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Aalto University

Plastic Waste in the Ocean

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Project website:

https://angelineoktaviana.wixsite.com/saveoceanlife

1. Topic Selection

The topic of this project is related to Goal 14 of the UN SDGs: Converse and sustainably use the oceans, seas and marine resources [1]. The ocean plays an important role for the environment. It is fundamentally the life support of the earth. Approximately more than half of the oxygen on earth comes from the ocean. The recent spikes of plastic pollution or ocean acidification is not ideal for the health of the ocean. Therefore, it is only natural to take care of the ocean against it, not only on the basis of the environment and the earth, but also for us, humankind.

The goal of this information visualization project is to share and tell about the dire situation the ocean life faces currently. There are more than one million seabirds and 100,000 marine animals die from plastic pollution annually [2]. Furthermore, in the near future, the number of plastics in the sea is estimated to be higher than the number of fish [3].

I am from Indonesia, which is a country with the largest archipelago in the world. It is located between the Indian and Pacific ocean. Since I grew up near the ocean, the ocean is really close to my heart, and hearing about how bad the plastic pollution is nowadays, especially in the country, has disheartened me. The huge amount of plastic disrupts marine biodiversity's lives. It is absolutely critical to take care of this issue since marine biodiversity is important for our planet and our health. This project will help raise awareness of the situation by providing the information with visualizations about the facts of the pollution and steps people can take to help the ocean.

2. Approach, Tools, Themes, and Data

The initial idea was to gather some data about plastic pollution and show how severely damaging the pollution is. The visualizations can include plots, images, charts, essentially an infographic. There are informative guides to show how we can help reduce the pollution.

The following figure 1 is an early sketch of the desired visualization for this project.
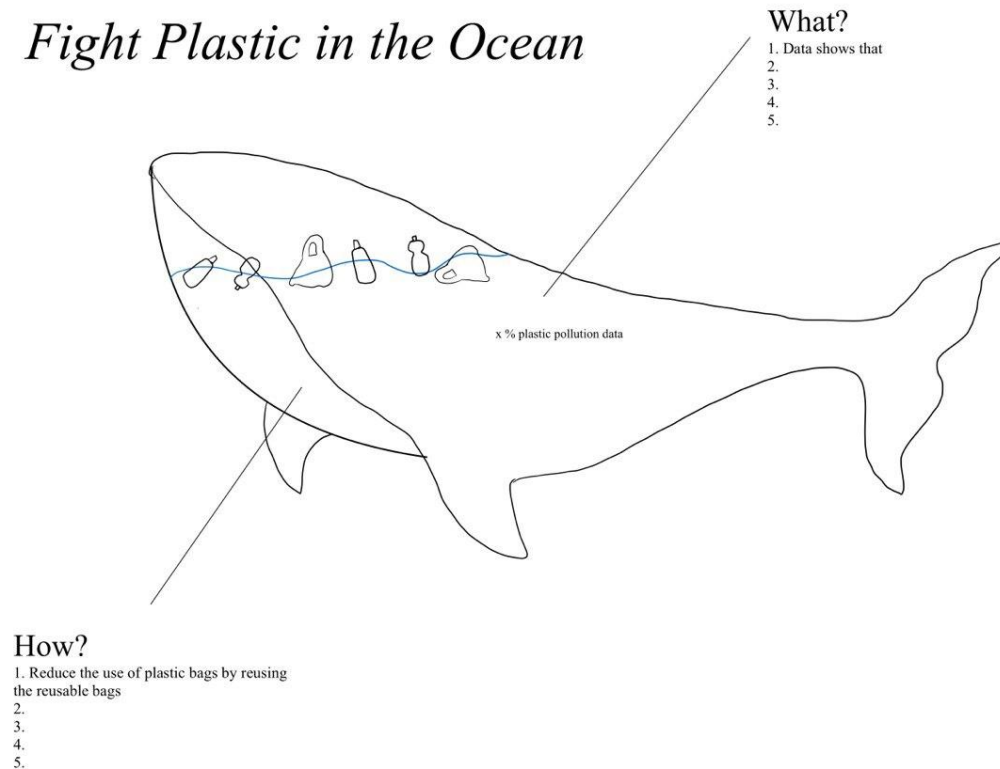
Figure 1. Sketch of an early project visualization

