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ARTICLE

The Environmental Impact of Plastic Waste

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ABSTRACT

The pollution caused by disposable plastic products is becoming more and more serious, and "plastic limit" has become a global consensus. This article mainly discusses the pollution problem from the following aspects: Integrate all relevant important indicators to establish a multiple regression model of the maximum amount of disposable plastic waste to estimate the maximum amount of disposable waste in the future without causing further damage to the environment; Establish an environmental safety level evaluation model and analyze the impact of plastic waste on environmental safety; Try to set the lowest level target that can be achieved by global waste at this stage, and conduct correlation analysis on the impact of humans, enterprises, and the environment; Select several countries based on their comprehensive strengths, conduct a comparative analysis of their plastic production, economic strength, and environment, and try to explore their responsibilities.

1. Introduction

Plastic is a commonly used material with huge social benefits. With the development of the world economy, the output of garbage around the world is also increasing rapidly, especially the use of plastic products is becoming more and more widespread, and disposable plastic are most commonly used in people's lives. Disposable plastic products have brought convenience to people's production and life, but due to the difficult degradation of plastic products, "white pollution" has become more and more serious. The large amount of disposable plastic products and the low recycling rate have caused serious pollution to the soil environment and the marine environment. The world is facing an environmental crisis caused by plastic waste. Currently, "Limiting plastic" has become a global consensus, and many countries and regions have launched actions to limit plastic and ban plastic. For example, in 2018, the European Parliament will

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issue a decree. Starting from 2021, the EU will completely prohibit member states from using 10 disposable plastic products such as drinking straws, cutlery and cotton swabs. A variety of disposable plastic products, including tableware and straw.

Therefore, in order to solve the problem of plastic waste, it is important to understand the current severity of plastic waste worldwide and mitigate the impact of plastic waste on the environment.

2. Assumptions and Symbols

2.1 Assumptions

(1) It is assumed that the moderate incineration of disposable plastic waste and proper treatment will not cause damage to the environment.

(2) It is assumed that all disposable plastic products produced each year are converted to waste.

(3) Assume no breakthrough in science and technology in the treatment of plastic waste.

2.2 Symbols

Here are the symbols and their meanings in this article :

Symbol	Meaning
Y	Maximum amount of disposable plastic waste.
A	Recycling of disposable plastic waste.
B	Amount of incineration of disposable plastic waste.
Z	Environmental safety level.
M	Environmental safety level impact criteria.
N	Environmental safety level impact indicators.
E	Environmental safety level.
S	Environmental safety level score
P	Correlation coefficient.

3. Multiple Regression Model for Maximum Amount of Disposable Plastic Waste

3.1 Establishment of Maximum Amount Index Affecting Disposable Plastic Waste

First, we consider the factors that affect the maximum amount of disposable plastic waste, and consider the following three aspects from the sources of plastic waste, the way to deal with plastic waste, and the availability of resources for processing plastic waste.

Figure 1. A diagram of the factors affecting the maximum amount of disposable plastic waste

From our collection of plastic use distribution data for various industries in 2015, packaging is the main use of disposable plastic, and more than 42% of plastic are used for packaging. At the same time, disposable consumer goods are the main source of disposable plastic. Such as disposable tableware, disposable straw and so on. Because of the excessive use and waste of disposable plastic, a large amount of disposable plastic waste has been accumulated. However, current treatment methods for disposable plastic waste are still relatively simple, including disposal, landfill, incineration, and recycling [1]. Among them, disposal of landfill and incineration is limited by disposal resources. For example, excessive land resources are used to discard plastic waste. Landfill, and the natural degradation of plastic in the soil takes hundreds of years, and it will cause serious "white pollution", so land resources have certain restrictions on the landfill of plastic waste; meanwhile, incineration of plastic waste will Waste of petroleum resources. According to statistics, nearly 4% of the world's petroleum resources are used for the incineration of plastic waste, and oil is a non-renewable resource. The global stock is not very optimistic. Therefore, petroleum resources are also a certain constraint on the incineration of plastic waste [2].

In summary, under the premise of not causing further deterioration of the environment, we finally selected the amount of disposable plastic waste recovery, incineration, and resource constraints as indicators that affect the maximum amount of disposable plastic waste.

3.2 Establishment and Solution of Multiple Regression Model

Based on 3.1, we select the recovery rate, incineration rate, and resource constraints of disposable plastic waste as indicators that affect the maximum amount of disposable plastic waste, so as to establish a multiple regression model of the maximum amount of disposable plastic waste. The following equation:

$$Y_{n+1}=\alpha A_n+\beta B_n-\gamma C_n \quad (1)$$

Among them, Y_{n+1} is the maximum amount of disposable plastic waste in the following year, A_n is the recycled amount of disposable plastic waste in the year, B_n is the incinerated amount of disposable plastic waste in the year, and C_n is the resource (such as petroleum resources, petroleum resources, Environmental load, energy, etc.). α and β are the regression coefficients of A_n and B_n. γ is the limit coefficient of resources on the amount of recovery and incineration.

