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THEMATIC REPORT 03

China Food Waste Treatment Industry

Edited by China-Italy Chamber of Commerce

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1.1. Macro Environment Impact Analysis of China's Food Waste Treatment Industry

The disposal of food waste (including household food waste, restaurant food waste, and other food waste) in China officially began during the 12th Five-Year Plan period. Various national policies, laws, regulations and local policies were approved. During the 12th Five-Year Plan period, the National Development and Reform Commission (NDRC), the Ministry of Finance, and the Ministry of Housing and Construction announced five groups of pilot cities (districts), for a total of 100, for the treatment of food waste in the 32 provincial administrative regions respectively in July 2011, October 2012, July 2013, July 2014, and May 2015.

In May 2016, the NDRC and other departments issued *the Notice on Carrying out the Final Acceptance and Funds Clearance of Pilot Cities for Harmless Recycling and Resource Reuse of Partial Food Waste*, requiring materials, such as self-assessment reports, from the pilot cities. The three institutions would review and conduct spot inspections. Among the first group of 33 pilot cities, only six cities, namely Nanchang, Weifang, Chongqing (Main District), Qingdao, Lanzhou, and Yinchuan, passed the acceptance check, and the overall progress lagged behind expectations.

Currently, only 47 out of 100 pilot cities have passed the acceptance check. The overall acceptance rate was considered not sufficient. However, because of national policies and the examples set by pilot cities, not only some provinces and municipalities, but also many prefecture-level cities and county-level cities have also drafted related food waste treatment measures or issued consultation drafts. It shows that the development of the food waste treatment industry is gradually accelerating.

1.2. Analysis of Industrial Policies, Laws and Regulations

1.2.1. National Policy

Since the 12th Five-Year Plan period started, China has introduced a number of related policies and regulations to promote the disposal of food waste. In 2010, the NDRC, the Ministry of Environmental Protection, the Ministry of Housing and Construction, and the Ministry of Agriculture jointly issued *the Notice on the Organizing of Resource Reuse and Harmless Recycling of Urban Food Waste*. It proposed a selection of suitable cities for the trial of resource reuse and harmless treatment of food waste. In 2012, the General Office of the State Council issued *the National Construction Plan for Harmless Treatment of Urban Waste Facility* during the 12th Five-Year Plan period. It stated that 242 food waste processing facilities by 2015 would have be constructed, and strived to achieve a treatment capacity of 30,000 tons per day. In 2016, NDRC and the Ministry of Housing and Construction jointly issued *the National Construction plan for Harmless Treatment of Urban Waste Facility* for the 13th Five-Year Plan period. It included the fact that 34,400 tons of food waste treatment capacity would be developed by the end of the 13th Five-Year Plan period. In 2017, the NDRC and the Ministry of Housing and Construction jointly issued the *13th Five-*

Year Plan for the Construction of National Urban Infrastructure, aiming to establish a city food waste recycling system by 2020.

1.2.2. Local Policies

Guided by national policies and driven by 100 pilot cities for the treatment of food waste, some provinces, municipalities, prefecture-level cities, and county-level cities across the country have issued local food waste management policies.

1.2.3. Subsidies

At present, China has not yet issued any unified food waste disposal subsidy document. Each municipality or prefecture-level city has issued municipal level food waste disposal subsidy according to the specific conditions.

Many regions, especially pilot cities, have introduced *the standards for food waste disposal subsidies*, which provide subsidies according to the actual conditions of each area, while encouraging classification of food waste, and carrying out harmless, resource reuse treatment.

Today, the average subsidy for food waste treatment is about RMB 110 per ton. Subsidy for collection and transportation is about RMB 100 per ton, whereas subsidy for integration of transportation and processing is about RMB 210 per ton.

