEP, 2016).

Mexico is one of the countries located in North America that faces the issue of marine plastic debris (Godin, 2023). Every year, Mexico generates over 100,000 tons of marine plastic debris (GIZ, 2022). This average amount of marine plastic debris is evidenced by the fact that in 2019, Mexico generated 150,000 tons, in 2020 it produced 140,000 tons, in 2021 it generated 160,000 tons, and in 2022, Mexico produced 150,000 tons of marine plastic debris (GIZ, 2022) (NOAA, 2025) (Rapa et al., 2024) (Pelamatti et al., 2019).

The types of marine plastic debris produced by Mexico include macroplastics and microplastics. The impacts faced by Mexico from marine plastic debris include effects on marine ecosystems, human health, and the economy (Mitra, 2024). Therefore, solutions are needed to address the various impacts of marine plastic debris generated by Mexico. These solutions include implementing programs such as international partnerships, regional and national partnerships, private sector partnerships, partnerships with non-governmental organizations, and civil society (Network, 2024)..

Additionally, Mexico's urban areas are densely populated and can generate up to 13,000 tons of waste per day, although this amount is not produced by all cities (UNEP, 2020). As a result, since January 1, 2021, the Mexican government has implemented a policy banning the use of single-use plastics in urban areas. Mexico City was one of the first regions to immediately apply this policy (Leo, 2021). Through the single-use plastic ban, supermarkets and stores in Mexico have stopped providing plastic bags (Press, 2020a).

With the implementation of the single-use plastic ban, the people of Mexico have begun switching to more environmentally friendly products that can be reused. Examples of products being used include corn starch plastic bags, fabric or tote bags, straw baskets, organic food containers, paper straws, stainless steel water bottles, bamboo or sugarcane eating utensils, and cucuruchos or cone-shaped paper used to wrap spices and seeds (*Mexico Bans Plastics*, n.d.) (Press, 2020b).

The United Nations Environment Programme (UNEP) is a branch of the United Nations (UN) that addresses environmental issues (Fund, 2015). UNEP was first established on June 5, 1972, in Nairobi, Kenya, East Africa, during the United Nations Conference on the Human Environment. The vision and mission of UNEP are to provide cooperation for preserving the global environment through public awareness and education to improve the quality of life without jeopardizing future generations. UNEP's role includes monitoring and conducting scientific research at both global and regional levels and providing policy recommendations to UN member countries wishing to collaborate (Nations, 2013). Currently, 193 countries have collaborated with UNEP.

As an environmental organization, UNEP recommends its member countries to create and implement policies related to plastic waste to address both land and marine waste issues (UNEP, 2023). Mexico, as one of its member countries, has also issued and implemented such policies. The effectiveness of UNEP's recommendations on plastic waste policies can be seen in the growing awareness and concern among the Mexican population about marine ecosystems (Nepote & Medina-Rosas, 2021). As a result, the people of Mexico have started to regularly clean several beaches affected by marine plastic debris. Furthermore, Mexico and UNEP have implemented several programs to address the issue of marine plastic debris.

Based on the explanation above, it can be concluded that this research is different. The study by Gading Nabilla Achsan, titled "*The Effectiveness of the United Nations Environment Programme (UNEP) in Addressing the Issue of Marine Plastic Debris in Mexico*," uses a descriptive qualitative research method. The data collection technique used in this study is literature review, and the data analysis technique is qualitative. This research applies the theory of international organization effectiveness by Frank Biermann and Steffen Bauer through three contextual variables output, outcome, and impact to answer the research question. The study analyzes the effectiveness of UNEP and Mexico in reducing marine plastic debris from 2019 to 2022, as well as in raising public awareness in Mexico regarding the dangers of marine plastic debris. From the explanation above, the researcher formulates the research question: "*How effective is the United Nations Environment Programme (UNEP) in addressing the issue of marine plastic debris in Mexico?*"

Theoretical Framework

According to Frank Biermann and Steffen Bauer, an international organization is an institution established by several countries or global actors to cooperate in addressing issues that transcend national borders (Biermann & Steffen, 2009). The effectiveness of international organizations can be understood through three contextual variables proposed by Frank Biermann and Steffen Bauer. Therefore, the researcher uses these three contextual variables to analyze this study. The following are the three contextual variables according to Biermann and Bauer (Biermann & Bauer, 2004):

First, output refers to the direct results of the organization's activities that can be observed in tangible forms. The key aspect of output lies in the institutional productivity or political mechanisms that enable the implementation of governance. In other words, it measures the extent to which international institutions or mechanisms can create policies, norms, agreements, and decisions. In short, output can be defined as all tangible actions carried out by the international organization.

