



# An Ineffective Industry Between the United States and China: Transnational Transfer of Plastic Waste

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**Abstract.** The waste transfer is a long-standing trade between countries, especially from developed countries to developing countries. It has been facing the debate on economic benefits and environmental costs for many years. This research paper focuses on the market of waste transferring within the United States and China. The paper selects key indicators in the transfer process for benefit and cost estimation. The benefits and costs are calculated from a global perspective, including the benefits of waste export in the United States, the benefits of waste disposal in China, and the cost of China's environment and labor. It indicates that this trade is not effective mainly due to the high cost of environmental governance in China. The suggestions of actions are concluded in this research. Boycotting and establishing stricter policies and constructing more integrated waste protocols is a legitimate resolution.

**Keywords:** Waste Transfer · China · United States · Plastic

## 1 Introduction

### 1.1 The Current Situation of Waste Transfer in the World

With the development of industry, the number of hazardous waste is increasing. According to the survey report of Chinairrn company, the annual number of hazardous waste produced in the world is 330 million tons [1]. (Hazardous waste accounts for half of all traded waste. As a plastic, it is generally not dangerous, but plastic is difficult to decompose and has toxic chemical components, which will cause harm to land and health in the decomposition process, and can enrich organisms.), of which 90% come from developed countries. The development of globalization has changed the production and treatment of waste. The progress of science and technology enables countries to use their comparative advantages. The development of international specialization of labour makes developing countries naturally become waste treatment plants for developed countries.

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Besides, Developed countries transfer hazardous wastes to developing countries on a scale of 50 million tons per year.

The Basel Convention is specifically aimed at controlling the transboundary movement and disposal of hazardous wastes, according to which plastic is a kind of hazardous waste. This convention restricts the export of toxics from developed to developing countries. However, it has not succeeded in controlling the transfer of hazardous waste or protecting developing countries from waste dumping. Because it does not involve compensation for damage and does not comprehensively prohibit the cross-border transfer of hazardous wastes.

## **1.2 The Reason Why There is a Huge Industry of Waste Transfer**

### **1.2.1 Why Developed Countries Export Waste**

With the expansion of waste, it is difficult to implement the disposal site only in developed countries' land. [2] At the same time, due to the high requirements of people in developed countries for environmental protection, hazardous waste has been called "political waste" in developed countries. The public is very sensitive to the problem of hazardous waste and opposes the establishment of waste treatment plants in their living areas. There is also a big gap in the cost of waste disposal between developed and developing countries. It costs about \$40 a ton in Africa, 4–25 times in Europe and 12–36 times in the United States [3]. Therefore, it is a temptation for developed countries to transfer waste to developing countries. Some developed countries use waste as trading commodities to obtain huge profits.

### **1.2.2 Why Developing Countries Import Waste**

Because plastics can be recycled, there will be the problem of technology costs in the process of plastic waste transfer. In developed countries, due to higher requirements for environmental protection, better science and technology are adopted and the cost of waste treatment is higher. In developing countries, the primitive method of manual sorting is often adopted, so the processing cost is low. Besides, due to the limited level of education, many people's awareness of environmental protection is relatively weak. At the same time, due to people's low income and high pressure of work competition, garbage smuggling is gradually collectivized. People's myopic sight makes people use cheap labour to process waste products, which solves the work problems for many people. Besides, in some developing countries, environmental standards are low, and the treatment fee for hazardous waste is only one-tenth of that of developed countries.

The waste is not properly treated and diffused into the environment, and the result of long-term accumulation will be harmful to the global environment. At the same time, the harm of cross-border transfer of these wastes is that these wastes enter under the cover of trade, which will bring immeasurable harm to the environment in the absence of supervision.

### 1.3 Current Situation of Waste Transfer in China and the United States

In recent years, China's economy has maintained rapid growth. In order to make up for the shortage of raw materials, China's garbage import has surged. China imports a huge scale of waste every year, which accounts for a considerable source of income for China's continuous economic growth [4]. As for waste plastics, about 106 million tons of plastic waste were directly transported to the mainland of China, accounting for nearly half of the world's total plastic waste imports.