Based on the collected data, the regression coefficient is calculated using the least squares method as

$$\alpha=1.1404$$

$$\beta=1.1404$$

Through the regression test, the correlation coefficient of α is $R^2=0.9993$, and the correlation coefficient of β is $R^2=0.9997$, both of which are close to 1, indicating that the correlation with Y is valid.

Because there are many influencing factors on the amount of resource restrictions, it is not possible to quantify and consider it at this time, so the forecast does not consider the amount of resource restrictions at this time. The regression coefficient is substituted into (1) to predict the maximum amount of disposable plastic waste in the future.

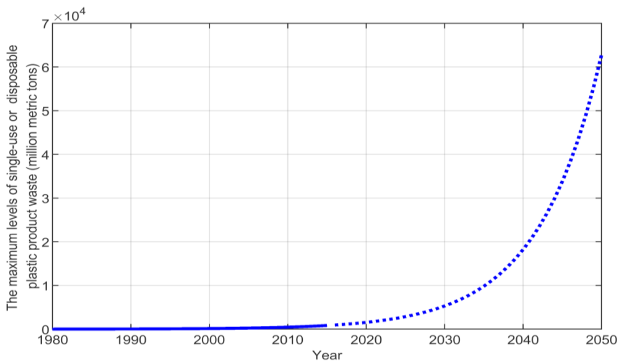

Figure 2. Multivariate regression model prediction charts for the maximum amount of disposable plastic waste (without resource restrictions)

3.3 Model Result Analysis

According to Figure 2, under the prediction of the multivariate regression model of the maximum amount of disposable plastic waste, the maximum amount of disposable plastic waste that the environment can withstand is increasing year by year without further environmental damage, while the maximum amount of disposable plastic waste The increase is affected by the amount of incineration and recovery each year, because the amount of incineration and recovery has gradually increased since 1980, as shown in Figure 3.

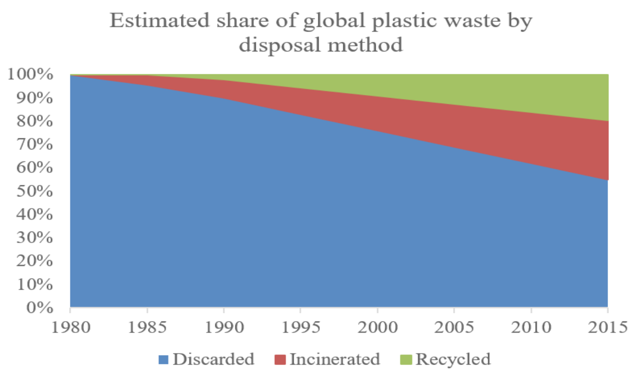

Figure 3. Estimated share of global plastic waste by disposal method

As of 2015, an estimated 55% of plastic waste worldwide have been discarded, 25% have been incinerated, and 20% have been recycled [2]. The discarded plastic waste will cause further damage to the environment. Therefore, the maximum amount of disposable plastic waste can only be assessed by changing the amount of incineration and recycling without further harming the environment. However, the amount of incineration will be controlled by petroleum resources. About 4% of the world's petroleum resources are used in plastic incineration. If excessive use of petroleum resources, it will also cause the lack of petroleum resources and cause unnecessary troubles. At the same time, excessive incineration will also it will cause damage to the atmospheric environment; and the amount of recycling is controlled by the current level of science and technology. Advances in science and technology can enable more plastic waste to be recycled and reduce environmental damage. On the contrary, if the level of science and technology stagnates, it will also cause the recovery rate of plastic waste to stop growing, which will have a negative impact on the disposal of throwaway plastic waste [3]. Therefore, after considering resource constraints, it should be fixed in Figure 4.

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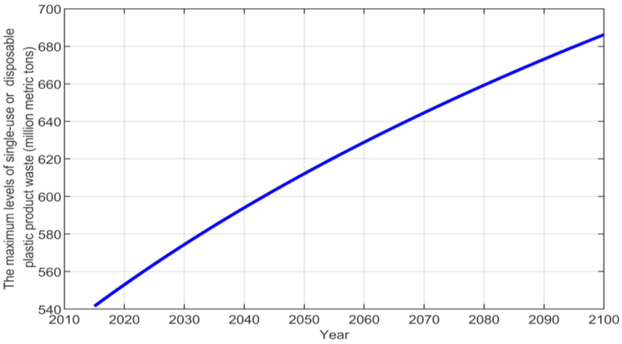

Figure 4. Multivariate regression model prediction charts of the maximum amount of disposable plastic waste (with resource constraints)

4. DPSIR Environmental Safety Evaluation Model Based on F-AHP

4.1 Model Introduction

4.1.1 Analytic Hierarchy Process

The Analytic Hierarchy Process (AHP) combines qualitative description and quantitative analysis organically. This process adopts systematic planning and evaluation, and finally expresses and reflects complicated phenomena and decision thinking process systematically, modeled, and quantitatively. Through the analytic hierarchy process, researchers can analyze the research objects precisely and understand the relative major and minor influencing factors. The importance scale used in calculating the weight is shown in Table 1.