Project Name	Designed capacity (ton/day)	Processing subsidies (yuan/ton)	Transport subsidy (yuan/ton)
Heishizi Food Waste Treatment Project in Jiangbei District, Chongqing	500	108	/
Heishizi Food Waste Treatment Project in Jiangbei District, Chongqing	500	130	/
Beijing Gaoantun Food Waste Treatment Plant	400	95	120
Beijing Nangong Food Waste Treatment Project	400	110	/
Beijing Shijingshan Wulilong Circular Economy Industrial Park Food Waste Disposal (Phase I) Project	200	185	/
Collection and Transportation of Food Waste in Luohu District, Shenzhen	300	110	60
Guangzhou Tianpu Mountain Food Waste Recycling Pilot Project	200 (22)	98	/
Changsha Food Waste Treatment Project	375	/	125
Wuhan Baixin Food Waste Treatment Project	200	90	/

Harbin Dining Food Waste Treatment Project	300	/	119
Qinhuangdao Food Waste Treatment Plant	150	120	/
Food Waste Treatment Plant of Nanjing, Jiangsu	100	75	/
BOT Project for Food Waste Treatment Plant in Shenyang	200	126	/
Xining Food Waste Treatment Plant	200	115	100
Qingdao Food Waste Treatment Plant	200	120	100
Yantai Food Waste Treatment Project	200 (25)	130	/
Jinan Food Waste Treatment Plant	200	119	89
Linyi Food Waste Treatment Project	200	120	/
BOT Project for Harmless Treatment of Food Waste in Zaozhuang	150	76	92
Chengdu Center City Harmless Treatment of Food Waste Plant Project	200	90	/
Guangyuan Food waste Treatment Plant	70	150	/
Ningbo Food Waste Treatment Project	300	90	85

Table 1 Operation subsidies for some food waste treatment projects. (Note: the numbers in "()" refer to the quality of trench oil processed).
Data source: Analysis of the Status of Subsidies for the Collection, Transportation, and Treatment of Food Waste Projects in China.

1.3. Technical Policy and Environmental Analysis

At present, China has formulated more than 10 related standards, including national, industrial and local standards on treatment of food waste. Related technical standards are still being improved.

2. Demand Analysis and Prospect Forecast of China's Food Waste Treatment Industry

2.1. Market Demand Analysis and Trend Forecast of Food Waste Treatment Industry

With the acceleration of urbanization in China and the improvement of people's living standards, food waste has become a large part of urban waste. In the urban waste structure, food waste accounts for about 50%. In 2018, China produced about 110 million tons of food waste, and the processing industry market size was valued at about RMB 12.8 billion, with a year-on-year increase of 2.4%. It is estimated that by 2025, China's food waste growth will reach about 130 million tons, and the processing industry market size will be valued at about RMB 15.2 billion, with an average annual compound growth rate of about 2.5%.