When the information is shown with visualizations or infographics, people are often more interested to check and read it further. After all, visuals are more attractive to most people. The audiences will learn about the dire situation of the ocean currently and have more knowledge on how to help decrease the pollution.

The project data is obtained from Our World in Data [6]. Our World in Data provides data that is mostly in csv (comma-separated values) files, that is in fact not difficult to work with. After careful selection, three csv data are chosen to be utilized in this project, that includes mismanaged plastic waste to ocean per capita (kg per year) for the year 2019 of 165 countries in the world; global plastic production from the year 1950 - 2019 in tonnes; and lastly, plastic production by sector in 2015 in tonnes. All the data is preprocessed before then utilized to make the plots. The data of production by sectors however, contained not only data by sectors, but also both sectors and plastic types, which is not clear and mixed. Figure 2 shows the plot of this data. Thus, in order to show a better and more easily comprehend plots, I divided both into two different plots.
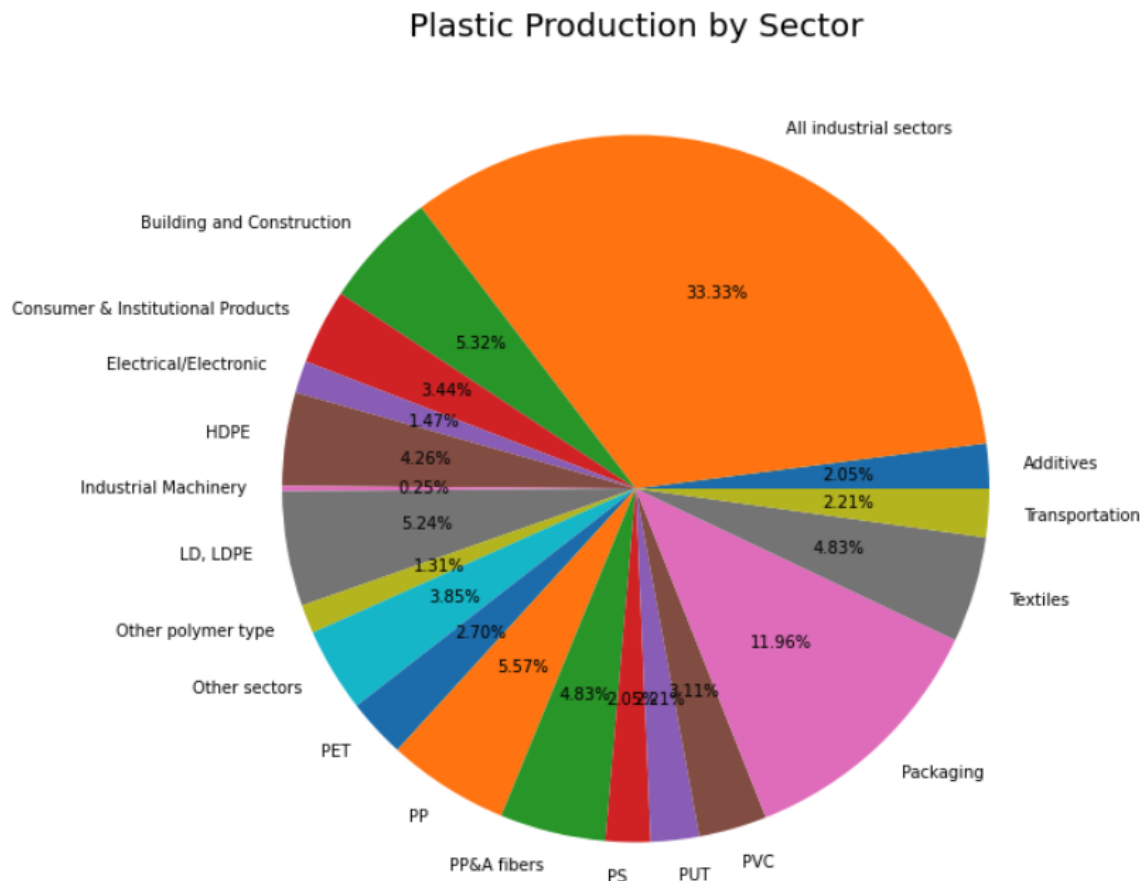
Figure 2. Data Visualization of Plastic Production by Sectors before dividing the data.