Second, outcome refers to the changes that occur as a result of the organization's output, including changes in behavior, policy, or practices at the national or international level that emerge in response to the organization's actions. The key aspect of outcome lies in the implementation of policies and the behavioral changes of actors influenced by the governance output. In short, outcome can be understood as the behavioral changes of actors involved, such

as organizations, states, governments, society, and the media, in response to the policies introduced.

Third, impact refers to the final results of the organization's activities, indicating tangible changes in the issues being addressed. This usually involves significant transformations in social, economic, or environmental conditions that demonstrate the organization's long-term effectiveness in achieving its goals. The key aspect of impact lies in the substantial and actual changes in the environment as a result of shifts in actor behavior. Impact tends to have a long-term nature and is more difficult to measure compared to output and outcome. In short, impact can be defined as the result of policy changes that directly address the organization's targeted issues.

The theory of international organizational effectiveness developed by Frank Biermann and Steffen Bauer can be used to analyze UNEP's effectiveness in addressing the problem of marine plastic debris in Mexico. Through the three contextual variables output, outcome, and impact this theory can be applied in this study. In terms of output, it is observed through the direct and tangible results of UNEP's activities. In terms of outcome, it can be seen in the behavioral changes of actors such as the Mexican government, state, and society influenced by UNEP. In terms of impact, it is reflected in the actual results from the efforts of UNEP and the Mexican government in tackling the marine plastic debris problem.

Methods

In this study, the author uses a descriptive qualitative research method to specifically explain the phenomenon being studied. Qualitative research is based on non-numerical data, meaning the data used comes in the form of narratives, sentences, words, expressions, and images (Kusumastuti & Khoiron, 2019). Descriptive research is used to describe the results of the studied phenomenon, with a focus that must not be too broad and the data must be factual rather than opinion-based (Ramadhan, 2021). The study on the effectiveness of the United Nations Environment Programme (UNEP) in addressing the issue of marine plastic debris in Mexico requires this method to explain the data in detail.

The data collection technique used by the researcher is literature review by gathering written sources from books, journals, articles, theses, and websites relevant to the research topic (Wada et al., 2024). The data analysis technique employed is qualitative, by processing and interpreting non-numerical data (Store, 2023). The researcher sets a time frame for the study on the effectiveness of the United Nations Environment Programme (UNEP) in addressing the issue of marine plastic debris, focusing on the years 2019–2022. In 2019, Mexico generated 150,000 tons of marine plastic debris floating in the ocean. In 2020, due to the COVID-19 pandemic, marine plastic debris in Mexico decreased to 140,000 tons. In 2021, the amount increased to 160,000 tons as the country entered the post-pandemic normal phase. In 2022, the figure dropped again to 150,000 tons. These fluctuations in marine plastic debris from 2019 to 2022 were influenced by the efforts of the Mexican government, UNEP, the Mexican public, and collaborative partnerships.

Result and Discussion

Marine Plastic Debris as a Global Issue

Marine plastic debris refers to plastic waste that can pollute the ocean and originates from land-based activities, floating into the sea (Noaa, 2024). The types of marine plastic debris can be categorized into three types: macroplastics, microplastics, and nanoplastics. Macroplastics are large plastic items larger than 5mm, such as plastic bottles, plastic bags, plastic straws, and fishing nets (Cleanup, 2022). Microplastics are small plastic fragments smaller than 5mm that result from the breakdown of macroplastics. Other examples of microplastics include

polyethylene microbeads in cosmetics, synthetic clothing fibers, vehicle tire dust, and textiles (EPA, 2024). Nanoplastics are extremely small plastics smaller than 1 micrometer that may potentially enter the food chain (A et al., 2024). (A et al., 2024).

The main sources of marine plastic debris can be divided into two categories: land-based and sea-based sources. On land, marine plastic debris can account for up to 80%, stemming from poor waste management and tourism activities (L. A. a B et al., 2024). Waste resulting from ineffective waste management includes industrial, household, and tourist site waste. Meanwhile, waste generated from tourism activities includes drink bottles, plastic bags, and single-use utensils left behind by visitors. Sea-based marine plastic debris accounts for about 20%, and originates from activities such as fishing, maritime transport and shipping industries, and offshore oil drilling (Fava, 2022). Waste generated from fishing activities can include fishing gear, such as nets and ropes that are abandoned. Waste from maritime transport and shipping industries includes plastic waste from cargo ships, cruise ships, and fishing vessels that are directly dumped into the ocean. Additionally, waste from offshore oil drilling activities involves plastic waste from the tools used during drilling operations.