Although gaining economic benefits a lot, plastic waste is toxic, and hundreds of Chinese workers are exposed to the danger of manual sorting. Some of them have suffered severe joint deformation and muscle decay due to long-term skin contact with corrosive substances; Residents who have long been drinking polluted water around garbage disposal sites are more likely to be infected with infectious diseases, organ diseases and even metal poisoning. At the same time, China's ecological environment has also been damaged by the transfer and treatment of waste. These damages include environmental damage caused by incineration and landfill of waste, as well as air pollution and water pollution.

According to the Guardian on July 3th, a new analysis by Verisk Maplecroft company shows that the United States accounts for only 4% of the global population, but produces 12% of the world's municipal solid waste [5]. According to reports, the United States is not only "ahead" of other countries in waste production, but also its waste recovery rate is far lower than that of other developed countries. The United States only recycles 35% of municipal waste, while Germany's recycling rate is 68%.

### 1.4 The Content This Paper Researches

Why do developing countries choose to accept a waste transfer from developed countries? Why do developed countries prefer to violate the Basel Convention to export garbage to developed countries? In the process of waste transfer, what do developed and developing countries gain respectively? In the comparison of environmental costs and economic benefits, Is transnational waste transfer an efficient decision? Although hazardous wastes have certain risks, they have high economic value after recycling, and can also be used as a source of energy and heat. They are potential industrial goods. This paper aims to answer these questions by analysing the plastic waste trade between the United States and China. When people only consider economic benefits, the voluntary transaction between developing and developed countries seems to achieve the Pareto optimal result, but if we consider the environmental cost, this result will not be at the optimal point.

## 2 Literature Review

Waste transfer can not only be read from the economic view, it is related to a kind of 'colonialism' [4]. Take Japan as an example, Japan promulgated a set of laws to transform waste electronics into commodities to export, which betray a persistent sensitivity to resources and cultural logic. The leaders have betrayed Japan's self-image as a technological leader and enlightened partner in East and Southeast Asia. With the regulation

of the Supreme Court, Japan was finally forced to abandon the law to export to Asian developing countries.

Yang categorized the countries into three kinds. In countries with different degrees of industrialization, the attitude towards waste transfer is different [6]. Countries play three roles in the transnational transfer of hazardous wastes. The first is countries that have completed industrialization and are trading a large number of hazardous wastes, wastes are becoming more and more commercialized; The second is the emerging countries undergoing industrialization, which are participants in hazardous waste management, while the least developed countries are opposed to waste trade but are often affected by waste trade.

The waste transfer makes the relationship between different countries complicated, there need useful policies to create a win-win situation. They should consider both environmental and economic effects. Therefore, countries that have fewer regulations about the environment can gain more investment in the rubbish transfer, and they are called 'waste havens'. The capital, labour, and resource determine the flow of waste [7].

Plastic disposal has high waste landfills costs, but also the possibility of the recovery of energy from plastics and the fact that recycled products are cheaper than virgin products [8]. So there is a transfer between The United States and China, to make a profit.

Consumers consider the environment generally, but this kind of consideration will not turn into action one hundred percent [9]. They are hesitant at three factors: the first is that they are not sure which kind of plastics should be recycled, the second is that the recycling action is not so important in their daily life, and the third is that they think government can take this responsibility more easily than individuals. These are the key factors that influence recycling actions.

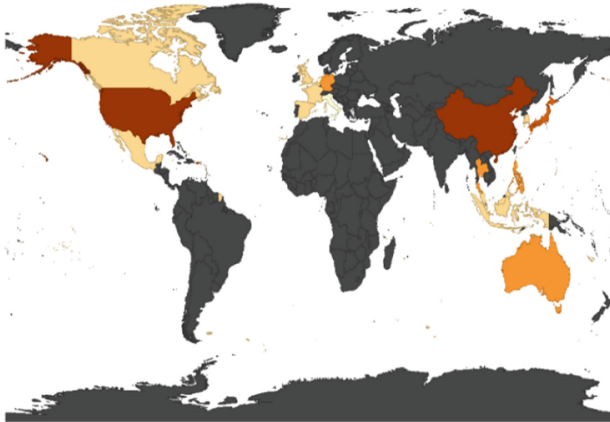
Previous studies mainly focused on the causes and mechanisms of the transnational transfer of hazardous waste. Most articles pointed out that this is a trade-off between environment and economy, but few articles compare this trade-off through calculation. This article selects China and the United States as typical representatives of the transnational transfer of hazardous wastes, compares the specific figures of economic and environmental benefits through conversion, and finally confirms the views of previous articles, indicating that this transfer is not a wise economic decision, and the environmental cost exceeds the economic benefits.