Table 1. Importance scale table

Importance scale	Meaning
1	Both elements are equally important
3	The former is slightly more important than the latter
5	The former is clearly more important than the latter
7	The former is more important than the latter
9	The former is far more important than the latter
2,4,6,8	Intermediate values corresponding to a scale of 1-9
1/k,k=1,..9	The two elements are more important than the former

4.1.2 DPSIR Model

The DPSIR model is a conceptual model of the evaluation index system commonly used in environmental systems. It divides the evaluation index of natural systems into five types, including Driving Forces, Pressure, State, Impact and Responses. And each type is divided into several indicators[4]. We will use the DPSIR model as the research framework and the analytic hierarchy process as the carrier to establish an environmental safety index system, as showed in Figure 5.

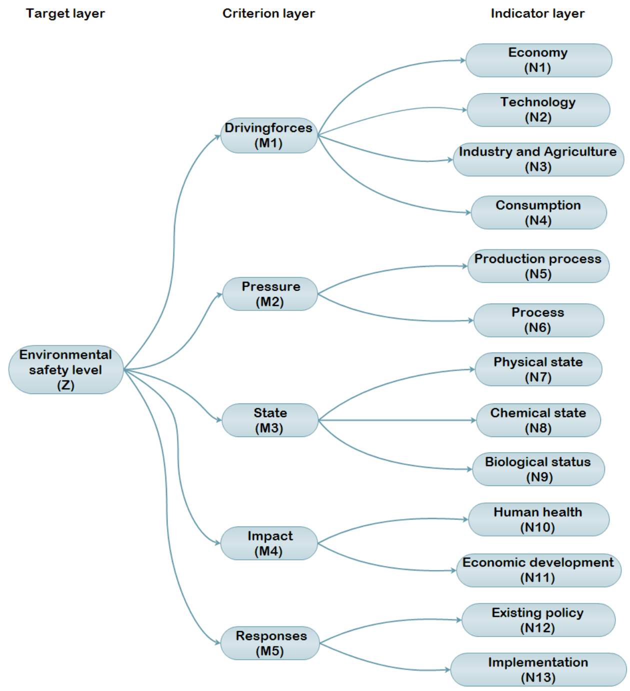

Figure 5. Index system diagram of environmental safety assessment

4.1.3 Fuzzy Comprehensive Evaluation Method

The fuzzy comprehensive evaluation method is a systematic evaluation of the fuzzy phenomenon of possibility and uncertainty, that is, a fuzzy evaluation of the evaluation object, such as "good, better, average, worse, worse", etc., is more important in fuzzy mathematics. The concept of membership, that is, the degree of membership, means the probability or degree of likelihood of the assessment[5]. We consulted the literature and collected data to judge the 13 indicators of the selected countries. After establishing an evaluation index system and calculating the weight of each index, after consistency testing, the test formula is as follows.

$$CI=\frac{\gamma_{max}-1}{n-1} \tag{2}$$

Evaluate the country's level of environmental safety according to four levels: very safe, safe, more dangerous, and dangerous.

4.2 Establishment and Solution of Environmental Safety Evaluation Model

Through our literature review and data collection, we learned that in the 2018 Global Environmental Performance Index (EPI) ranking released by Yale University in

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the United States, Australia ranked first in many scoring items and ranked first overall, so Australia Known as the "most suitable area for human habitation", we chose Australia as the best level of environmental safety.

At the same time, China is the largest developing country in the world. In recent years, China has played an important role in the development of the world economy. However, China's environmental security level is not very optimistic. Therefore, we chose China as the research object to analyze China and environmental security. The best level is the gap between Australia .

4.2.1 Establishment and Solution of AHP Model

(1) According to the analysis, the following matrix is obtained:

$$Z=\begin{bmatrix}1 & 1/2 & 1/4 & 1/5 & 1/3\\ 2 & 1 & 1/3 & 1/4 & 1/2\\ 4 & 3 & 1 & 1/2 & 2\\ 5 & 4 & 2 & 1 & 3\\ 3 & 2 & 1/2 & 1/3 & 1\end{bmatrix}$$

$$M_1=\begin{bmatrix}1 & 3 & 2\\ 1/3 & 1 & 1/2\\ 1/2 & 2 & 1\end{bmatrix}$$

$$M_2=\begin{bmatrix}1 & 1/2\\ 2 & 1\end{bmatrix}$$

$$M_3=\begin{bmatrix}1 & 3 & 2\\ 1/3 & 1 & 1/2\\ 1/2 & 2 & 1\end{bmatrix}$$

$$M_4=\begin{bmatrix}1 & 1/2\\ 2 & 1\end{bmatrix}$$

$$M_5=\begin{bmatrix}1 & 2\\ 1/2 & 1\end{bmatrix}$$

(2) Indicator weight calculation

The weight of each indicator is determined according to the basic method of the analytic hierarchy process, and the weight of the first-level indicator obtained is.