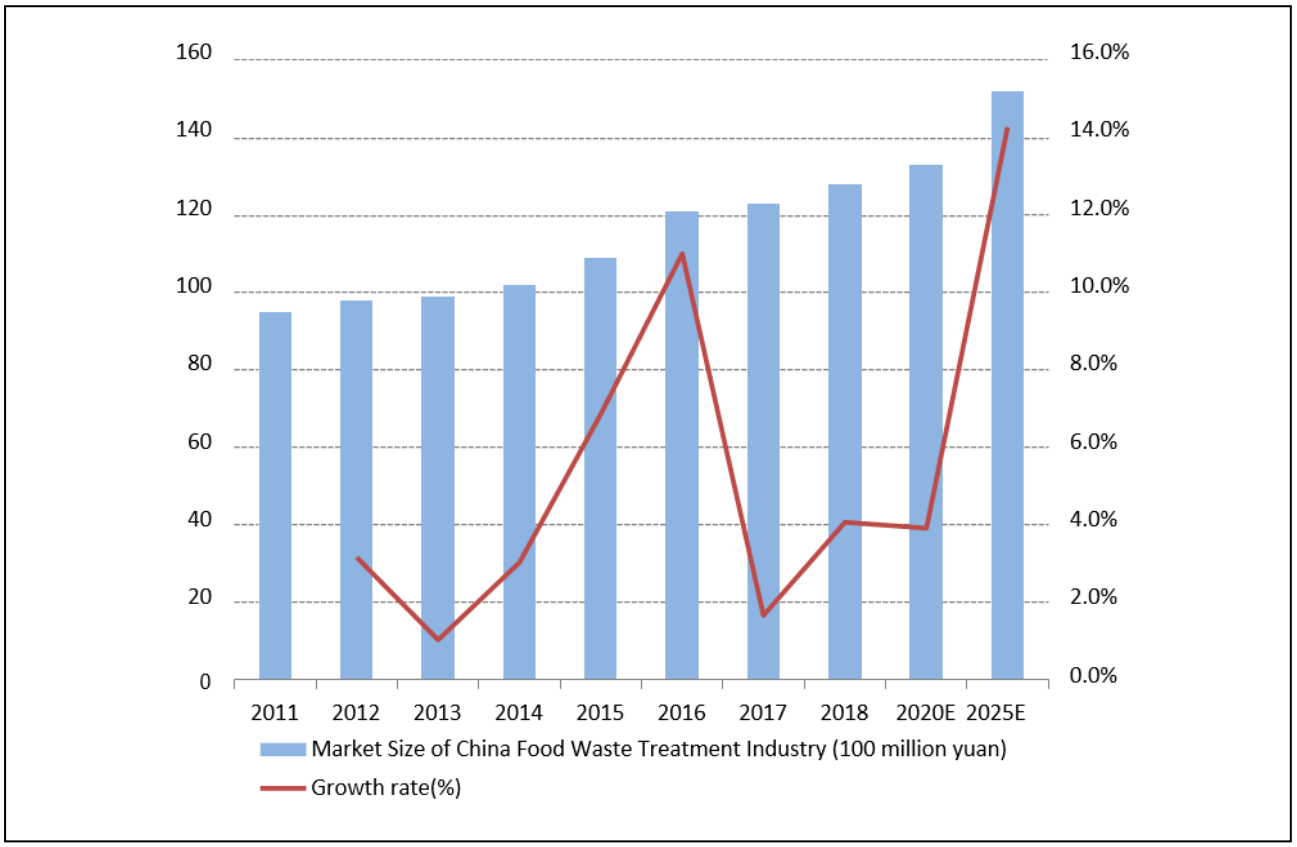

Figure 1 2011-2018 Market Size and Forecast of China Food Waste Treatment Industry.
Data source: Urban and Rural Construction Statistical Yearbook, GEP Research.

According to GEP Research data, investment value in food waste processing projects is based on the data of the construction of urban waste treatment facilities during the 12th and 13th Five-year Plans periods, and the average cost of food waste operation is calculated at RMB 100 per ton, excluding the collection and transportation. The average cost of the whole process (collection-shipment-disposal) is about RMB 200-300 per ton. The market of China's food waste treatment industry is composed of two parts, the engineering investment market for food waste and the food waste treatment operation market. In 2018, the market scale of the food waste treatment operation was worth about RMB 10.9 billion (about 85%), and the market size of the food waste engineering investment market was about 1.9 billion yuan (about 15%). It is estimated that from 2019 to 2025 both the market of engineering investment for food waste and the

market of food waste treatment operation will maintain steady growth.

In 2018, the market size of China's food waste treatment industry was worth RMB 12.8 billion (about 110 million tons of processing capacity), of which the landfill treatment market size was about RMB 5.9 billion (60 million tons of processing capacity), the incineration treatment market size was about RMb 5.1 billion (40 million tons processing capacity), and the biological and other treatment market was about RMB 1.8 billion (10 million tons of the processing capacity).