### 3 Methodology and Data

#### 3.1 The Choice of Sample and Data

As can be seen from the map, the amount of garbage exported by the United States is much larger than that exported to other countries. China also imports far more garbage than from other countries. The United States and China are the largest waste exporters and waste importers respectively. This paper selects the waste import and export between the United States and China as the representative of waste transfer (Fig. 1).

According to Science Advance research, the United States produced 42 million tons of plastic waste in 2016, more than any other country. In 2016, the United States exported



**Fig. 1.** The distribution of the import and export of garbage [10] (photo credit: original)

1.99 million tons of waste plastics to 89 trading partners. More than 88% of the waste is exported to countries where the rate of improper waste treatment is higher than 20%. In this paper, plastic is selected as the representative of the types of waste exported. The following data selected in this paper are from 2014 to 2017.

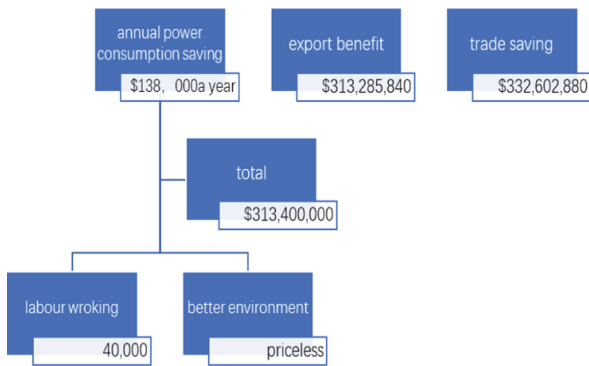
### **3.2 Stage of Exporting from the U.S. to China**

#### **3.2.1 How Much Money Has the United States Saved?**

To calculate the capital the United States saved through white waste transfer, this paper uses electricity fees in the United States to measure the value of energy savings. Because energy conservation can act as an intermediate connection between waste disposal and the electricity produced. ISRI's 2016 Yearbook shows that according to the estimation of the US Environmental Protection Agency, each ton of recycled plastic can save 50 million to 75 million BTUs [11]. According to the data estimation of scientific progress and the US Census Bureau [12], the United States exported about 855,392 metric tons of garbage to China in 2015, which can save 4.276 billion to 6.415 billion BTUs of domestic energy for waste treatment, which is about one million kWh of electricity, According to the statistics of EIA [13], this is equivalent to the annual power consumption of 100 households in the United States, with \$1380 per family a year, saving a total of about \$138,000 a year.

#### **3.2.2 How Much Money Has the United States Gained?**

At the same time, According to the US media, the benefit from the export of waste plastics in the United States this year was \$313,285,840. According to the statistics of China's Greenpeace Toxic Pollution Prevention and Control Project [14], the cost of waste treatment in the United States and other developed countries has reached \$400–1000 per ton. After being transported to China, due to China's cheap labor, strong demand for garbage and relatively perfect freight system, it costs only US \$10–40 per ton; For



**Fig. 2.** The processing mindset of the first stage (photo credit: original)

example, a waste power plant in Heze, a city in Shandong Province in China has a treatment fee of only 10 yuan/ton, while the average standard of waste treatment in the United States is 56 dollars/ton. The economic cost saved is about 332 million dollars.

Therefore, before exporting, the United States already has an expected economic return of nearly 313 million dollars.

### 3.2.3 Something Cannot Measure by Money

In the waste export industry of the United States, 40,000 people are engaged in jobs related to China’s waste export. Therefore, the United States also relies on this industry to solve some domestic employment problems. Also, the environment in the U.S becomes better and the people there enjoy higher life quality, the self-repairing ability and resource reserve of the environment can be better, which means the better human resources and natural resources for economic development and potential (Fig. 2).

## 3.3 China Processing Stage

### 3.3.1 Recycled Parts

China’s total recycled imports have increased with economic growth. In fact, the growth rate of China’s total recycled imports exceeded the economic growth rate. According to Adam Minter’s “waste planet” [15], this is because of the huge profits in the garbage industry. In China, According to the statistics of the General Administration of international recycling (BIR), The yield of recycled plastics is about 82%, and the average scale of waste plastics imported by China from the United States is 2.8 million tons [16]. China’s domestic plastic recycling rate reached about 46% in 2016. The profit of processing waste plastics can reach 3,500–7,500 yuan per ton, while the price of raw materials per ton is no more than 1,000 yuan. These businessmen see the value-added opportunities of unprocessed materials.