(M_1,M_2,M_3,M_4,M_5)=(0.0624,0.0986,0.2618,0.4161,0.1611)

The weight of the secondary indicator is

$$(N_1,N_2,N_3,N_4)=(0.2771,0.4658,0.1611,0.0960)$$

$$(N_5,N_6)=(0.6667,0.3333)$$

$$(N_7,N_8,N_9)=(0.5390,0.1638,0.2972)$$

$$(N_{10},N_{11})=(0.3333,0.6667)$$

$$(N_{12},N_{13})=(0.6667,0.3333)$$

All the above judgment matrices have passed the consistency check, so the ownership reassignment is satisfactory. As shown in table 2.

Table 2. Index weight table

Index	N_1	N_2	N_3	N_4	N_5	N_6	N_7
Weight	0.0173	0.0291	0.101	0.0060	0.6557	0.0329	0.1411
Index	N_8	N_9	N_{10}	N_{11}	N_{12}	N_{13}	
Weight	0.0429	0.0778	0.1387	0.2775	0.1074	0.0537	

All the above judgment matrices have passed the consistency check, so the ownership reassignment is satisfactory.

4.2.2 Solution of Fuzzy Comprehensive Evaluation Method

(1)Establish a set of evaluation indicators.

$N=(N_1,N_2,N_3,N_4,N_5,N_6,N_7,N_8,N_9,N_{10},N_{11},N_{12},N_{13})$

=(Economy,technology,…,existing policies and implementation)

(2)Create a Judging Set

$E=(E_1,E_2,E_3,E_4)$=(very safe, safe less secure and dangerous)

(3)We judged 13 indicators in Australia and China by consulting the literature and collecting data.

(4)Establish a single factor evaluation matrix R.

$$R=(r_{ij})_{13\times 4} \quad (3)$$

Among it, $r_{ij}=\frac{C_{ij}}{\sum_{j=1}^{4} C_{ij}}$,

C_{ij} is the score for the i-th index and the j-th evaluation

Matrices for Australia and China can be obtained separately:

$$R_1$$

$$=\begin{bmatrix}0.58 & 0.52 & 0.40 & 0.46 & 0.48 & 0.63 & 0.45 & 0.42 & 0.45 & 0.53 & 0.61 & 0.68 & 0.65\\ 0.28 & 0.32 & 0.31 & 0.29 & 0.30 & 0.22 & 0.20 & 0.28 & 0.22 & 0.35 & 0.30 & 0.20 & 0.27\\ 0.12 & 0.12 & 0.20 & 0.20 & 0.16 & 0.13 & 0.20 & 0.18 & 0.28 & 0.10 & 0.06 & 0.11 & 0.06\\ 0.02 & 0.04 & 0.09 & 0.05 & 0.06 & 0.02 & 0.15 & 0.12 & 0.05 & 0.02 & 0.03 & 0.01 & 0.02\end{bmatrix}$$

$$R_2$$

$$=\begin{bmatrix}0.48 & 0.30 & 0.20 & 0.12 & 0.16 & 0.14 & 0.18 & 0.13 & 0.14 & 0.12 & 0.30 & 0.15 & 0.20\\ 0.30 & 0.20 & 0.34 & 0.30 & 0.22 & 0.21 & 0.26 & 0.32 & 0.30 & 0.32 & 0.40 & 0.39 & 0.35\\ 0.12 & 0.28 & 0.40 & 0.26 & 0.50 & 0.40 & 0.46 & 0.40 & 0.26 & 0.30 & 0.20 & 0.31 & 0.32\\ 0.10 & 0.22 & 0.06 & 0.32 & 0.12 & 0.25 & 0.10 & 0.15 & 0.30 & 0.26 & 0.10 & 0.15 & 0.13\end{bmatrix}$$

Using the weights obtained by the analytic hierarchy process as the weight vector of the fuzzy comprehensive evaluation index, the different weights of Australia and China in the four levels of very safe, safe, less secure and dangerous can be obtained through calculation, that is Table 3.

Table 3. Comprehensive weight table of Australian and Chinese environmental safety levels

Environmental safety level.	very safe	safe	less secure	dangerous
Australian comprehensive weight.	0.5515	0.2711	0.1269	0.0508
Chinese comprehensive weight.	0.2035	0.3274	0.3117	0.1576

Finally, we define the score, (very safe, safe, less secure and dangerous)=(4,3,2,1), Substitute the comprehensive weights of Australian and Chinese environmental safety levels in Table 3 to get the final scores of the two countries.

$$S_1=3.3237$$

$$S_2=2.5773$$

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4.3 Model result analysis

Australia's final environmental safety rating is 3.3237, which is at a safe level, and China's final environmental safety rating is 2.5773, which is at a relatively dangerous level. From this comparison, we can see that there is still a certain gap between China and the environmental safety level.