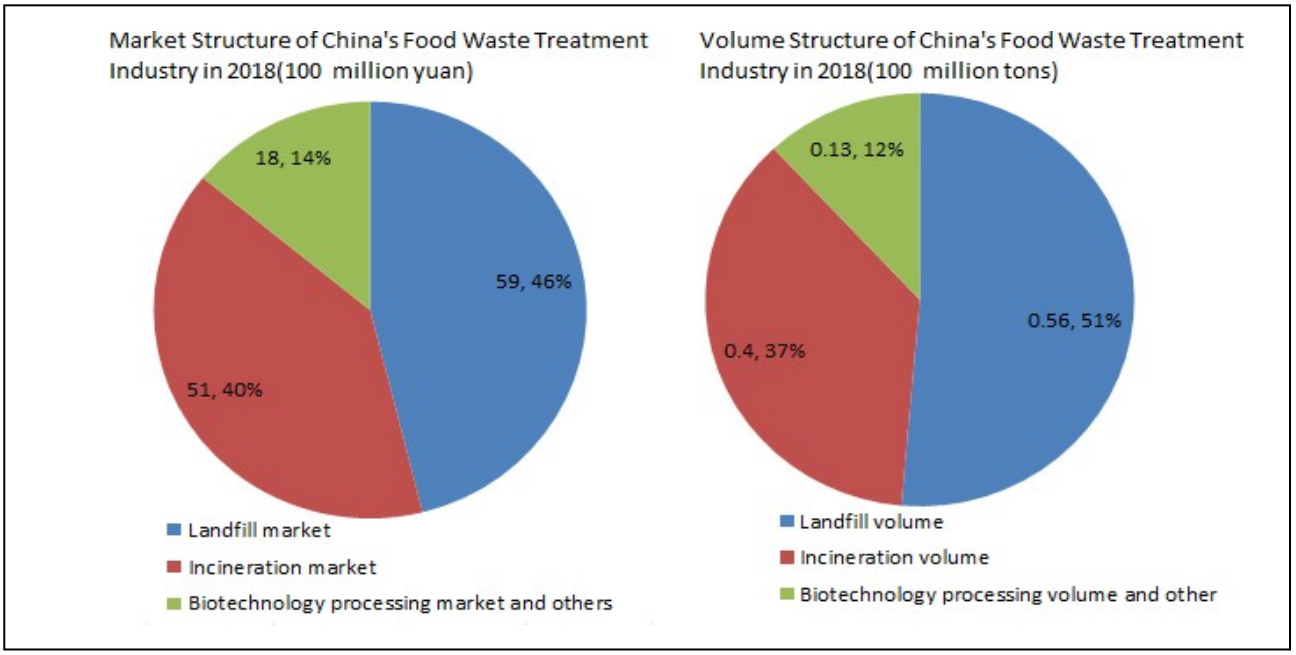

*Figure 2 Market Structure and Volume Structure of China's Food Waste Treatment Industry in 2018 ((market/volume)*percentage). Data source: Urban and Rural Construction Statistical Yearbook, GEP Research.*

2.2. Demand Trends and Driving Factors

There are some major driving factors of the market growth of China's food waste treatment industry, including population growth, urbanization level, per capita income, industry policies, treatment technology, industrial chain integration and operation mode. The main development trends are as follows:

1. The food waste volume continues to increase. It is driven by many factors, such as population growth, urbanization acceleration, and per capita income increase, and it grows as collection rate improves.

2. The cost of food waste disposal is on the rise. The average investment cost remained stable, yet the average operation treatment cost continued to increase, mainly due to the continuous decline in the market share of landfill treatment and the increase in the market share of resource reuse treatment (the average operating cost of the food waste resource reuse market was RMB 200-500 per ton).

3. The investment market of food waste will grow steadily. Mainly due to the continuous increase in the treatment capacity and insufficient production capacity in the context of new coming garbage classification policies, it is estimated that the demand for urban food waste treatment will continue to be the main trend in the short-term, and it will develop mainly on the county-level in the future.

4. In the context of the continuous promotion of waste classification, the market share of harmless recycling and resource reuse of food waste will increase continually. The market share of incineration treatment will be diverged due to the different levels of land resources and economic development in various regions (the overall trend is increasing). The decline in landfill disposal market share is sharp.

2.3. Regional Market Demand Analysis and Prospects

In the *13th Five-Year Plan for the Construction of Facilities for the Harmlessly Processing of Urban Waste*, the total amount of investment for the constructions of facilities for the harmless processing of urban waste was about RMB 251.84 billion. The special project investment for food waste was worth RMB 18.35 billion, with an average annual investment of RMB 3.67 billion (the actual completion rate of investment in special project constructions of food waste during the 12th Five-Year Plan period was about 43%).

The top ten regions for the special project investment for food waste during the 13th Five-Year Plan period are Zhejiang (RMB 1.85 billion), Guangdong (RMB 1.37 billion), Jiangsu (RMB 1.32 billion yuan), Henan (RMB 960 million), Beijing (RMB 900 million), Ningbo (RMB 880 million), Chongqing (RMB 840 million), Xinjiang (RMB 740 million), Hebei (RMB 660 million) and Hunan (RMB 650 million). The total investment was of RMB 10.17 billion, accounting for 55.4% of the whole investment.