### 3.3.2 Unusable Garbage Parts

According to the research results of Chinese scholar Ke, after decades of development, several large-scale waste plastic recycling and recycled plastic trading markets and processing distribution centres have been formed in China. According to the confessions of smugglers of Hefei Trading Co. Ltd. Seized by the customs, the remaining unusable garbage (accounting for about 8% of the total) only needs 60 yuan per ton to be handed over to qualified enterprises to specially process [17].

### 3.3.3 Middleman Profit

Middlemen are also one of the main profit makers in China's imported plastic waste market. Middlemen involved in foreign garbage smuggling are usually professional trading companies that connect foreign suppliers with domestic importers. Middlemen who resell foreign garbage to domestic enterprises can obtain a profit of about \$10 per ton. Due to the huge turnover, the profit is very considerable. Therefore, it is roughly estimated that the profit of middlemen in trade is about \$28 million.

### 3.3.4 Human Resources Cost

The garbage exported from the United States supplies plastic to manufacturers, and the remaining garbage that is difficult to sort is often buried in China. In this process, China's cheap labour force is employed for intermediate processing. This process is often primitive unarmed sorting, which is very harmful to the health of workers. According to the industry research report of China CPRA, the low labour cost of sorting imported plastic waste is another reason for domestic importers to make huge profits. The number of employees in the waste plastic collection is about 800,000; The number of employees in regeneration is about 100,000, with a total of about 900,000. The employees are older and are not in the golden age of good health. It is understood that the domestic sorting cost is only one-tenth of the foreign sorting cost, the domestic sorting workers' salary is only 2,000 yuan per month, the working hours reach 60 to 70 h per week, and there are almost no protective measures in the sorting process; In foreign countries, the sorting salary is about 2,000 euros per month, and the working hours are only 40 h per week. In addition, the cost of protective measures such as protective clothing is very high. In China, the labour sorting cost of one year is about 2.16 billion yuan.

### 3.3.5 Environment Cost

In developing countries, the environmental cost is more invisible. According to the statistical data, a garbage plant can extract 50 tons of groundwater per hour, which is about the daily domestic water consumption of more than 200 people [18]. According to the current price of residential water of 2.80 yuan / cubic meter, the annual water cost of a plastic garbage dump is 403,200 yuan. Among the garbage that cannot be recycled, the environmental costs caused by landfills and incineration include air pollution control costs, residents' health costs and water pollution control costs. According to the data of China's National Bureau of statistics, air pollutants - 1.2 yuan to 12 yuan per pollution equivalent, while the production of waste gas is heating one ton of plastic, which can

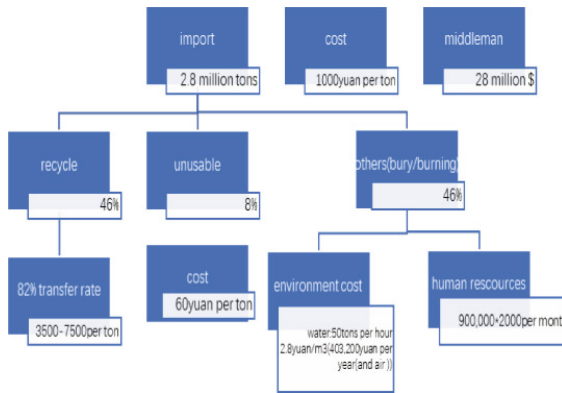


Fig. 3. China processing stage (photo credit: original)

produce 10,000 m<sup>3</sup> / min of waste gas; Water pollutants - 1.4 yuan to 14 yuan per pollution equivalent (according to local specific regulations). According to fan Bin’s research, in an area with a population of 100 million, the cost of water pollution treatment in China is about 3000 yuan/year per person. Therefore, the environmental cost of waste treatment is more than a 17million yuan per day. (excluding the cost of labour loss compensation) (Fig. 3).

