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Problem Statement Final Draft

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### Team – Problem Statement

#### PROBLEM

Plastic consumption has spread throughout the world and become a deeply ingrained part of daily existence, making it a pervasive feature of modern life. The use of plastic has increased due to its durability (Callister, 2007) and low cost (Balakrishnan and Sreekala, 2016). However, plastic takes hundreds of years to decompose which has led to pollution. As the world struggles with the effects of excessive plastic usage, countries are focusing more and more on sustainable ways to lessen their impact on the environment and protect the earth for coming generations.

Qatar is also experiencing an excessive use of plastic, especially single-use plastic that leads to many environmental problems like marine pollution. Single-use plastic products such as plastic bags, bottles, straws, food containers, wrappers etc., are used once or for a very short period before being thrown away. We see a lot of single-use plastic consumption in Qatar despite attempts to be more eco-friendly. In addition to increasing environmental degradation, Qatar's continued reliance on single-use plastics also shows a lack of commitment to sustainability and its hopes for a more environmentally friendly future. In order to change this, we need to find better ways to use less plastic.

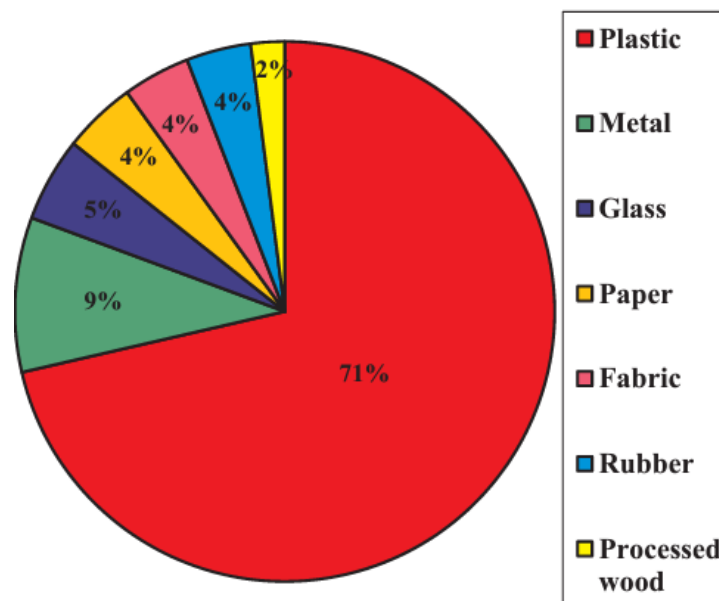


Figure 1: Percentage of Different Marine Litter Types in Qatar (Source: Veerasingham et al., 2020)

Figure 1 depicts the composition of marine trash in Qatar, with plastic accounting for 71% of the total. This considerable statistic shows the critical issue of plastic pollution in marine environments, emphasizing its prevalence over other materials such as metal, glass, paper, fabric, rubber, and processed wood, which together account for less than one-third of total litter. The pie chart is a graphic representation of the tremendous environmental burden that plastic trash poses, particularly in the maritime context. It verifies our project's focus on plastic pollution and the importance of targeted measures to minimize plastic waste in Qatar's marine habitats. The high amount of plastic found in the sea waste is a very important sign that we need to act quickly. We need to use things in a way that is better for our world, improve how we get rid of waste, and start using complete programs to recycle plastic. This is to keep sea life safe and make our oceans healthy. (Veerasingham et al., 2020)

The problem of single-use plastic takes on particular significance when considered in the context of Qatar, a country that is quickly developing, with a booming economy and expanding population. Qatar has seen an increase in the use of plastic in a number of ways, from consumer goods and packaging to infrastructure and construction. Qatar generates around 1.4 kg of solid waste per day, with 13-14% consisting of plastic, placing us among the top plastic consumers globally (Hahladakis & Aljabri, 2019). The increasing use of plastic and its effects on the environment, public health, and the country's larger sustainability program is extremely concerning.

## **PURPOSE**

The purpose of this research is to analyze how single-use plastic pollutes the marine life in Qatar especially plastic bags which are identified as the most harmful to the marine life (Hardesty et al., 2015). Our specific goal is to assess how well the various solutions fit within the distinct social, economic, and environmental context of Qatar identified through secondary research. We hope to identify important individuals, companies, communities, and governmental organizations, and comprehend their role in plastic consumption and regulation. Moreover, we will suggest strategies that are sustainable for Qatar, environmentally friendly, and efficient at cutting down on single-use plastic consumption. We can effectively address the plastic issue and build a more sustainable future of Qatar if we identified the roles of individuals, companies, communities as well as governmental organizations.