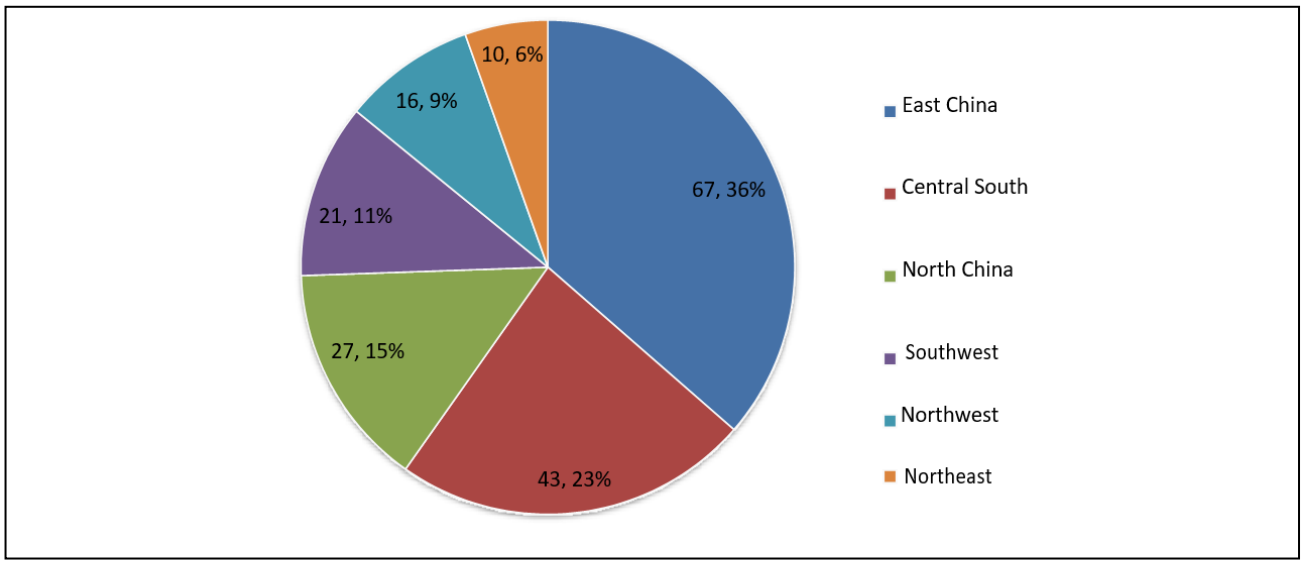

Figure 3 Investment in the Construction of Food WasteTreatment Facilities in China during the 13th Five-Year Plan Period (RMB 100 million) (volume, percentage).
Data source: GEP Research.

In terms of different regions, during the 13th Five-Year Plan period, the construction investment market for food waste treatment facilities in China is mainly concentrated in East and Central South China. The market size is worth about RMB 6.7 billion and RMB 4.3 billion, accounting for about 36% and 23% respectively of the national size, and about 59% together in total. Provinces with relatively large investment in East China are Zhejiang (RMB 1.85 billion) and Jiangsu (RMB 1.32 billion). Provinces with relatively big investment market sizes in Central and Southern China are Guangdong (RMB 1.37 billion) and Henan (RMB 960 million).

2.4. Analysis of Regional Operating Market

In 2018, China's food waste treatment capacity was about 35,000 tons per day, yet the treatment volume accounted for less than 15% of the total food waste. More than 85% of the food waste disposal suffers obstacles such as non-sorting or low collection rate of domestic waste, and most of it is disposed by landfill and incineration.

The top ten regions in terms of food waste operation market volume in 2018 are Guangdong (about RMB 1.3 billion), Jiangsu (about RMB 900 million), Shandong (about RMB 800 million), Zhejiang (about RMB 700 million), Sichuan (about RMB 500 million), Henan (about RMB 500 million), Beijing (about RMB 500 million), Hubei (about RMB 500 million), Liaoning (about RMB 400 million) and Fujian (about RMB 400 million). The total operating market size was worth about RMB 6.4 billion, accounting for about 59% of the total operating market size.

China's food waste treatment operation market is mainly concentrated in East and Central South China. The market size respectively accounts for about RMB 3.8 billion and RMB 2.9 billion, which are 35% and 27% of the national market size, 62% in total. Provinces with a relatively large operation market size in East China are Jiangsu (about RMB 900 million), Shandong (about RMB 800 million), and Zhejiang (about RMB 700 million), and provinces with a relatively large operating market size in Central and South China are Guangdong (about RMB 13 billion), Henan (about RMB 500 million) and Hubei (about RMB 500 million).

