

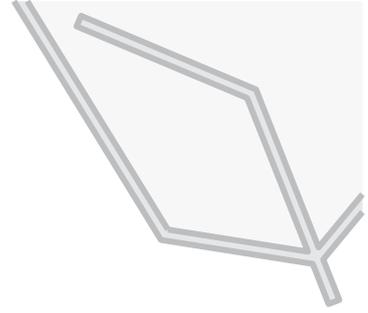
THEMATIC REPORT 06

China Waste Sorting Industry

Edited by China-Italy Chamber of Commerce



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中国意大利商会
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1. Overview of China Waste Sorting Industry

Waste sorting refers to sorting materials based on their physical or chemical properties (including particle size, density, gravity, magnetism, elasticity, etc.), which mainly includes manual sorting, screening, gravity sorting, magnetic sorting, photoelectric sorting (infrared, X-ray), flotation, and friction elastic sorting.

At present, the wastes in China are divided into domestic wastes (including commercial wastes), industrial wastes, and agricultural wastes, according to their sources. The waste sorting in China mainly focuses on domestic wastes, although some industrial wastes are mixed into domestic wastes.

The following are the three main steps of waste sorting in China. The first step is source classification. The preliminary classification is conducted by residents when they throw wastes. They generally adopt the method of "sorting wastes into four categories", including recyclable wastes, kitchen wastes, hazardous wastes, and other wastes. The waste classification is still under a popularization process in China, with Shanghai as a demonstration city. The areas that have carried out waste classification account for no more than 5%. With respect to the informal channels, waste classification has mainly been carried out by junkmen who directly recycle valuable supplies from trashcans or users. In recent years, some companies have also deployed source classification to recycle valuable waste products, such as mineral water bottles and waste papers.

The second step is routine sorting. Garbage disposal plants or waste transfer stations with sorting capabilities generally conduct it. Routine sorting could sort out organics, metals, combustibles, inorganics, slags, and other materials from wastes. It provides the basis for subsequent waste treatment. The main sorting equipment applied in this step includes bag breaking machine, rotary screen, magnetic separator, air separator, electric separator, among others.

The third step is sophisticated sorting. It refers to the recycling, classification and reprocess of waste plastics, scrap metals, waste glasses, and other resources, with renewable resource recycling companies as its main players. For instance, the sorting process includes using optical sorting equipment to remove plastic impurities (PVE, ABS, PP, PE, etc.) from PET bottle flakes.