The impact of marine plastic debris can affect marine ecosystems, social and economic sectors, and human health. Looking at the impact on marine ecosystems, marine plastic debris poses a threat to marine life such as turtles, seabirds, fish, and mammals, as they often ingest plastic, mistaking it for food (Centre, 2017) (Conservancy, n.d.). This can lead to starvation, digestive issues, and even death in these marine organisms. Furthermore, marine life such as dolphins and seals often get entangled in fishing nets, which can restrict their movement and lead to death (Mammals, 2023). Additionally, in Mexico, the impact of marine plastic debris on marine ecosystems has caused damage to coral reefs due to plastic accumulation on the ocean floor. Microplastics can also pose a threat to coral reefs, as they can disrupt marine sediments (Sciencedaily, 2023).

Moreover, marine plastic debris can endanger human health. Consuming seafood contaminated with microplastics, which enter the human body, can be harmful since microplastics contain chemicals such as bisphenol A (BPA) and phthalates, which can potentially cause hormonal disruptions in humans (Yuan et al., 2022). Furthermore, water and air pollution are among the harmful effects of marine plastic debris. Water pollution can result from plastic breakdown, releasing toxic chemicals. Air pollution can occur due to the degradation of plastic in the environment, releasing microplastic particles into the open air, which, if inhaled, can cause respiratory issues (S. N. D. a B et al., 2022).

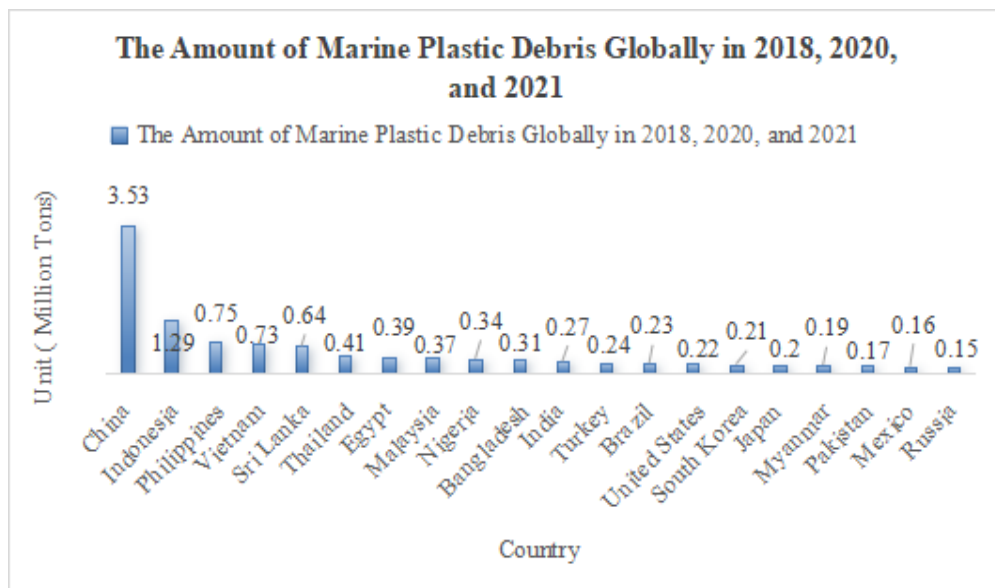
Next, the impact of marine plastic debris in Mexico on the social and economic sectors includes a decline in the fishing sector, effects on tourism, and high waste management costs. In terms of the decline in the fishing sector, this occurs due to the reduction in fish populations and the damage to fishing gear caused by marine plastic debris, leading to a decrease in catch and income for fishermen (M. R. I. a B et al., 2022). In terms of tourism, the impact is reflected in a decrease in the number of tourists, as beaches contaminated with marine plastic debris result in lower revenue. Additionally, the high cost of waste management is also a consequence of marine plastic debris, as the debris requires cleaning from beaches and waters that are covered and polluted by plastic (Guertin, 2019). Globally, marine plastic debris is a serious environmental issue that can threaten marine ecosystems, marine life, and human health. Each year, it is estimated that 4.8 to 12.7 million tons of marine plastic debris enter the ocean (Schwartz, 2015). By 2040, this amount is expected to triple (Brogan, 2020). Furthermore, marine plastic debris threatens over 800 marine species (Readdy, 2018).