In the beginning of the project, visualizations were planned to be entirely programmed and visualized on a free website by *Heroku* [5]. However, after careful consideration, it is more important to focus on the attractive and purposeful visualizations and utilize freely available sources to easily build a website page. Therefore, at the end this project utilizes *wixsite.com* for the website application and design [7]. The plots of the data are still included and they are coded on a jupyter notebook in the python programming language. There are slides of the data visualizations shown on the website.

The final product of this project is an interactive website (available on this address: *https://angelineoktaviana.wixsite.com/saveoceanlife*) that provides information to spread awareness of the plastic pollution issue. Information included in this website is all obtained from different sources (references) and the images are mostly provided already by *wixsite* and the first welcome photo on the website is from my own private collection.

3. Information Usability, and Interaction

The project website is designed so that users can view it by scrolling and clicking effortlessly. When the users open the website, the users will be welcomed by the welcome image and title of the project. It is then intuitive for the users to scroll down to view more of the contents. The next content is a slide gallery of the data plots, users can check and click to view the full size of the images and information. The plots provide main information and factual data the users can learn. They are about plastic production and mismanaged plastic waste by countries which are shown on figure 3, 4, 5, and 6 below.
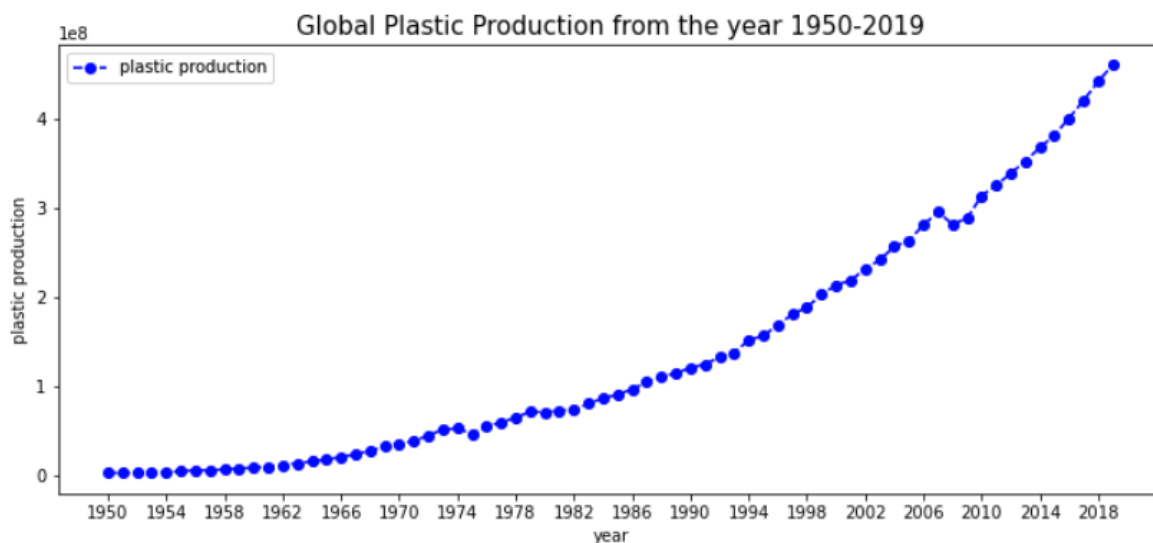