It can be seen from the matrix listed above that China's environmental safety level is significantly different from Australia's in various aspects. Because this article mainly discusses the impact of plastic waste on environmental safety, we will only focus on plastic waste. Analyze the gap between China and Australia and how to close it.

Table 4. Comparison of Australian and Chinese plastic waste (2010) [2]

Index	Total plastic waste output (million tonnes)	World share of undertreated plastic waste	Plastic waste entering the ocean (million tonnes)	Plastic waste per capita (kg per person per day)	Improper waste management in countries
Australia	0.9	0%	0.01~0.25	0.112	0.04%
China	59.08	74%	>5.00	0.121	27.7%

From Table 4, China has a huge gap in Australia in terms of total plastic waste production, inadequately treated plastic waste, plastic waste entering the ocean, and improperly managed waste.

From an economic point of view, as a developing country, China's economic development has enabled various industries to choose plastic products that are widely used, easy to process, and inexpensive under the principle of maximizing economic benefits. Increasing demand has led to the rapid development of the plastic manufacturing industry, so the output of plastic waste is huge.

From a technical perspective, in 1921, China began to industrialize plastic plastic products. Scientists are constantly searching for new plastics manufacturing technology, and globalization has enabled the technology to be exchanged and improved in various countries, making the production and widespread use of plastic possible.

In terms of consumption, economic development has increased consumption and increased domestic demand, and people's daily consumption has also promoted the development of the plastics industry. Consumers have a tendency to choose convenient plastic bags when shopping for neat and clean product packaging. Because of its strong corrosion resistance, durable, waterproof, lightweight, and easy to shape, plastic has been the first choice for packaging materials in the express delivery and takeaway industries. The emergence of e-commerce and food delivery has dramatically increased the demand for plastic, which has greatly promoted the development of the plastics industry.

In terms of policy and implementation, the Chinese government issued a "plastic restriction order" in 2007, which clearly stipulates that the production, sale, and use of plastic shopping bags with a thickness of less than 0.025 mm are nationwide; in all supermarkets, shopping malls, and trade fairs The market and other commodity retail establishments implement a system of paid use of plastic shopping bags. Plastic shopping bags are not permitted to be provided free of charge. Although China proposed the policy of restricting the use of plastic very early, there were problems in the implementation. In the early stage of implementation of the Plastic Restriction Order, the effect was very significant. However, with the development of the time, there has been a saying that Plastic Restriction makes the name exist. The "white pollution" is not simply disappeared, but has become increasingly widespread. Depending on statistics, from 2008 to 2015, the consumption of plastic bags in China's express delivery industry increased from 8.268 billion to about 14.7 billion [6].

Therefore, China needs to solve the problem in terms of people's environmental awareness, technical methods for processing plastic waste, and implementation of policies that restrict the use of plastic. It must pay more attention to reducing the gap with environmental safety.

5. Relevance to Minimum Levels of Goals and Impact

5.1 Set Minimum Goals

In order to eliminate plastic waste and minimize the negative impact of plastic waste on the environment and human beings, we plan to set a goal at the lowest level at this stage.

In an ideal state, we hope that the annual output of plastic waste is zero, that is, no more plastic waste is produced every year, and humans no longer use any single-use or disposable plastic products. The plastic waste generated can be fully recycled, and plastic waste will not be recycled. Any negative impact on the environment, society and humanity.

However, it is clear that at the current stage of human science and technology or economic level, the ideal state cannot be achieved. At this stage, human beings still need a large number of plastic products. Some plastic products cannot be replaced by other substitutes, such as used in plastic products in packaging, construction or other fields, as showed in Figure 6

They have the irreplaceable advantages in various fields, and the generation of some non-recyclable plastic waste cannot prevent that. Therefore, we have to find the

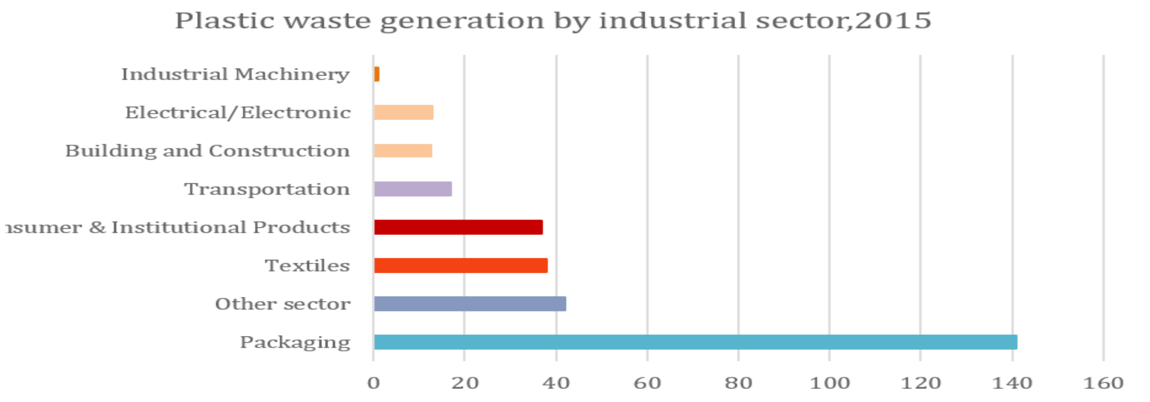

Figure 6. Plastic waste generation by industrial sector, 2015 [2]

amount of non-recyclable plastic waste in the world at this stage as the minimum level of plastic waste at this stage.

