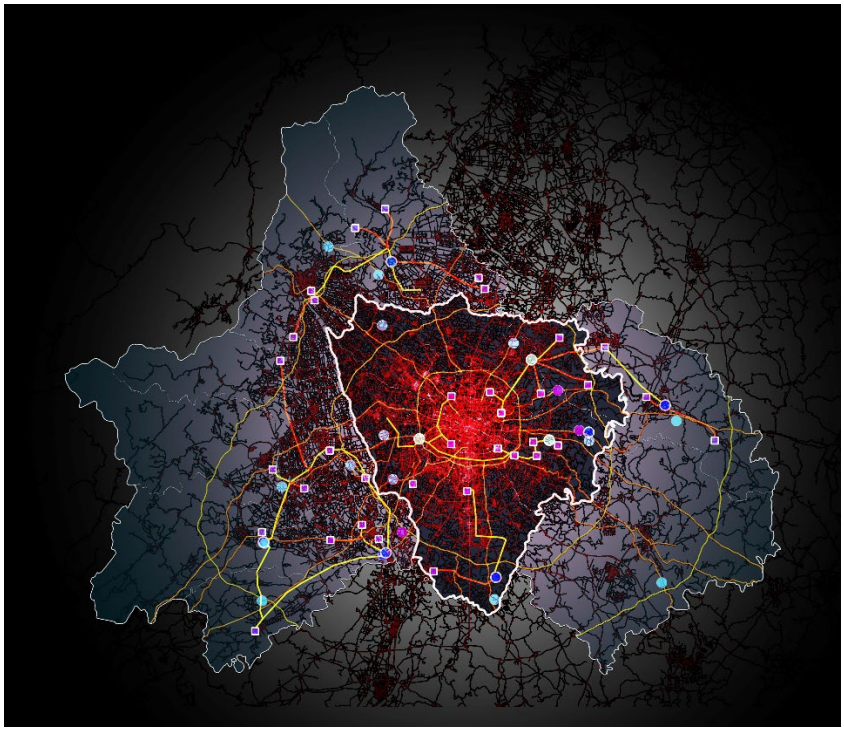
Environmental and Social impact of takeaway food waste

A case study in Chengdu, China



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Environmental and Social impact of take-away food waste: a case study in Chengdu, China

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Abstract

More than 3 billion plastic bags are consumed every day in China, posing a huge challenge for solid waste management. And scientists estimate that online food delivery businesses in China generated 1.6 million tons of packaging waste in 2017, nine times more than two years ago. This includes 1.2 million tons of plastic boxes, 175,000 tons of disposable chopsticks, 164,000 tons of plastic bags, and 44,000 tons of plastic spoons(Raymond Zhong & Carolyn Zhang, 2019) Despite the Chinese government's implementation of a "plastic ban" in 2008 and the issuance of guidelines by the National Development and Reform Commission and the Ministry of Ecology and Environment in early 2020 to further strengthen plastic pollution control (also known as the new "plastic ban"), many people still use plastic bags in their daily lives, especially for takeaway food.

The take-away industry in China has grown rapidly in recent years, but related take-away waste recycling measures are inadequate, so understanding the implementation of government policies and people's behavior regarding the use of such materials is key to reducing take-away waste. Therefore, this study aims to analyze the socio-demographic, economic, housing, social participation, and environmental perception factors that influence households' use of single-use plastic bags or reusable items when ordering takeaway food, as well as changes in government policies for the recycling and disposal of take-away waste.

The study found that take-out waste includes not only plastic packaging but also food residue, which indirectly increases the difficulty of recycling. So this paper focuses on government policies, recycling strategies and public feedback, and based on these results, implications for policymakers and suggestions for further future study are offered.

Keywords: Take-away food, food delivery, garbage classification, public feedback, policy implementation

Abbreviations

TFW: Take-away food waste

TPW: Take-away packaging waste

KWR: Kitchen waste recycling

1. Introduction

With the popularization and development of the Internet, O2O(Online to Offline) business model combining Offline services and Internet platforms is implemented. With the popularization and development of the Internet, O2O(Online to Offline) business model combining Offline services and Internet platforms should be implemented(C Lu & Y Lu, 2013) . Chinese take-away food industry has developed rapidly since 2009(Z Li & H Jiang, 2017), which has also led to the emergence of a large number of packaging wastes such as discarded lunch boxes and negative impact on the environment.

The pressure of solid waste disposal caused by waste packaging is an important embodiment of the environmental impact of the takeaway food industry. Besides, the environmental impact of packaging

production, transportation, waste disposal, such as resource and energy consumption, multi-media environmental pollution, human health damage, and other aspects should also be assessed. In order to comprehensively evaluate the whole process of environmental impact assessment of the take food and beverage industry, this study is based on takeaway food and beverage industry chain perspective, through the use of GIS geographic data to analyze take-out food packaging status quo and the impact on the surrounding area, combining questionnaire at the same time, to further understand the driving factors of reducing take-away junk, so as to give suggestions about the sustainability of take-out food industry's development.