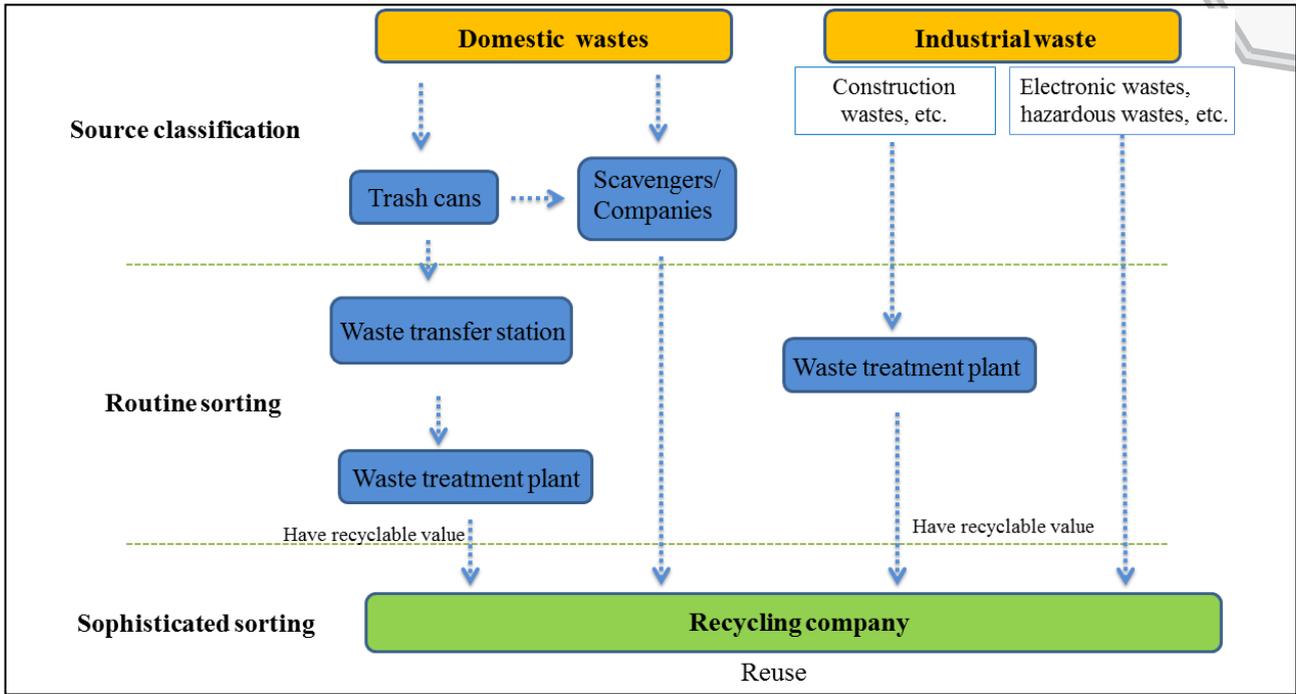


Figure 1 Schematic Diagram for Waste Sorting Process in China.
 Date source: GEP Research.

2. Market Environment and Policy Environment Investigation

2.1. National Policies

The waste sorting policies in China are directed at the source sorting household domestic wastes. Since 2000, China has set up waste separation and collection pilots in cities such as Beijing and Shanghai. However, these pilots only achieved modest overall results. In 2017, the National Development and Reform Commission and the Ministry of Housing and Urban-Rural Development of the PRC released the *Implementation Scheme for the Classification System of Domestic Wastes*. It explicitly listed 46 cities in China into the mandatory waste classification scope and planned to reach a domestic waste recycling rate of more than 35% by the end of 2020. Since then, China has commenced to release various waste classification policies in an intensive manner. In June 2019, the Ministry of Housing and Urban-Rural Development of the PRC issued a document requesting all cities across China at prefecture level and above to comprehensively implement domestic waste classification starting from 2019.

Year	Institution	File Name
2000	Former Ministry of Construction	<i>Notice on the Publication of Pilot Cities for Separate Collection of Domestic Wastes</i>
2011	The State Council	<i>Opinions on Further Strengthening the Treatment of Municipal Domestic Waste</i>
2015	The State Council	<i>Opinions on Accelerating the Construction of Ecological Civilization</i>
2015	The State Council	<i>Overall Scheme for the Reform of Ecological Civilization System</i>
2016	The State Council	<i>Several Opinions on Further Strengthening the Management of Urban Planning and Construction</i>
2017	The National Development and Reform Commission and the Ministry of Housing and Urban-Rural Development	<i>Implementation Plan for Domestic Wastes Classification System</i>
2017	The Ministry of Housing and Urban-Rural Development, etc.	<i>Notice on Promoting the Domestic Wastes Classification in Public Institutions Such As Party and Government Organs</i>
2017	The Ministry of Housing and Urban-Rural Development, etc.	<i>Opinions on the Implementation of Domestic Wastes Classification System in Military Units</i>
2017	National Health and Family Planning Commission, etc.	<i>Notice on Promoting the Management of Domestic Waste Classification in Medical Institutions</i>
2017	Ministry of Housing and Urban-Rural Development	<i>Notice on Accelerating Waste Classification in Some Key Cities</i>
2018	Ministry of Education	<i>Notice on Promoting the Management of Domestic Waste</i>

		<i>Classification in Schools</i>
2019	Ministry of Housing and Urban-Rural Development	<i>Notice on the Comprehensive Implementation of Domestic Waste Classification in Cities at and Above Prefecture Level Countrywide</i>
2019	Ministry of Ecology and Environment	<i>Law of the People's Republic of China on Prevention and Control of Environmental Pollution by Solid Wastes (Revised Draft)</i>

Table 1 Waste Classification Policies in China.
Data source: GEP Research.

2.2. Local Policies

According to the requirements of *the Notice on Comprehensive Implementation of Domestic Waste Classification in Prefecture-level Cities Countrywide* issued jointly by nine departments in April 2019, including the Ministry of Housing and Urban-Rural Development, the National Development and Reform Commission, the Ministry of Ecology and Environment, the Ministry of Education, the Ministry of Commerce, the mandatory waste classification is planned to be first popularized in 46 cities.

Region	Number of cities
Municipality	4
Municipality with independent planning status	5
The first batch of domestic waste demonstration cities listed by the Ministry of Housing and Urban-Rural Development	10
Capital city	52

Table 2 Key Cities for the Popularization of Waste Classification in China.
Data Source: Notice on the Comprehensive Implementation of Domestic Waste Classification in Cities at and Above Prefecture Level Countrywide.