## **OBJECTIVES**

The success of this project will be measured by solutions that are inclusive, flexible, and culturally appropriate while also being in line with Qatar's sociocultural values, economic goals, and environmental goals. In order to reach these goals, the main objectives of this report are:

- Understand the impact of single-use plastic on Qatar's coastal waters which severely affects the marine life and ecosystem.
- Identify the most important criteria that are economically and environmentally acceptable.
- Using the criteria to propose effective strategies and solutions to reduce pollution caused by single-use plastic.

## **SCOPE**

Although the use of plastic is a worldwide problem, our focus is on addressing single-use plastic and its impact on marine life within Qatar. As Qatar shares the boundaries with other countries, Qatar's

approach to plastic consumption and pollution influences neighboring countries. Furthermore, identifying potentially effective solutions appropriate for Qatar is made easier by learning from international communities and how they regulate the impact of single-use plastic. Learning from other countries could help us to identify the issues arising from different solutions. Analyzing the issue from the perspectives of individuals, companies, and industries offers a detailed understanding of the ways in which plastic is used in Qatar. However, it is important to recognize the relationships between local and global issues.

## **PREVIOUS & CURRENT RESEARCH**

There has been extensive research conducted on plastic consumption and its hazardous effects globally. Eriksen et al. (2014) estimated the amount of floating plastic debris in the North Pacific to be 12,100 metric tons, compared to 21,290 metric tons calculated by one research group based on data spanning 11 years (Law et al., 2014). Similarly, Eriksen et al. (2014) reported the total floating plastic load to be 35,500 metric tons, although a different recent study on the global dispersion of plastic implies a range of 7,000 to 35,000 metric tons (Cozar et al., 2014). Additionally, a large 100-fold discrepancy between the projected weight and abundance of plastic and the actual findings is found in the latter investigation, suggesting a major loss of plastic.

Due to plastic's durability, plastic bags detected in the water are a hazardous waste. Plastic waste is produced by a variety of mechanisms, including weathering and photodegradation. It breaks down and disperses, building up in areas around heavily inhabited coastlines of the oceans (Hardesty et al., 2015). Plastic bags have a well-documented effect on marine species by entanglement and ingestion, harming creatures at various trophic levels. Furthermore, as chemicals to plastic and enter the food chain, plastic pollution poses health concerns to people (Waring et al., 2018). It is found that the substances used in plastic bags affect the development of sea creatures, which includes deformities, and shell height (Ke et al., 2019).

When single-use plastics (SUPs) are subjected to heat, sunlight, or physical stress, they break down gradually and become small particles known as secondary microplastics (MPs) (Pandey et al., 2023). Microplastic pollution is becoming a significant issue since tiny microplastic is smaller and more easily dispersed than larger plastics. Microplastic is a major concern for the environment and public health as they can be detected in freshwater lakes, rivers, and even drinking water (Schymanski et al., 2018).

Nearly all plastic produced finds its way into the ocean via rivers, tides, wind, and wastewater (Veerasingham et al., 2020). Approximately 80% of the debris discovered in the water is made of plastic, with plastic bags being among the most often encountered objects. As biodegradable plastics are meant to decompose more quickly than conventional plastics like polyethylene, some people advise using them instead (Green et al., 2015). Still, not much research has been done on whether biodegradable plastics truly decompose in the environment, and some varieties can persist years after being discarded.