2. Materials and Methods

2.1 Construction of the whole industrial chain of the take-away industry

Environmental problems caused by the emergence and rapid development of the takeout industry are directly related to all links of the whole industry chain, including the production, transportation, use, and discard of lunch boxes, tableware and plastic packaging bags(Fig.01).

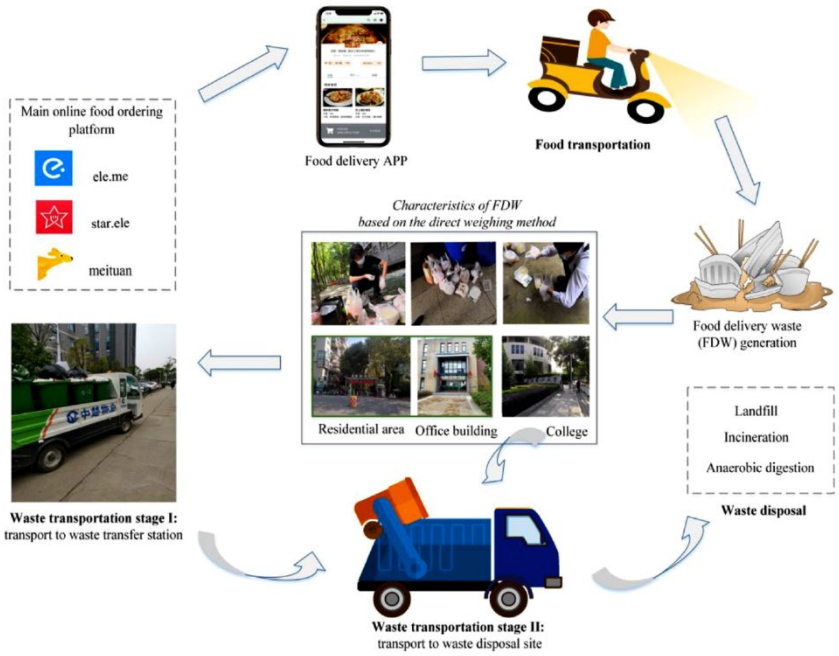

Fig.01 System definition for FDW generation, transportation, and disposal. (Zhang, Hui, Li Xue, Yinhua Jiang, Mingwei Song, Dingrui Wei, and Gang Liu. 2022. "Food Delivery Waste in Wuhan, China: Patterns, Drivers, and Implications." Resources, Conservation and Recycling 177 (February). https://doi.org/10.1016/j.resconrec.2021.105960.)

The production section

The production section means the production process of lunch boxes, tableware and packaging bags of different materials and specifications. The materials and specifications of packaging are selected by the restaurants according to the characteristics of dishes and packaging costs. Based on the analysis and statistics of 35.61 million orders from a takeaway platform(Y. Zhang & Wen, 2022), this study concluded that the materials of lunchboxes in the takeaway market mainly include PP, PS, white cardboard, corrugated paper, kraft paper, aluminum foil, degradable materials, etc. Tableware mainly includes: disposable bamboo chopsticks, melamine plastic chopsticks, fork spoons and so on; Packaging materials mainly include: HDPE, kraft paper, white cardboard, corrugated paper, degradable materials, aluminum

film pearl cotton and so on.

The transportation and use section

Transportation and use section including i) packaging from the manufacturer to the unified transportation link; ii) Takeaway delivery link, that is, the rider will deliver takeaway goods from the merchant to the designated location of the order. The environmental impact of this link is related to the average delivery distance of each order, the type of transportation and efficiency. iii) Takeaway packaging waste is generated after consumers use it, and the waste is collected and transported to the transportation link of household garbage treatment facilities through the sanitation system.

Waste disposal section

Waste disposal section: Under the current situation of insufficient domestic waste classification mechanism and inadequate take-away packaging recycling system in China, take-away packaging waste and urban household garbage are mixed into the sanitation system, and incineration, landfill and other major treatment methods are finally adopted.

2.2 General data analysis- questionnaires and big data

Respondents

Taking all kinds of objective factors into consideration, the survey group selected citizens in Chengdu for a questionnaire survey. I randomly selected 300 people on the Internet according to the proportion, including 100 white-collar workers, 100 students and 100 local residents, to conduct a questionnaire survey on the attitude of garbage selling. About 313 questionnaires were collected on the Internet, 301 valid questionnaires were collected, and the online questionnaire recovery rate was 97.2%

Survey method

The method of survey is a questionnaire survey. The questionnaire built a framework on the basis of integrating a large number of Chinese and foreign literature and information about takeaway food waste, and then it was modified and optimized after the test. In the questionnaire, 20 questions were designed and divided into three sections. The first section includes general demographic questions, such as gender, age, occupation, education level, and household income. The second section includes questions about convenience, environmental concerns, and ethical beliefs. And the final section encompasses questions about their attitudes and behaviors changed based on the impact of the coronavirus pandemic.