There is also a ranking of countries with the largest amounts of marine plastic debris from 2018 to 2022 worldwide. In 2018, 2020, and 2021, China ranked first with 3.53 million tons of marine plastic debris, followed by Indonesia with 1.29 million tons, the Philippines with 0.75

million tons, Vietnam with 0.73 million tons, Sri Lanka with 0.64 million tons, Thailand with 0.41 million tons, Egypt with 0.39 million tons, Malaysia with 0.37 million tons, Nigeria with 0.34 million tons, Bangladesh with 0.31 million tons, India with 0.27 million tons, Turkey with 0.24 million tons, Brazil with 0.23 million tons, the United States with 0.22 million tons, South Korea with 0.21 million tons, Japan with 0.20 million tons, Myanmar with 0.19 million tons, Pakistan with 0.17 million tons, Mexico with 0.16 million tons, and Russia with 0.15 million tons (Ritchie et al., 2018).

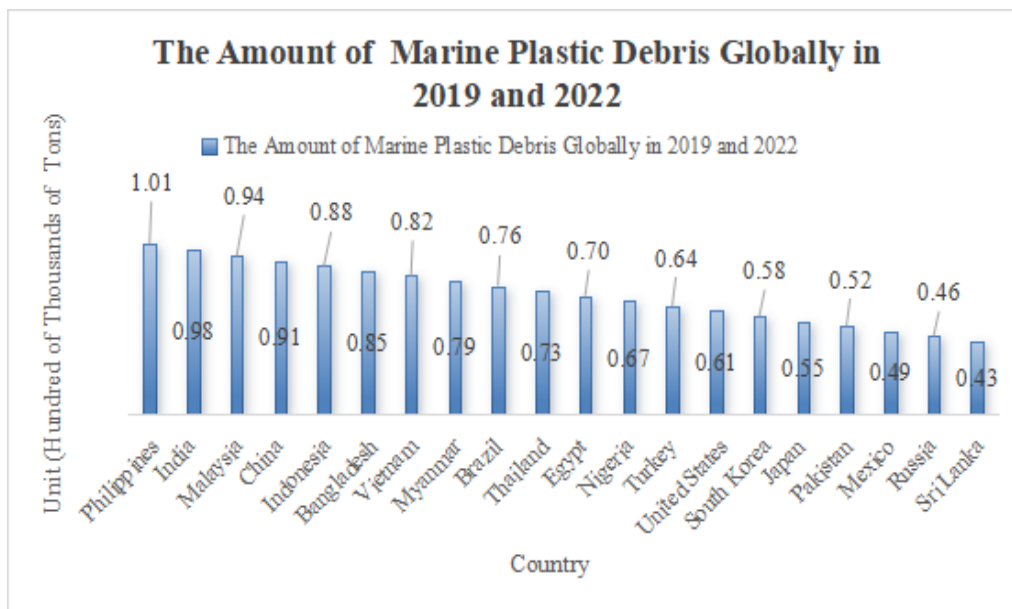
In 2019 and 2022, the country ranked first with the largest amount of marine plastic debris differed from previous years. In these years, the Philippines ranked first with 1.01 million tons of marine plastic debris, followed by India with 0.98 million tons, Malaysia with 0.94 million tons, China with 0.91 million tons, Indonesia with 0.88 million tons, Bangladesh with 0.85 million tons, Vietnam with 0.82 million tons, Myanmar with 0.79 million tons, Brazil with 0.76 million tons, Thailand with 0.73 million tons, Egypt with 0.70 million tons, Nigeria with 0.67 million tons, Turkey with 0.64 million tons, the United States with 0.61 million tons, South Korea with 0.58 million tons, Japan with 0.55 million tons, Pakistan with 0.52 million tons, Mexico with 0.49 million tons, Russia with 0.46 million tons, and Sri Lanka with 0.43 million tons (UNEP, 2016).