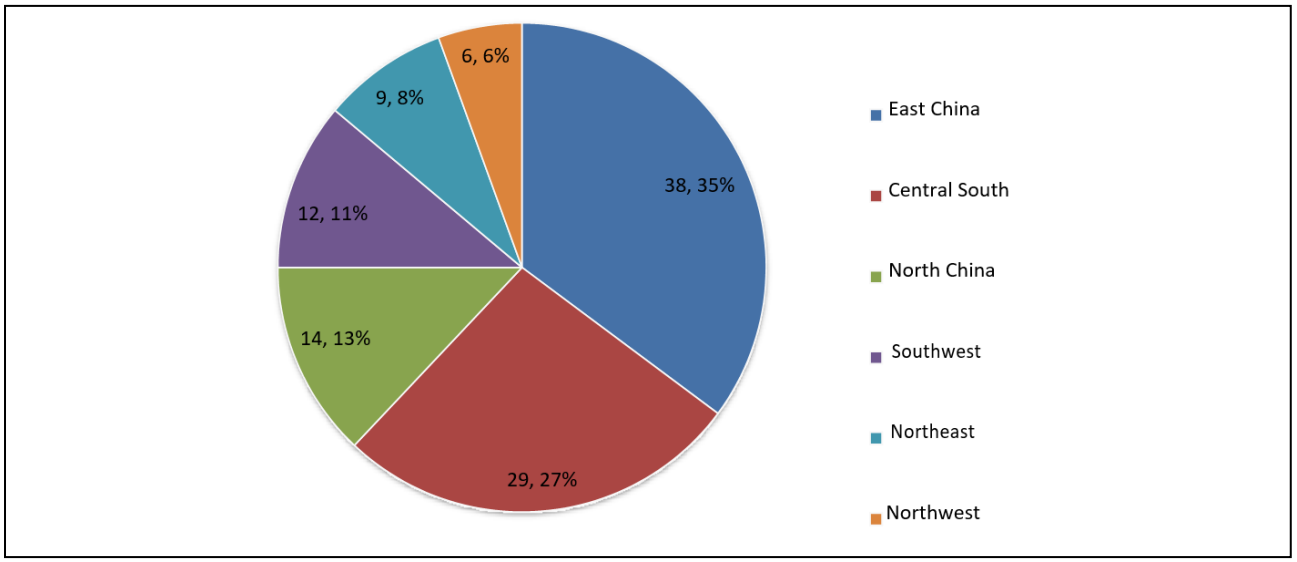

Figure 4 Market size (volume, percentage) of China's food waste operation in 2018 (RMb 100 million).
Data source: GEP Research.

3. Analysis of Supply and Competition in China's Food Waste Treatment Industry

3.1. Supply Analysis of Food waste Treatment Industry

China's food waste treatment industry hosts a large number of companies. As project constructions bloom, some food waste treatment companies have gradually scaled up, but not a single enterprise has been in the lead. Enterprises are relatively scattered and the industry concentration is not high. Most of the processing projects adopt BOT operation mode, in which competition is fierce. At present, thousands of enterprises are engaged in the treatment of food waste in China.