It can be consulted on Figure 3 Estimated share of global plastic waste by disposal method in 3.3. As of 2015, it is estimated that 55% of plastic waste worldwide is discarded, 25% are incinerated, and 20% are recycled. Among them, 80% of plastic waste discards and incinerated. According to collect data, the output of plastic waste in 2015 was about 302 million tons.

In the end, through calculation, we set a minimum level of disposable plastic waste at the current stage of 241.6 million tons.

5.2 Correlation Analysis

When the world reaches the minimum level of plastic waste at this stage, we will discuss the impact from three aspects: human, business, and the environment. In terms of impacts on humans, we consider the impact of plastic production on average consumption levels; in terms of impacts on enterprises, we consider the impact of plastic production on the operating profit of plastic enterprises; in terms of environmental impact, we consider the impact of plastic production on Impact of Environmental Performance Index (EPI).

We select China as the research object of this problem and collect relevant data. As shown in Table 5:

Table 5. China's relevant data from 2012 to 2017 [7]

Year	Per capita annual consumption level / yuan	Annual profit of the plastics industry / yuan	EPI	Plastic production / 10,000 tons
2012	14699	0.96×10^{11}	42.24	2730.3
2013	16190	1.12×10^{11}		6878.8
2014	17778	1.18×10^{11}	43	7485.8
2015	19397	1.20×10^{11}		7860.7
2016	21285	1.29×10^{11}	65.1	7267.5
2017	22902	1.35×10^{11}		7515.5

We calculate the correlation coefficient P between China's per capita annual consumption level, the annual operating profit of the plastic industry, and EPI and China's plastic output.

Pearson correlation coefficient (Pearson Correlation Coefficient) is used to measure whether two data sets are on a line. It is used to measure the linear relationship between distance variables, that is, the correlation strength. The formula is as follows:

$$P_{X,Y}=\frac{cov(X,Y)}{\sigma X\sigma Y}=\frac{E((X-\mu X)(Y-\mu Y))}{\sigma X\sigma Y}=\frac{E(XY)-E(X)E(Y)}{\sqrt{E(X^2)-E^2(X)}\sqrt{E(Y^2)-E^2(Y)}} \quad (4)$$

Correlation coefficients of the three are obtained through calculation

$$P_1=0.681$$
$$P_2=0.824$$
$$P_3=0.472$$

All the per capita consumption and plastic production showed significant significance. The correlation coefficient value was 0.681, ranging from 0.6-0.8, showing a strong correlation, and the correlation coefficient value was greater than 0, meaning that there was a positive correlation between per capita consumption and plastic production relationship.

The plastic industry's operating profit and plastic output all show significant significance. The correlation coefficient value is 0.824, which is between 0.8-1.0, showing a strong correlation, and the correlation coefficient value is greater than 0, which means the plastic industry's operating profit there is a positive correlation with plastic production.

The correlation coefficient value between EPI and plastic output is 0.472, ranging from 0.4 to 0.6, which is moderately correlated, and the correlation coefficient value is greater than 0, which means that there is a definite correlation between EPI and plastic output.

After calculation of the correlation coefficient, it was found that the plastic output has the greatest impact on the

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plastic industry, with a correlation coefficient of 0.824, because plastics are commonly used in building materials and engineering products. They have excellent performance and low cost, and are the best choice for basic materials of industrial enterprises. The demand for plastic in the commercial and industrial fields also promotes the rapid development of the plastics industry, which can occupy an important position in the light industry. Therefore, when we achieve the objective of the lowest level of waste, the plastics industry will be greatly impacted. There will be a big gap in profits. At the same time, the plastic industry will also face the opportunity to reform technology and seek breakthroughs.

The impact of plastic output on per capita consumption levels is also strong, with a correlation coefficient of 0.681, because economic development has increased consumption and increased domestic demand, and people's daily consumption has also promoted the development of the plastic industry. Consumers tend to choose convenient plastic bags when shopping for neat and clean product packaging. Because of its durable corrosion resistance, durable, waterproof, lightweight, and easy to shape, plastic has become the first choice for packaging materials in the express delivery and takeaway industries. The emergence of e-commerce and food delivery has dramatically increased the demand for plastic, which has greatly promoted the development of the plastics industry. Therefore, when we achieve the objective of the lowest level of waste, the level of per capita consumption may decline to some extent.

The impact of plastic production on EPI is relatively general, with a correlation coefficient of 0.472, because EPI uses 10 policy categories and 25 environmental indicators for evaluation, and the "white pollution" caused by plastic waste is part of all environmental pollution, and there is a certain Relevance, but it didn't play a vital role. Therefore, when we achieve the goal of the lowest level of waste, the EPI will increase to a certain extent and will not be particularly affected.