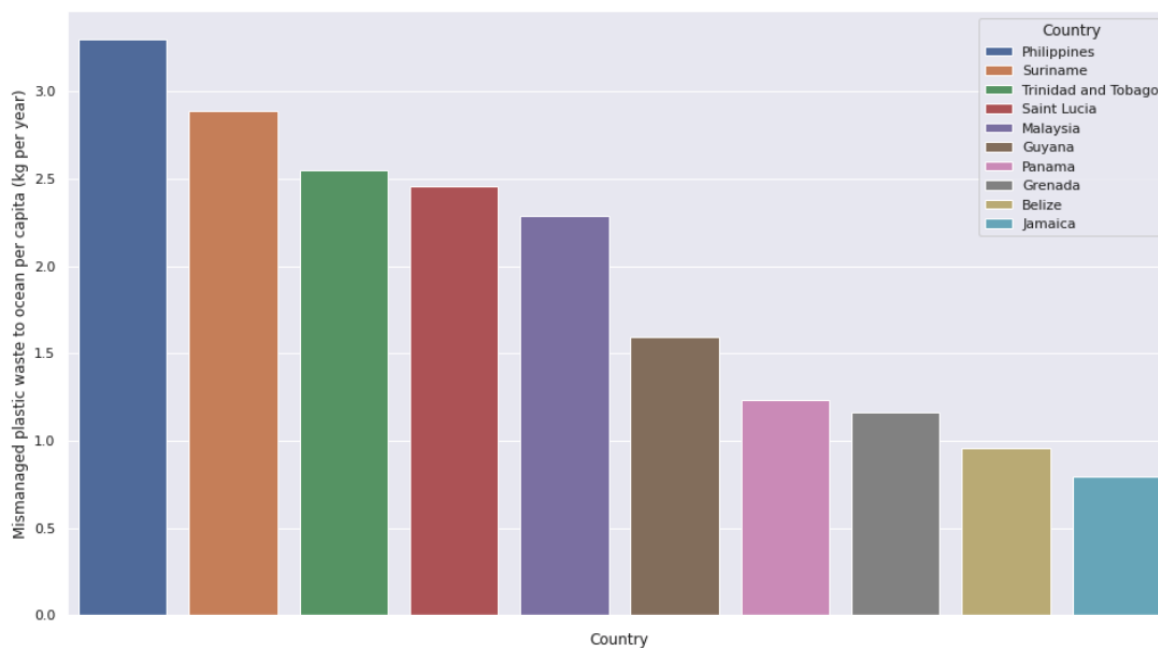**Figure 3. Data Visualization of Global Plastic Production in year 1950-2019**