To sum up, the final cost-benefit analysis in the whole world view (total benefit and cost in US and China) is -\$9.75billion, 1.07 times equal to China’s economic benefit, in which the environment cost in China accounts for about 75% cost. That is, it is unwise for developed countries to transfer waste to developing countries after comprehensively considering environmental costs and economic benefits.

### 4 Discussion

In 2018, China has announced a ban on importing transfer waste. This has cost a lot to developed countries like the US. Their garbage processing technique cost is too high for many companies’ budgets. Therefore, they try to export their garbage to other developing countries in South Asia, which has a lower level of processing garbage and higher transportation fee than China. To sum up, garbage processing in developing and developed countries need a long time to reach a balance between the economy and the environment. Generally speaking, promoting the technic of garbage processing, and reducing its cost is the best way to reduce the exporting to solve the problem.

In addition to export, the methods of garbage disposal mainly include sanitary landfill, incineration and composting [19].

Sanitary landfill technology has a wide range of applications and low operating costs. It is a widely used garbage disposal method, but improper operation may cause secondary pollution to surround soil and groundwater sources. In addition, waste that has been buried underground for a long time undergoes various chemical changes that can generate viruses and pollutants.



Incineration is also a common method, and even many developed countries have long used waste as fuel for thermal power generation. However, this method has serious problems. The smoke and dust generated during the incineration process, and even highly toxic substances such as dioxins, will cause serious air pollution [20]. Therefore, waste incineration has high restrictions on the composition of waste and also has high requirements on the classification level of waste. In addition, the construction and operation costs of incineration are high, and it is not suitable for countries with underdeveloped industrial systems and poor waste classification.

Composting is a treatment method that is only suitable for waste that is mainly composed of organic matter, such as kitchen waste. Using this method, it is necessary to separate non-degradable plastics, glass, metals and other substances in advance, and the organic content in the garbage must be high, otherwise composting will be difficult to generate economic benefits. Another disadvantage is the long processing cycle.

So far, there is no one perfect way to dispose of garbage. As can be seen from the three main waste disposal methods, non-degradable waste, such as plastics, is difficult to dispose of whether it is landfilled, incinerated, or composted. Between California and Hawaii, nearly 80,000 metric tons of plastic reside in the “Pan-Pacific Garbage Patch,” according to a new scientific estimate. In the estimated 1.6 million square kilometres of sea area, there are as many as 1.8 trillion plastics.

Whether it is the severe plastic pollution in the ocean or the findings of the Austrian Environment Agency, they all send a message to people: the waste generated by humans, especially non-degradable waste, is beyond the limit of nature.

So far, human technology has not found a perfect way to deal with it. Therefore, people should devote themselves to the development of degradable materials that can replace plastics and develop clean energy. Some companies have realized this. For example, Tesla, founded by Elon Musk, has been committed to developing clean energy, promoting the transformation of the automobile industry to the use of clean energy, and reducing human dependence on fossil fuels. Some European governments have already made relevant efforts, too. For example, France announced a ban on ultralight plastic bags in 2015, and Italy introduced the same measure in 2016.

Governments should also raise citizens’ awareness of environmental protection through media and other channels, and promote the advancement of related technologies through public policies, such as the popularization of clean energy and the research and development of degradable materials, and introduce relevant laws to limit the generation of waste, especially for developing countries. Just like Leo Tolstoy’s said, “One of the first conditions of happiness is that the link between man and nature shall not be broken.”

## 5 Conclusion

By using cost-benefit analysis, after calculating the environmental cost, the cost of transferring waste across borders is greater than the benefit. Considering the damage to the environment in the importing country, and the health impact on the waste sorting personnel, it is not wise to transfer waste across borders. The root problem is not in the transfer industry. It’s just because human beings generate too much garbage.

The waste transfer industry chain makes people in developed countries feel that no matter how much garbage they generate, the environment will not be harmed. However,

the environment is actually harmed, it's just poor nations paid the garbage bill for them. Through the study of the two most typical countries, this article confirms the view that the environmental cost brought by waste transfer is higher than the economic benefit in the previous study.

As the economic level of developing countries improves and their awareness of environmental protection increases, they are reluctant to import garbage. As more and more countries are reluctant to import waste, latent problems will gradually come up. A beautiful environment and excessive waste discharge will become inherently contradictory at that time, requiring our research and effort now to find good ways to solve the problem.

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