6. Fairness of the Global Environmental Crisis

Depending on the data on income levels of countries in the world provided by the World Bank[8], select high-income countries-Australia, high- and middle-income countries-China, low- and middle-income countries-India, and low-income countries-Guinea. The proportion of improperly managed plastic waste, the amount of plastic waste per capita, and national plastic consumption are used as reference indicators. Table 6 is generated to analyze the fairness of the global environmental crisis.

Table 6. Comparison of relevant data for Australia, China, India and Guinea [9]

Country	GDP per capita ($)	EPI	Percentage of mismanaged plastic waste	Per capita amount of plastic waste generated (kg)	Plastic consumption (million tonnes)
Australia	57200	65.7	0%	0.11	16.5
China	9770	49	74%	0.12	80
India	2010	48.3	85%	0.01	14.56
Guinea	880	44.4	84%	0.03	0.27

Comparing the indicators of Australia, China, India and Guinea, we get Figure 7:

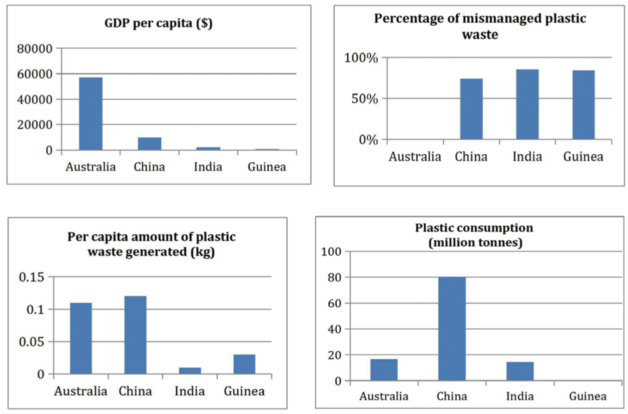

Figure 7. Comparison chart of indicators in Australia, China, India and Guinea

Australia is a developed country with high per capita GDP, leading productivity level, high level of industrialization, and high level of national education. Therefore, the amount of plastic waste per capita is high, but the EPI is high, and the proportion of plastic waste management is extremely high. The emphasis on wasting management has led to high national environmental performance.

China and India are at the same time developing countries, and they are ranked one or two in the world's population. The difference in EPI is small. China's industrialization level is higher than India, and plastic consumption is significantly higher than India. With the continuous improvement of industrialization level and people's living the level of plastic waste per capita in China is constantly improving. Although the proportion of improperly managed plastic waste in China is still astronomical, it is observed that the proportion of plastic waste in China is lower than that in India and Guinea. It can be seen that China's management of plastic waste is effective. but there is still plenty of room for further improvement.

Guinea is located in Africa, its productivity is lagging, its economy is dominated by agriculture and mining, its industrial base is weak, plastic consumption is low, and the amount of plastic waste per capita is small, but the

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proportion of improperly managed plastic waste is high, reflecting the great expectations Control.

To ensure the fairness of countries in the global environmental crisis, the following solutions are recommended:

Each country signed a plastic waste management agreement, imposed restrictions on the country's plastic production and plastic waste volume, strengthened the research and development and productivity of plastic alternatives, and implemented strong single-use or disposable plastic control policies within the country. As developed countries have reached the current high level, they have completed the process of industrialization and achieved primitive accumulation, but in the process have caused irreversible damage to the environment. Therefore, compared with developing countries, developed countries Higher responsibilities and obligations should be assumed. Developed countries should provide technical, equipment, and financial assistance to countries with low productivity, so that countries with low productivity can realize the industrialization process as soon as possible, and help them minimize the production and use of disposable plastic. At the same time, with the help of developed countries, developing countries should strive to improve the production process of plastic and the process of waste disposal, and improve the level of national waste management.

7. Strengths and Weaknesses

7.1 Strengths

(1) In the multivariate regression model of the maximum amount of disposable plastic waste, the constraints of resources on recycling and incineration have been fully considered, making the model more comprehensive.

(2) An evaluation method that uses DPSIR as an indicator and combines the analytic hierarchy process and fuzzy comprehensive evaluation method, making full use of the advantages of the two methods, the weighting is reasonable, the calculation is relatively simple, and it has certain advantages and reliability.

(3) In the impact analysis of plastic waste, the correlation is used to determine the magnitude of the impact with the strength of the correlation, making the analysis more concrete and concrete.

7.2 Weaknesses

(1) No consideration of the impact of plastic alternatives on model results.

(2) The fuzzy analytic hierarchy process has certain subjectivity when determining the weight of the index, and lacks scientific and objective evaluation.

8. Conclusions

(1) The multiple regression model was used to estimate the maximum amount of plastic waste in the environmental carrying range, and the factors affecting the maximum amount of plastic waste were analyzed from three aspects: the source of the plastic waste, the current severity, and the treatment method.