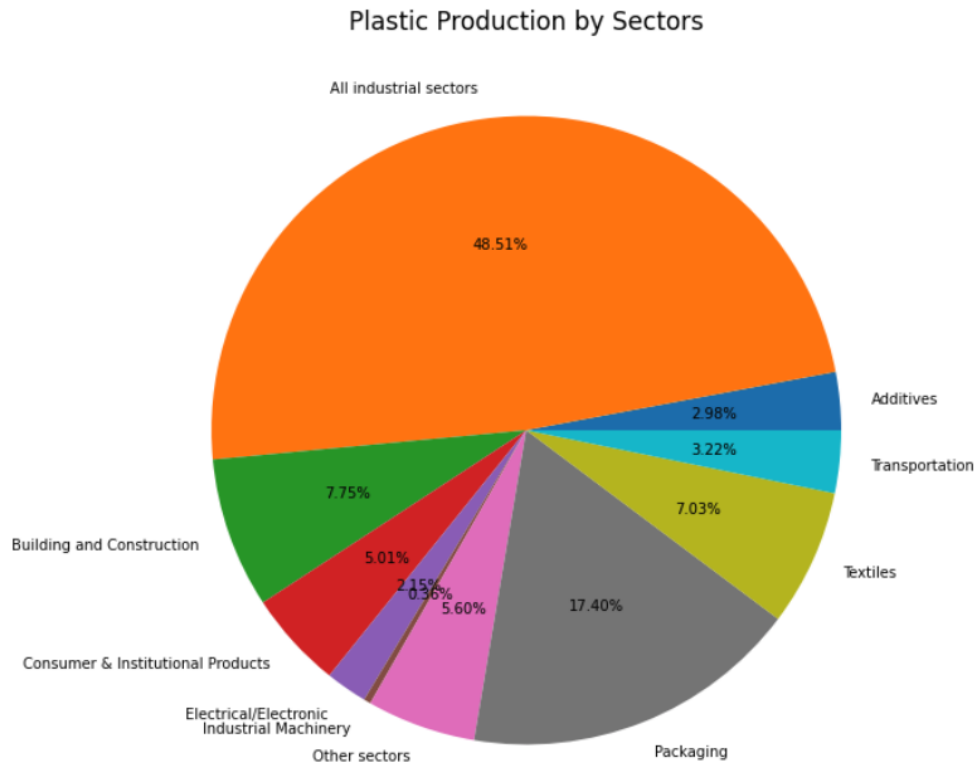**Figure 4. Data Visualization of Mismanaged Plastic Waste per capita**