Among these cities, Shanghai took the lead to carry out comprehensive domestic waste classification in China. At the end of January 2019, the Second Meeting of the Fifteenth Municipal People's Congress of Shanghai passed *Shanghai Municipal Regulations on Domestic Waste Management*, incorporating waste classification into the development framework of Shanghai. This Regulation specified that the individuals could be fined up to RMB 200 for their mixed waste throwing and the units could be fined up to RMB 50,000 for their mixed stowage and transportation. It also pointed out that Shanghai would gradually establish a domestic waste charging system for metering charges and classified pricing based on the principle that "the person who generates wastes shall pay for such wastes." The waste classification policies mainly include three key points.

2.2.1. The Method of "Sorting Domestic Wastes into Four Categories"

Shanghai implements the standards of "four classifications" for domestic wastes: hazardous wastes, recyclable wastes, wet wastes, and dry wastes. Among the four classifications, hazardous wastes refer to

domestic waste products that cause direct or potential harm to human health or natural environment, such as waste batteries, waste lamps, waste drugs, waste paints, and their containers. Recyclable wastes refer to waste papers, waste plastics, waste glass products, scrap metals and other domestic waste products suitable for recycling and reuse. Wet wastes refer to perishable wastes, including food wastes, leftovers, expired foods, flowers and plants, etc. Dry wastes refer to the wastes other than the above three classifications.

2.2.2. Hotels and Restaurants Shall Not Actively Provide Disposable Items

The Regulation stipulates that hotels shall not provide one-time daily necessities in guest rooms. In case they are found to actively provide such items and refuse to correct, they will be fined RMB 500-5000. Restaurant service providers and catering delivery service providers shall not actively provide one-time tableware. Those who are found to provide tableware in such manner and fail to make corrections within the time limit shall be fined RMB 500-5000.

2.2.3. A Recycling System for Recyclables and the "Internet Plus Recycling" Approach

The Regulation specifies the interest into establishing a recycling system for recyclable wastes and promoting the "two-network integration" of domestic waste classification and renewable resource recovery. It stipulates that the Landscaping and City Appearance Administrative Bureau is responsible for promoting the construction of "sites, stations and yards" of recyclable wastes, and formulating the support policies for the recovery of low-value recyclable wastes jointly with the other authorities concerned to cultivate the recycling service market. In addition, the Regulation points out that the commerce, economic informatization, and other relevant departments, shall establish a public information service platform for recycling renewable resources, thus to provide the public with reservation recycling services, as well as information on transaction prices and recycling methods, and to encourage to use the recycling methods, such as "Internet Plus Recycling" and smart recycling.

Time	Institution	Policy Name
2004	Shanghai Municipal City Appearance and Environmental Sanitation Administrative Bureau	<i>Shanghai Municipal Development Planning for the Disposal of Solid Wastes</i>
2005	Shanghai Municipal City Appearance and Environmental Sanitation Administrative Bureau	<i>The Administrative Measures for Shanghai Municipal Domestic Waste Program</i>
2007	Shanghai Landscaping & City Appearance Administrative Bureau	<i>Notice on Further Conducting Pilot Works for the New Sorting Methods of Domestic Wastes in the Residential Areas of Shanghai Municipality</i>
2014	The General Office of Shanghai Municipal People's Government	<i>Shanghai Municipal Measures on Promoting the Domestic Waste Classification and Disposal Volume Reduction</i>

2014	Shanghai Landscaping & City Appearance Administrative Bureau	<i>Shanghai Municipal Implementation Planning for Wet Waste Treatment (2014-2020)</i>
2014	Shanghai Landscaping & City Appearance Administrative Bureau, etc.	<i>Shanghai Municipal Domestic Waste Classification Catalogue and Relevant Requirements</i>
2017	The Office of Shanghai Municipal Joint Conference on Promoting Domestic Waste Classification and Disposal Volume Reduction	<i>Shanghai Municipal Implementation Planning for the Mandatory Classification of Domestic Wastes in Units</i>
2017	The Office of Shanghai Municipal Joint Conference on Promoting Domestic Waste Classification and Disposal Volume Reduction	<i>Action Plan for the Construction of Whole-Process Domestic Waste Classification System in Shanghai Municipality (2018-2020)</i>
2019	Shanghai Municipal People's Congress	<i>Regulations of Shanghai Municipality on Domestic Waste Management</i>
2019	Shanghai Landscaping & City Appearance Administrative Bureau	<i>Shanghai Municipal Guidelines for the Classification and Disposal of Domestic Wastes</i>

Table 3 Waste Classification Policies of Shanghai.