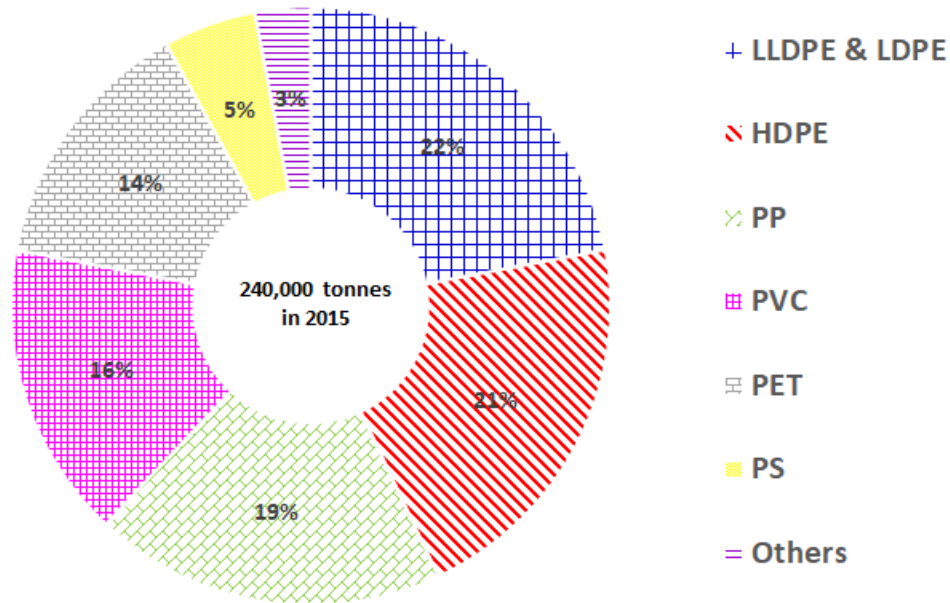


Figure 2: Distribution of plastic product usage in Qatar in 2015 by the type of plastic. (Source: Green et al., 2015)

In our review of Qatar's plastic usage in 2015, we found that out of 240,000 tonnes, the majority was LLDPE & LDPE, taking up 19% and found in everyday items like shopping bags and packaging. HDPE was next at 16%, known for its use in durable goods like milk containers and cleaning product bottles. PP made up 14%, seen in car parts and storage containers around the house. PVC, which made up 5%, goes into making things like window frames and pipes. The same percentage was noted for PET, commonly used in water bottles and snack packaging, and for PS, found in throwaway cups and insulation material. The rest, making up 27%, were assorted plastics used in a wide range of products, from gadgets to specialized packaging. It's clear that the variety of plastics used in Qatar calls for tailored recycling strategies for each type to tackle their environmental effects properly. (Green et al., 2015)

There are various ways of disposing plastic waste in order to reduce plastic pollution. Landfilling, heat treatment (incineration, pyrolysis), chemical degradation, etc. are examples of traditional plastic waste management techniques. Physical and chemical processes, as well as incineration, are standard procedures used in COVID-19 waste treatment and are applied at different phases of the waste management systems. Open dumping is the most common technique of disposing of rubbish in countries in the Middle East. Whereas plastic is presorted before disposal in KSA, mixed garbage is processed on-site in Qatar. Qatar places a high priority on sanitation in addition to waste management techniques including separation, collection, the 3Rs (Reduce, Reuse, Recycle), and Waste to Energy Transformation (WET) (VK, 2023).

In addition, this report focuses on how various local and international organizations and communities have developed strategies to reduce plastic marine debris caused by plastic bags. While some places have chosen to fine consumers for using lightweight plastic bags or impose taxes on retailers that sell them, others have elected to outright forbid their use. For instance, there have been prohibitions on plastic bags in regions such as the United Kingdom, Australia, and North America. During the early 1990s, a number of European nations, including Germany and Denmark, were among the first to outlaw plastic bags in the majority of retailers (Dikgang et al., 2012). As time went on, many nations in Asia,

Europe, and Africa adopted similar policies, either outright prohibiting plastic bags or charging a price for them (Poortinga et al., 2013). Often, the national level is where these actions are conducted. Even some nations have imposed unique taxes on plastic bags; the specific charges and regulations vary by location. For example, only on Saturdays is there a fee on plastic bags in Malaysia (Asmuni et al., 2015). Furthermore, several nations have levied fees on plastic bags that do not adhere to their standards, establishing benchmarks for the quality of bags that can be used.

## **USER NEEDS AND DESIGN CONSTRAINTS**

**Users:** Residents, tourists, and businesses in Qatar are the primary users impacted by the issue of single-use plastic consumption and marine pollution. Whereas, marine life and ecosystems are the secondary users. While secondary users need protection from plastic pollution to preserve biodiversity and ecosystem health, primary users' requirements and problems center on minimizing plastic waste and promoting sustainable alternatives. Providing easily accessible alternatives to single-use plastics and putting in place efficient waste management systems are two ways that solutions must address these various requirements and difficulties.

**Design Constraints:** In the design phase of our project, recognizing the constraints is crucial to developing feasible solutions. The geographic uniqueness of Qatar necessitates adaptable strategies that can integrate with the urban, coastal, and marine environments distinctive to the region. Creative initiatives like beach clean-ups, coastal restoration, and marine sanctuaries are promising but must be tailored to fit Qatar's specific landscape. The project's ambitious timeline requires prioritizing solutions that are not only effective but also rapid to deploy within a tight two-month window. Financial investment, manpower, and sustainable resources are fundamental requirements to ensure these solutions are not just conceptual but actionable. Essential to this endeavor is garnering support from government bodies, businesses, local communities, and residents, establishing a collaborative effort that aligns with Qatar's commitment to reducing environmental impact and fostering a sustainable future.

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