Plastic Production by Sectors

Figure 5. Data Visualization of Plastic Production by Sectors

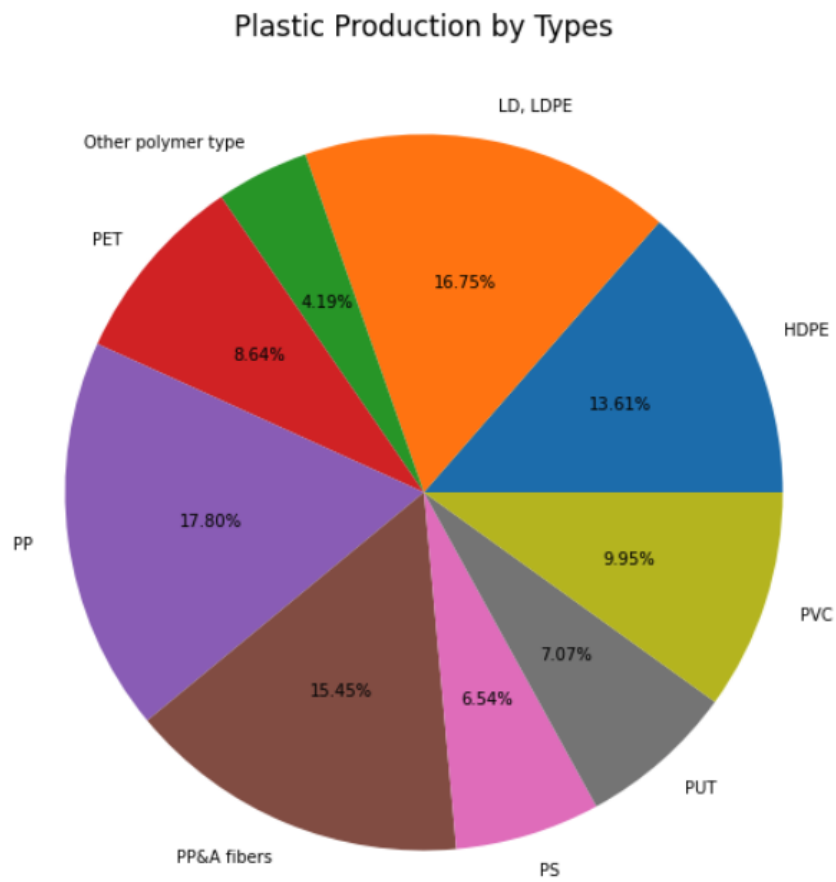## Plastic Production by Types

Figure 6. Data Visualization of Plastic Production by Types

Next part of the website is an infographic of the pathway plastic escapes to the oceans. This informs the users on how the mismanaged plastic ends up in the ocean. This part is essential to build the knowledge and story of the plastic journey. Facts and images then are shown next, followed by a gif that I have created by using *adobe photoshop*. The gif is to display more clarity how much plastic escapes to the ocean annually. The amount is compared with the weight of blue whales. This comparison opens a different perspective of the huge amount of plastic with images and not just by numbers. Sometimes people cannot imagine how enormous it is just by numbers, this gif visualization helps the users to picture it.

Human and Blue Whale size comparison
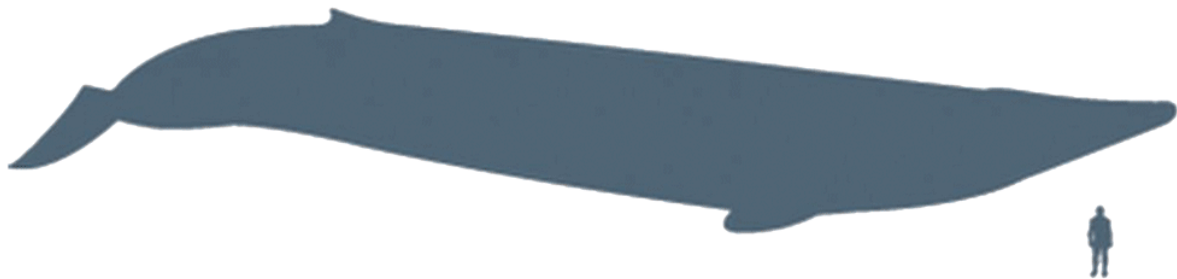
Figure 7. Dynamic gif of plastic and whales comparison

The average weight of a blue whale is 190 tons and 8 million tons of plastic escapes to the ocean each year, that is equal to 42,105 blue whales. Data from different sources, *BBC.com*, *WWF*, shows that there are not more than 25,000 blue whales living in the world today [9].

The next part is an infographic of the actions that users can do to help minimize plastic wastes in the ocean followed by images of the campaigns [10, 11]. Finally a "make a difference" text and "act now" button could be implemented further if the project is going to be made as an actual published project.

The time needed to check the website is depending on how much time the users invest to read and understand the infographics and contents. The simplicity and easily readable information

of the contents should not take too much time of the users. I would say approximately 15 minutes is enough to read all of the information.

4. Time Relevance

It is crucial to mention how time is relevant to this topic. The timeline shows how time is relevant to this topic to better understand different dimensions, such as representation, scale, and layout. The time relevance of the visualizations also combines the generalization, purposefulness and interpretability.

Generally, data that is utilized in this project is time related data in the yearly time. The Global Plastic Production plot on figure 3 is an example of the data visualization in time series. We can see how the global plastic production has been increasing every year from 1950 - 2019. It increases almost exponentially with a few exceptional years such as 2008 and 2009. Most of the time the amount of global plastic production rises. This is concerning and the project should raise awareness. If the plastics are not recycled properly, some of them finally end up in the ocean. Figure 4 also shows the yearly mismanaged plastic waste per capita by country.

5. Places and Spatial Information

Since the report is about the plastic waste and the ocean, the places and spatial information would be geographical, focusing on the ocean locations where there is a lot of plastic pollution, and countries that are responsible for the plastic waste around the world. The plot of the mismanaged plastic waste per capita by country in figure 4 shows the geographical information. Spatial information is also included in figure 5, Data Visualization of Plastic Production by Sectors.

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