Date source: Shanghai Municipal People's Government.

3. Demand Analysis and Forecast for China Waste Sorting Industry

3.1. Overview of Demands in China Waste Sorting Industry

The domestic wastes in China not only include urban residents' domestic wastes, commercial wastes, public place wastes, but also some industrial wastes. Waste sorting equipment usually needs to be appropriately adjusted according to the local waste characteristics.

Waste disposal plants (conventional channels) and junkmen/companies (unconventional channels) sort the municipal domestic wastes in China. They have recycled most of the items with recyclable value (metals, plastics, glasses, papers, etc.). The waste classification in China is still in the initial promotion stage, and the items with recyclable values that have been delivered to waste treatment plants have a relatively low recycling rate.

According to GEP Research, the clearance and disposal volume of municipal domestic wastes in China in 2018 was about 318 million tons. Among them 228 million tons of wastes were cleared and disposed by waste disposal plants (conventional channels), and about 90 million tons of wastes were recycled by junkmen/companies (unconventional channels). In recent years, the clearance and disposal volume of municipal domestic wastes in China has maintained a growth rate of 5%-10%. It is estimated that the clearance and disposal volume of domestic wastes in China would reach 360 million tons by 2020 and would exceed 500 million tons by 2025.

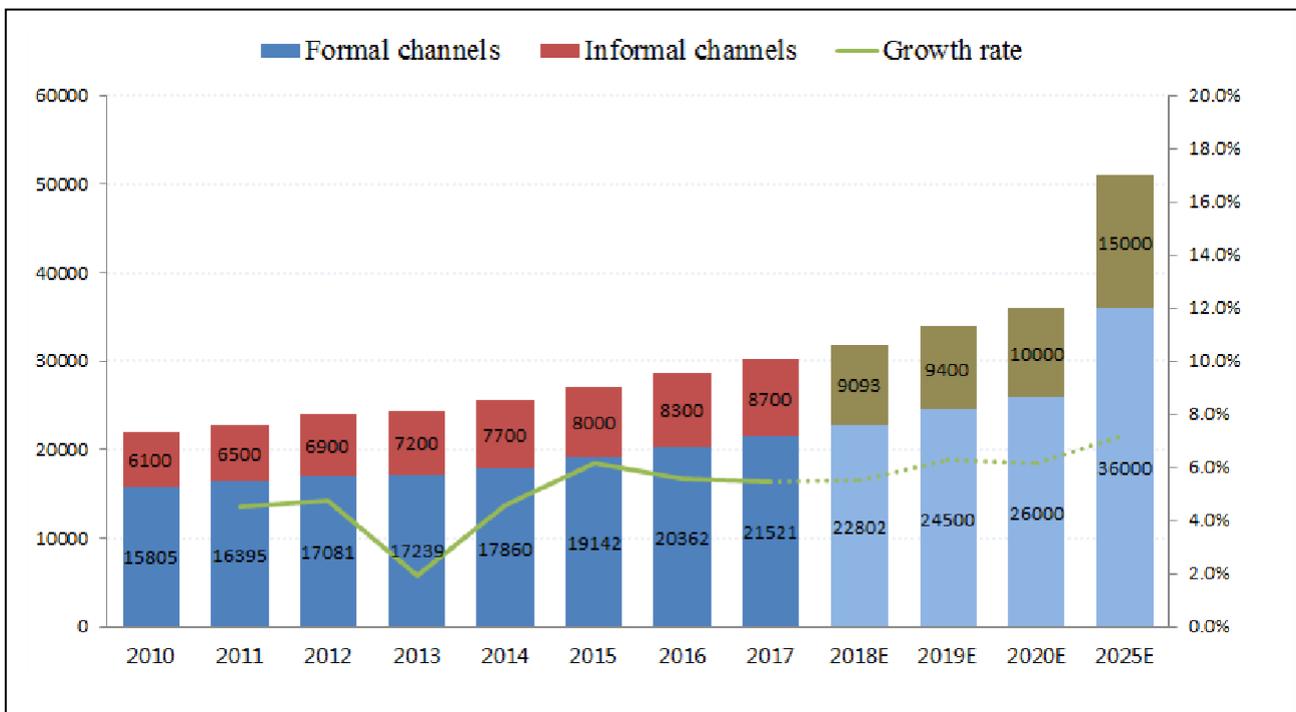


Figure 2 Total Clearance and Disposal Volume of Municipal Domestic Wastes in China.
Data source: GEP Research and the National Bureau of Statistics of the PRC.