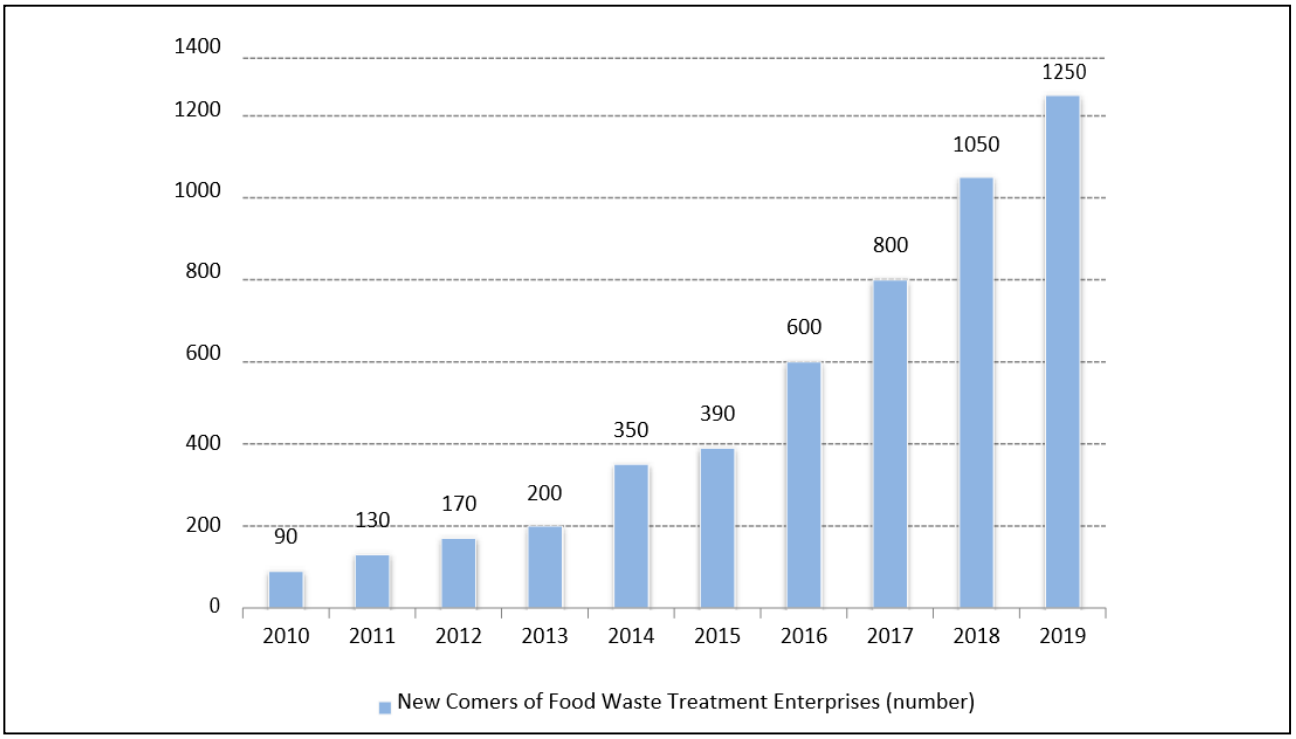

Figure 5 New Comers of Food Waste Treatment Enterprises in China from 2011 to 2019 (Number).
Data source: GEP Research.

3.2. Concentration of Food Waste Treatment Industry

In the last five years, the attention and competition of the food waste treatment industry has increased rapidly. Various environment-focused groups with heavy assets have laid out ahead to seize the market. Regional environmental groups focusing on comprehensive service and system solution providers have added food waste treatment to comprehensive solutions for solid waste and wastewater. They have deepened plans for treatment of food waste and intensified the competition.

The CR10 in China's food waste treatment industry is below 40%, with low industry concentration and scattered industry competition. In future, as the focus on food waste treatment industry increases, industry concentration will be brought to a new high.

At present, major companies are still in the key stage of development, and their market share is not big enough. There are no industry leaders with obvious advantages, and some companies specialized in food waste treatment have been squeezed by major environmental protection groups, which leads to slow

development and lagged overall growth rate.

3.3. Analysis of Profitability of Food waste Treatment Industry

The gross profit margin of China's food waste treatment industry is about 30%, and profit mainly comes from government subsidies and the subsequent operation of the projects. The food waste treatment projects generally adopt BOT model. Most companies operate for a period of 10 to 30 years. With a long operating time, returns are relatively stable and there is some room for growth. It is expected that the profitability of the food waste treatment industry will gradually increase in the future, as China attaches more importance to the treatment of food waste and more mature technology for food waste is applied.

Company name	Margin Gross Profit				Memo
	2018	2017	2016	2015	
Gland blue	35.20%	40.05%	39.86%	42.86%	Related treatment to solid waste
Wangneng Environment	52.14%	46.89%	—	—	Livelihood projects and food waste
Weiming Environment	36.49%	30.96%	27.35%	—	Food waste processing
Shifang Environment & Energy	36.50%	29.13%	35.53%	34.56%	Recycling and resource reuse of organic waste, accounts for about 90%.
Shanghai Environment	38.78%	39.16%	40.12%	—	Related to solid waste treatment

Table 2 Gross Profit Margin of Major Food Waste Treatment Companies.
Data source: GEP Research.

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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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