Diagram 1.1 Global Marine Plastic Debris in Amount in 2018, 2020, and 2021



Source: Data Processed by Researcher

Diagram 1.2 The Amount of Marine Plastic Debris Globally in 2019 and 2022



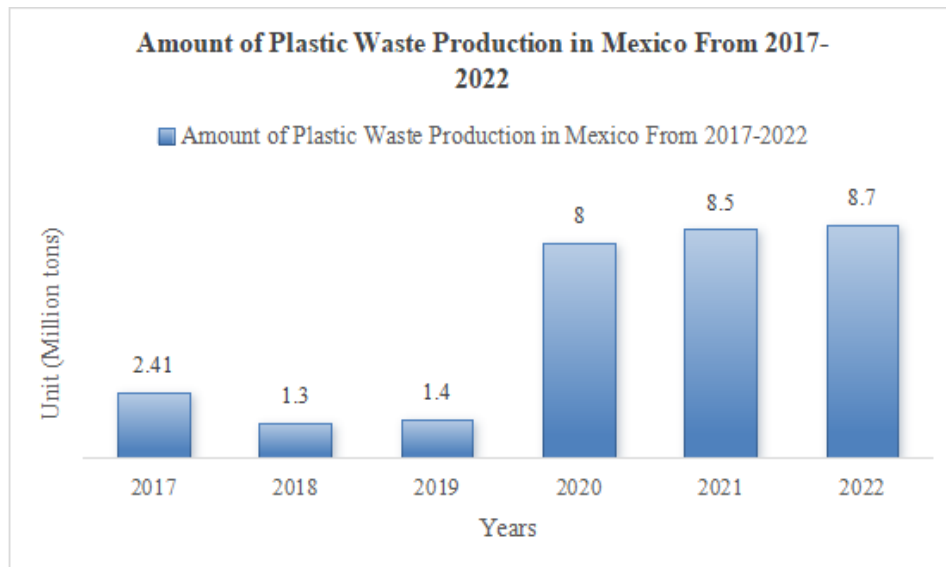
Source: Data Processed by the Researcher

Marine Plastic Debris in Mexico

Mexico is one of the countries with both increases and decreases in plastic waste production. In 2017, the amount of plastic waste produced by Mexico was 2.41 million tons (Jaganmohan, 2024). Then, in 2018, plastic production in Mexico decreased by 1.3 million tons compared to the previous year, with the main sources being household plastic waste, commercial and industrial waste, agricultural activity waste, and waste from tourism and hospitality (Griffin & Karasik, 2021). In 2019, Mexico saw an increase in plastic production of 1.4 million tons compared to the previous year, with the main sources again being household waste, commercial and industrial waste, agricultural activity waste, and waste from tourism and hospitality (Alves, 2023). In 2020, the amount of plastic waste produced in Mexico saw a significant increase of 8 million tons, which came from household waste, commercial and industrial waste, agricultural activity waste, and tourism and hospitality waste (Чебулаева, 2020).

In 2021, Mexico experienced an increase in plastic waste production of 8.5 million tons, sourced from household waste, commercial and industrial waste, agricultural activity waste, tourism and hospitality waste, and electronic waste (Griffin & Karasik, 2021) (Pearson, 2024). Then, in 2022, Mexico saw an increase in plastic waste production of 8.7 million tons, sourced from household waste, commercial and industrial waste, agricultural activity waste, tourism and hospitality waste, and electronic waste (Pearson, 2024).

Table Diagram1.3 Amount of Plastic Waste Production in Mexico from 2017 to 2022



Source: Data Processed by Researcher

Mexico is one of the countries located in North America that faces issues related to marine plastic debris. The marine plastic debris produced by Mexico each year can reach approximately 100,000 tons annually (GIZ, 2022). Additionally, Mexico has issues with both increases and decreases in marine plastic debris. In 2018, Mexico faced a marine plastic debris problem, producing over 100,000 tons of waste that floated in the ocean (BBC, 2015). Then, in 2019, Mexico saw an increase, generating 150,000 tons of marine plastic debris, sourced from macroplastics and microplastics (GIZ, 2022). In 2020, due to the COVID-19 pandemic, marine plastic debris in Mexico decreased to 140,000 tons, but most of the waste generated came from personal protective equipment (PPE) and single-use masks (NOAA, 2025). In 2021, as the situation returned to normal, marine plastic debris in Mexico rose to 160,000 tons, with waste sources including macroplastics and microplastics (Rapa et al., 2024). Then, in 2022, marine plastic debris in Mexico decreased to 150,000 tons due to improvements in waste management and recycling processes, driven by initiatives from the Mexican government (NOAA, 2025) (Pelamatti et al., 2019).

Table Diagram 1.4 Amount of Marine Plastic Debris in Mexico from 2018 to 2022



Source: Data Processed by Researcher

To address the issue of marine plastic debris, both government and non-governmental organizations in Mexico have undertaken various efforts and initiatives, including educational campaigns, planning for plastic waste management and recycling, and implementing policies to ban single-use plastics (Broom, 2019). In addition, as a result of these efforts, several regions in Mexico have begun enforcing single-use bans on plastic bags and straws. Mexico has also engaged in international cooperation with the United Nations (UNCTAD, 2024). However, there are challenges in managing plastic waste due to inadequate infrastructure, particularly in rural and suburban areas. As a result, Mexico's marine environment suffers from pollution due to poor waste management. Although public awareness is gradually increasing, many people are still not fully aware of the negative impacts of marine plastic debris.