3.2. Resource Recovery and Utilization Status

According to GEP Research data, the recycling rate of renewable resource wastes in China has increased year by year, reaching nearly 300 million tons in 2018. The recycled resources relating to the components of municipal domestic wastes include waste steel, waste non-ferrous metals, waste plastics, waste papers, waste glasses, waste batteries, etc., totalling about 250 million tons.

4. Competition Analysis on China Waste Sorting Industry

4.1. Overview of Enterprises in the Waste Sorting Industry

There are tens of thousands of enterprises in the waste sorting industry in China. Enterprises in different sorting differ greatly in terms of performance form, scale and operation mode. Enterprises could be divided into source sorting enterprises, conventional sorting enterprises (equipment, operation), and sophisticated sorting enterprises.

4.2. Market Share and Industry Concentration

The overall market concentration of the waste sorting industry is relatively low and with large differences. According to the data from GEP Research, the source sorting link is dominated by junkmen, with an extremely low market concentration. The scale of conventional sorting equipment enterprises is generally small, with low market concentration, having a CR3 not exceeding 10%. With respect to waste sorting and operating enterprises, the market is mainly dominated by waste treatment and disposal enterprises, with a CR3>25%.

5. Technologies Applied in Waste Sorting Industry

Common domestic waste sorting technologies mainly include screening, gravity sorting, buoyancy sorting, magnetic sorting, electric sorting, and electrostatic sorting. In recent years, some new waste sorting technologies have emerged, such as image recognition sorting and variable weight sorting.

5.1. Screening

Screening refers to putting the mixed wastes with varying particle sizes on a sieve. Through the vibration of the sieve, it is possible to make wastes with a diameter smaller than the screen hole penetrate screen surface, while keeping wastes with a diameter larger than the screen hole on the screen surface. This process of sorting of domestic wastes is applicable with different diameters.

5.2. Gravity Sorting

Gravity sorting refers to layering and separating domestic wastes to obtain products at different densities through the combined effect of gravity, medium power, and mechanical force. The process is based on the difference in densities among different components of domestic wastes. The gravity sorting of domestic wastes could be divided into different categories, such as wind sorting, jig sorting, shaker sorting, and heavy media sorting.

5.3. Buoyancy Sorting

Buoyancy sorting is mainly carried out by means of liquids, surface treatment agents, etc. Due to the differences in the surface properties of various components of domestic wastes and their adsorption capacities, some wastes could float on the surface of a liquid, while some would sink at the bottom, thus achieving the purpose of sorting.

5.4. Magnetic Sorting

Magnetic sorting is a method to achieve sorting based on the differences in magnetic properties of various components of domestic wastes. After putting domestic wastes into a magnetic separator, the magnetic particles in domestic wastes are magnetized by the attractive force of magnetic field, which then remain by adsorbing on the cylinder of magnetic separator. Non-magnetic particles are discharged together with other wastes.

5.5. Electric Sorting

Electric sorting is a method to achieve sorting through the use of the differences in electrical properties of various components of domestic wastes in electric field. Most domestic wastes belong to semiconductors and non-conductors, so the electric sorting process of domestic waste is also a process of separating semiconductors and non-conductors.

5.6. Electrostatic Sorting

Electrostatic sorting is a method to achieve sorting by using the differences in electrostatic properties of

various domestic wastes. The electrostatic sorting method is mainly used for plastic domestic wastes. It is particularly suitable for polarized polyvinyl chloride, with a sorting purity reaching 99%.



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The high-level training program Sicab – Sino Italian Capacity Building for Environmental Protection is supported by IMELS – ITALIAN MINISTRY FOR THE ENVIRONMENT, LAND AND SEA.



Sicab is included within the SINO-ITALIAN COOPERATION PROGRAM FOR ENVIRONMENTAL PROTECTION (SICP). SICP was launched by IMELS – the Italian Ministry for the Environment, Land and Sea and MEE – the Chinese Ministry of Ecology and Environment.

Sicab consortium includes five partners: Politecnico di Milano (Lead Partner), Euro-Mediterranean Center on Climate Change, Italy China Foundation, Fondazione Politecnico di Milano, Sapienza University of Rome.



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