(2) Select Australia and China, use Australian environmental quality as the environmental safety level standard, and use the DPSIR environmental safety evaluation model based on fuzzy analytic analysis to score the two countries, with score of 3.3237 and 2.5773, respectively. It analyzes the gap between China and Australia on the level of environmental safety.

(3) On the basis of the multiple regression model of question 1, set the current minimum level of global waste that can be reached at 241.6 million tons per year, and through correlation analysis, get the plastic output to humans, enterprises, and the environment. The correlation coefficients are 0.681, 0.824, and 0.472, respectively.

(4) Select four high-income, high-middle-income, low-middle-income, and low-income countries, Australia, China, India, and Guinea, and analyze the gaps between the four countries' plastic waste issues through various data comparisons and propose reasonable solutions Solution: Developed countries should give developing countries some support and assume the responsibilities of big countries in the global plastic crisis.

Expectations and Recommendations for Future Global Disposable Plastic Waste

First, We analyzed the basic situation of global disposable plastic waste at the current stage by consulting the literature and collecting data. Since 1950, the global plastic output has grown rapidly. As of 2015, the annual global plastic output has increased by nearly 200 times, reaching 381 million tons. When the global plastic output is increasing rapidly, the global plastic waste is also increasing rapidly. By 2015, 5.8 billion tons of plastic wastes have been accumulated, and only 9% of it has been recycled. These accumulated plastic wastes have produced a global environment. Serious damage.

Then, we comprehensively considered the sources, severity, and treatment of unnatural waste, and established a multiple regression model to predict the maximum amount of plastic waste that the environment can withstand in the future. When the maximum amount is reached, the global environment will no longer be Being further these lands filled plastic waste can be safely reduced. Then, according to this model, we also found the lowest level of global

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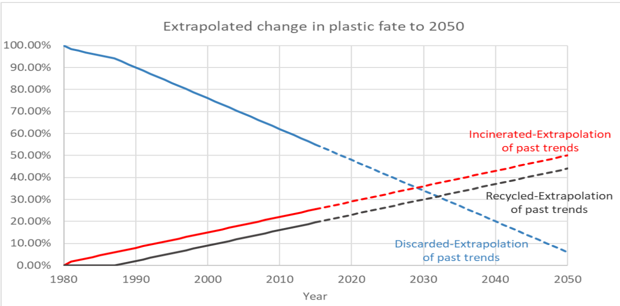
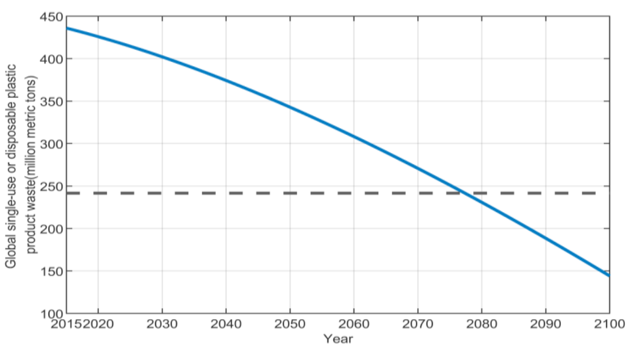
plastic waste at the contemporary stage, which is 241.6 million tons. We take it as our goal at this stage. In order to predict the specific time when the global target will be reached at the current stage, we made a simple prediction of the global plastic waste recovery rate, incineration rate and discard rate, as showed in the figure:



It can be seen from the forecast chart that before 1980, the recycling and incineration of plastic were negligible, so 100% were discarded. Starting from incineration in 1980 and recycling in 1990, the garbage recovery rate has risen by an average of about 0.7% per year. As of 2015, an estimated 55% of plastic waste worldwide have been discarded, 25% have been incinerated, and 20% have been recycled. After a straightforward prediction, we can see that by 2050, the incineration rate will be increased to 50%; the recovery rate will be 44%; and the discarded waste will be reduced to 6%. According to this forecast chart, we predict the amount of global plastic waste in the future, and get:



It is predicted that by 2078, the amount of plastic waste worldwide could be reduced to 241.6 million tons, reaching the minimum level of our target.

Finally, we make a timetable:

TIME	Predicted Result
2019	Drop rate is below 50%
2029	Incineration rate = Discard rate
2032	Recovery rate = Discard rate
2078	Meet the expected minimum level

Of course, this is only a reasonable prediction under our assumptions, and in the real world, there are numerous factors that will accelerate or hinder the realization of our goals. For example, more and more national governments have promulgated policies that restrict the use of plastic and even ban plastic, which will accelerate the achievement of our goals to a certain extent. Similarly, the development of science and technology in the future may lead to the emergence of better plastic alternatives, New breakthroughs have been achieved in the treatment of plastic waste. On the contrary, some factors will hinder the progress of our goals. For example, the economic crisis will greatly inhibit the development of many enterprises, including the plastic industry. Of course, it will also limit the consumption level of the people and reduce the purchasing power. Obstacles in the same way, as well as the outbreak of war, climate change and other factors will also hinder the realization of our planned goals to a certain extent.

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