Cooperation Between UNEP and Mexico in Addressing the Marine Plastic Debris Issue

Marine plastic debris is a serious problem that poses threats to marine ecosystems, human health, and the economy in Mexico. Therefore, Mexico has collaborated with UNEP by implementing various programs to tackle the issue of marine plastic debris. In addition to the cooperation between UNEP and Mexico, these programs are supported by various partnerships, including international, regional, and national partnerships, private sector partnerships, non-governmental organizations, and civil society. Below are several programs carried out by UNEP and Mexico with their partners:

First, one of the programs implemented by Mexico and UNEP is a multi-stakeholder partnership with the Global Partnership on Marine Litter (GPML). GPML focuses on environmental issues, particularly marine pollution. It was established in June 2012 during the United Nations Conference on Sustainable Development (UNEP, n.d.-b). The objectives of GPML are to reduce and prevent marine pollution caused by plastic waste and to offer global solutions to marine litter by involving international organizations, governments, the private sector, civil society, and academia (EPA, 2025). The outcomes of this program include national action plans, community engagement, capacity building, and the promotion of a circular economy (UNEP, n.d.-b). Mexico is one of the countries participating in these initiatives. As part of the national action plan, Mexico has developed strategies to reduce plastic waste in the

ocean by improving waste management systems, promoting recycling, and raising public awareness about the responsibility of waste management (UNEP, 2022). Additional results from the program include fostering public awareness in Mexico for participating in clean-up efforts. Moreover, Mexico has conducted training to enhance marine waste management and has performed data analysis related to marine litter (UNEP, 2022).

Second, another program carried out by Mexico and UNEP is a collaboration with the Parley Foundation. The goal of this program is to reduce plastic waste and raise awareness about the importance of preserving marine ecosystems through educational campaigns and community involvement. *Parley for the Oceans* leads several marine conservation projects in partnership with Mexico and UNEP. Mexico has undertaken marine debris clean-up efforts along the coastal areas of Holbox and Cozumel islands. Parley's focus is to increase awareness of marine litter, particularly within the tourism industry. As a result of this collaborative program, coastal clean-up efforts have been conducted 130 times in the Holbox area, successfully collecting 45,000 kilograms of waste and abandoned fishing gear (Parley, 2024). In addition, around 4,000 volunteers worked alongside local fishers to combat marine pollution.

In addition, the Mayor of Holbox initiated a plan to implement "Thermal Valorization" technology to convert waste into energy, addressing the 40,000 to 50,000 tons of accumulated waste (Maya, 2024). This method was previously implemented in 2018 and 2021 and proved to be a solution to the waste problem on Holbox Island. Another outcome of the collaboration program was the implementation of the "Avoid, Intercept, and Redesign (AIR)" strategy by the Parley Foundation in partnership with NOAA Marine Debris on Cozumel Island in September 2022 and August 2024. Through this program, the Parley Foundation and NOAA Marine Debris successfully reduced plastic waste by 50% by involving 20 local businesses, thereby minimizing plastic usage and promoting plastic alternatives. Moreover, hotels, restaurants, nightclubs, and bars in Cozumel experienced an 80% increase in educational awareness. To further raise public awareness on Cozumel Island about plastic-free zones and the AIR program, 10 public information boards were installed.

Third, a program carried out by Mexico and UNEP to address marine plastic debris is the "Clean Seas" campaign. The Clean Seas campaign is an initiative aimed at tackling plastic waste in the oceans. The campaign's goals include raising awareness and promoting policies to reduce the use of single-use plastics and marine litter (UNEP, 2021a). Through this campaign, Mexico actively engaged in several implementations, such as banning single-use plastics and organizing beach cleanups. The outcomes of this program included a beach cleanup on Isla Mujeres, which collected over 30,000 cigarette butts and removed 60 kg of plastic waste from the beach (Post, 2024). The event was supported by 80 volunteers in conjunction with World Cleanup Day.

In addition to implementing programs to combat marine plastic debris, Mexico also introduced a single-use plastic ban policy. UNEP was one of the organizations that recommended the policy to Mexico (UNEP, 2021b). The single-use plastic ban policy has been enforced since January 1, 2021, in Mexico City and is indefinite, making it a permanent measure (Seren, 2024). The policy prohibits the use of single-use plastic products such as plastic straws, plastic bottles, and plastic bags (Galeana, 2024). The objectives of this policy are to reduce land and marine pollution, shift public behavior toward using more environmentally friendly products, and mitigate the negative health impacts of plastic. As a result of this policy, Mexico experienced a reduction in plastic waste by approximately 50% (Pearson, 2024). Additionally, public awareness in Mexico has increased regarding the transition to eco-friendly products, industries have begun using environmentally friendly materials in their products, and plastic pollution in Mexico's marine environment has declined.

The Effectiveness of UNEP in Addressing the Problem of Marine Plastic Debris in Mexico

UNEP is an environmental organization established in 1972 with its headquarters located in Nairobi, Kenya, East Africa. It was founded as an organization tasked with coordinating and guiding international efforts to protect environmental sustainability (UNEP, n.d.-a). UNEP operates through global and regional collaborations, policy development, research, and advocacy. This study utilizes the theory of international organizational effectiveness by Frank Biermann and Steffen Bauer, using three contextual variables to analyze and assess the effectiveness of UNEP, as follows:

1. Output

From the perspective of output, UNEP has carried out various activities and programs to address the issue of marine plastic debris in Mexico. First, the *Parley for the Oceans* program, where UNEP conducted waste clean-up along the shores of Holbox Island and Cozumel in Mexico in collaboration with the Parley Foundation. This clean-up program has been carried out 130 times with volunteers from the Parley Foundation and local residents, totaling 4,000 people. Through this program, they successfully collected 45,000 kg of waste (Parley, 2024). Additionally, the program led the mayor of Holbox to implement a waste management plan for plastic waste using thermal valorization technology. Through this program, plastic waste was reduced by 50%, and 80% of the population became more aware of the issue (Maya, 2024). As a result of this program, the community in Cozumel installed 10 public information boards and created plastic-free zones.

Second, the "Clean Seas" campaign, which aims to raise awareness and encourage policies to reduce single-use plastic and decrease marine litter (UNEP, 2021a). Through this campaign, Mexico has been active in implementing measures such as banning single-use plastics and conducting beach clean-ups. The results of this program include a beach clean-up on Isla Mujeres Island in Mexico, where over 30,000 cigarette butts and 60 kg of plastic waste were removed from the beaches of Isla Mujeres (Post, 2024).

Third, the Global Partnership on Marine Litter (GPML) program, which aims to reduce and prevent marine pollution from plastic waste (EPA, 2025). The outcome of this program includes Mexico's national action plan to reduce marine plastic waste, focusing on improving waste management systems, recycling waste, and providing socialization to the Mexican public about the responsibility for waste management (UNEP, 2022). Another outcome of the program is the increased awareness among the Mexican public regarding beach clean-ups. Additionally, Mexico has conducted training to improve marine waste management and analyzed data related to marine waste (UNEP, 2022).

Fourth, the implementation of a single-use plastic ban policy in Mexico. This policy was implemented on January 1, 2021, in Mexico City (Seren, 2024). It prohibits the use of single-use plastic products such as plastic straws, bottles, and bags (Galeana, 2024). The policy aims to reduce land and marine pollution and change public behavior towards using more environmentally friendly products. As a result of the policy, Mexico experienced a reduction of about 50% in plastic waste (Pearson, 2024). Moreover, there has been increased public awareness in Mexico about switching to environmentally friendly products, industries in Mexico have started using eco-friendly materials for their products, and there has been a positive environmental impact on Mexico's marine life with a decrease in plastic pollution.

2. Outcome

In terms of outcomes, the community in Mexico has started to become more aware of the dangers of single-use plastics for the ocean. Gradually, people in Mexico have begun

adopting environmentally friendly materials. The use of tote bags, which can be used to carry shopping items, is being adopted by the Mexican community, as tote bags can be reused multiple times, unlike plastic bags that are single-use. Additionally, some markets in Mexico have begun using eco-friendly paper called *cucuruchos* to wrap spices and seeds (Press, 2020b).

Moreover, another form of behavioral change is the reduction of marine litter through the collection and recycling of lost fishing gear. A collaboration between the Parley Foundation and NOAA involves local fishing communities in beach clean-ups (NOAA, 2025). The program also introduced specialized machines to turn nylon nets and other debris into recycled plastic, creating new products. This program has also raised public awareness about the impacts of marine waste and encouraged people to reduce their household plastic usage. Through education and information dissemination, the program has successfully reduced plastic pollution and engaged local communities in better waste management (Parley, 2024).

Furthermore, the behavioral change outcomes from the output activities include beach clean-ups on the islands of Cozumel, Holbox, and Isla Mujeres in Mexico. The result of the beach clean-up on these shores was the collection of waste from the beaches. Through this program, 45,000 kg of waste was collected from the beaches of Cozumel (Parley, 2024). Additionally, the program led the mayor of Holbox to implement a waste management plan for plastic waste using thermal valorization technology, successfully reducing plastic waste by 50% (Maya, 2024). Furthermore, the beach clean-up on Isla Mujeres Island resulted in 60 kg of plastic waste being removed (Post, 2024).

3. Impact

In terms of impact, through UNEP's involvement in addressing the issue of marine plastic debris, there has been both an increase and a decrease between 2019 and 2022. In 2019, marine plastic debris in Mexico amounted to 150,000 tons, mostly from macroplastics and microplastics. In 2020, the amount of marine plastic debris in Mexico was 140,000 tons, largely due to personal protective equipment (PPE) and single-use masks, showing a decrease. Compared to 2019, marine plastic debris in Mexico decreased by 10,000 tons in 2020 (Pelamatti et al., 2019). In 2021, marine plastic debris in Mexico increased to 160,000 tons, primarily from macroplastics and microplastics. Compared to 2020, marine plastic debris in Mexico rose by 20,000 tons. Then, in 2022, marine plastic debris in Mexico decreased to 150,000 tons, which is a reduction of 10,000 tons compared to 2021 (NOAA, 2025) (Pelamatti et al., 2019).

In terms of the impact on marine ecosystems, particularly marine life in Mexico, the effects of marine plastic debris have been observed from 2018 to 2022 (NOAA, 2025). In 2018, various marine species were affected by marine plastic debris, including 1,200 turtles, 3,500 seabirds, 10,000 fish, and 500 marine mammals. In 2019, the number of affected marine species increased, with 1,300 turtles, 3,800 seabirds, 11,000 fish, and 550 marine mammals impacted. Then, in 2020, the number of affected marine species continued to rise, with 1,400 turtles, 4,000 seabirds, 12,000 fish, and 600 marine mammals affected. In 2021, marine life in Mexico continued to experience increasing impacts from marine plastic debris, with 1,500 turtles, 4,200 seabirds, 13,000 fish, and 650 marine mammals affected. In 2022, marine life in Mexico was still facing increasing impacts, with 1,600 turtles, 4,500 seabirds, 14,000 fish, and 700 marine mammals affected by marine plastic debris (Parley, 2024).

Furthermore, in terms of the economic impact on local communities in Mexico, there has been both an increase and a decrease in tourism income from 2018 to 2022. In 2018, Mexico generated \$22 billion USD in tourism revenue but experienced a 5% decrease in tourism income due to the effects of marine plastic debris, equivalent to \$1.1 billion USD. In 2019, tourism income in Mexico increased to \$23 billion USD compared to the previous year, but the impact of marine plastic debris caused a 6% decrease, equivalent to \$1.38 billion USD. In 2020, Mexico

experienced a decrease in tourism revenue of \$14 billion USD due to the COVID-19 pandemic, and the impact of marine plastic debris caused a 4% decrease, or \$560 million USD. In 2021, Mexico's tourism revenue increased again to \$18 billion USD, but the impact of marine plastic debris caused a 5% decrease, equivalent to \$900 million USD. In 2022, tourism revenue in Mexico increased to \$20 billion USD, but due to the effects of marine plastic debris, it saw a 5% decrease, equivalent to \$1 billion USD (OECD, 2017).

Conclusion

The phenomenon of marine plastic debris in Mexico can pose a serious global threat and challenge if not addressed promptly. The impact of macroplastics, microplastics, and nanoplastics in marine plastic debris can cause damage to marine ecosystems, human health issues, and affect the economy and tourism. Mexico is one of the countries experiencing several of these impacts due to the issue of marine plastic debris. To address this, Mexico has partnered with UNEP through the implementation of several programs.

Through the three contextual variables by Steffen Bauer and Frank Biermann output, outcome, and impact the effectiveness of UNEP in tackling marine plastic debris in Mexico can be demonstrated. In terms of output, UNEP successfully implemented a program called *Parley for the Oceans* for clean-up along the shores of Cozumel and Holbox, leading to a reduction in plastic waste and educating the local community to be more aware of the issue of marine plastic debris. Another program, the "Clean Seas" campaign, was conducted for the beach clean-up at Isla Mujeres. UNEP also successfully implemented a policy banning single-use plastics in Mexico.

In terms of outcome, the community in Mexico has gradually started to recognize the dangers of plastic use for marine ecosystems. The public has begun to switch to and implement more environmentally friendly materials by using products that can be reused. Additionally, Mexico has taken the initiative to manage and recycle waste through thermal valorization technology as an effort to reduce plastic waste. In terms of impact, from 2019 to 2022, Mexico experienced both an increase and decrease in marine plastic debris in terms of the environment and economy. These three variables demonstrate the effectiveness of UNEP and the Mexican government in addressing marine plastic debris.

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