Big Data

The big data related to take-out mainly comes from the research report on the development of China's take-out industry released by platforms such as Eleme, Meituan, and various market analyses based on this research report. This kind of big data is mainly used to compare the changes in national policies related to the take-out industry before and after the epidemic, as well as the development trend of the take-out industry, and to propose recommendations for handling take-out waste in the post-coronavirus epidemic era

2.3 Mapping of urban and disposal plants developments

This thesis focuses on waste recycling and disposal policies in Chengdu, so the relevant urban development maps are based on the administrative areas released by the Chengdu Municipal Planning Bureau, and the data on waste recycling and disposal sites are derived from the domestic waste

incineration and power generation plan released by the Chengdu Municipal Planning Bureau in 2013 and the food waste plan released by the Chengdu Municipal Planning Management Commission in 2019. As the administrative area of Chengdu has been expanding in the past 10 years, the location of waste disposal sites has gradually fallen into smaller counties outside the core urban area. Therefore, through the visualization of map data, we can explore better ways of waste recycling from the perspective of urban development.

3. Characteristics of food delivery waste

3.1 Development of the takeaway industry

With the popularity of the telephone and the Internet, the take-away industry has grown rapidly and become more regulated. This included three main periods:

Phone call ordering

People are used to order a meal at the store and then ppackingit back, but there is time at home and they want to eat something from that store, then the merchant solves that demand, the customer reports the dish and address by phone and the merchant can deliver the meal to that customer. The flow of the transaction is: the customer orders by phone, the merchant takes the order, makes it, delivers it, and collects money from the customer. This process is limited by: the customer has the phone number of the merchant, the number of deliverers in the store, and the inconvenience of collecting money, and takeout did not develop rapidly in this period.

Website ordering

The popularity of the Internet in the 1990s led to the rapid growth of the take-out industry. Students and white-collar workers became the main force of website ordering. With this, many Internet food ordering businesses also developed, such as Shenzhen ABC takea-away food website, which was established in 2011.

Mobile ordering

In 2011, Android's global market share surpassed Symbian's for the first time, and in the fourth quarter of 2013, Android's global market share reached 78.1%. In 2013, Alipay was frantically exploring the mobile market, and in 2013, Hungry Meal quickly opened up the school market through high subsidies, and Meituan then began to enter the campus market. The two platforms began to compete.

3.2 Negative environmental effects of food delivery waste

The rise of the take-out industry has really solved the problem of eating for many people. However, while enjoying the convenience, the large amount of packaging waste generated by take-out is increasingly becoming a headache for environmental protection. Food waste is an important pollution source in the urban environment, which is very serious to the environment and people. Its main harm includes:

i) pollution of the urban environment. On the one hand, kitchen waste is rich in a large amount of water, if left untreated, they will be damaged in the process of surface and underground flow and infiltration, and pollute urban water bodies. On the other hand, kitchen waste contains more organic matter and water, they are susceptible to microbial action and corruption, which can cause the spread of pathogens and infections.

ii) Threats to food safety. First, livestock meat scraps are the main component of kitchen waste, and

feeding livestock directly with slop can lead to "man-eating man"; second, because urban kitchen waste inevitably increases microbial content during the long collection and transportation process, toxins produced by food mold, etc., may bring bacteria to livestock, which in turn can infect people; at the same time, toxic and harmful substances in the production and collection process of kitchen waste can Through the food chain into the human body, damage to human nerves, liver, kidneys and immune system, causing foot and mouth disease, and even lead to cancer in addition.

iii) Impact on urban construction. On the one hand, after a large amount of fermented and mixed water in the food waste enters the urban sewage treatment system, the increase of organic matter will increase the difficulty of sewage treatment and thus increase the cost of urban sewage treatment. On the other hand, the unique properties of food waste engage it to have higher requirements on the corrosion resistance and sealing of collection and transportation containers, which increases the cost of urban waste treatment.

iiii) Spread the disease. If food waste is kept in the open air for a long time, or the seal is not strict in the collection and transportation process, mosquitoes, flies, and insects will multiply and circulate widely in this environment, causing the spread of diseases.

3.3 Characteristics of food waste in Chengdu

Particularity of food waste in Chengdu

Food waste is a special kind of urban household garbage. On the one hand, improper disposal will cause great harm. On the other hand, its rich organic composition is an important resource for people's production and life. Its characteristics can be summarized as:

i) Food waste contains a lot of water, the average weight of water accounted for 80%-95%, thus it increasing the difficulty of collection, transportation, and treatment. It is easy to leak and pollution of the environment, and at the same time, the resource ratio is low, a ton of garbage treatment, sometimes less than 10% of the resource rate.

ii) The composition of food is rich and has high recycling value. It contains a lot of organic matter, such as protein, cellulose, starch, fat, also contains rich nutrients, including nitrogen, phosphorus, potassium, calcium, and various trace elements, and contains salt, pepper, acetic acid, etc., therefore, though it can be recycled, the resource recycling technology is difficult, and the cost is relatively high.

The difference in food waste between Chengdu and other cities in China

i) The ingredients are different. Due to the unique dietary habits of Sichuan people, the dietary structure of Chengdu residents generally shows that the intake of milk, fruit and aquatic products is low, while the intake of edible oil, beans, animal meat and animal food is high, and the taste is heavy, like spicy and greasy, and the variety is very rich. Therefore, Chengdu’s food waste generally contains high oil and salt content. Thus, higher requirements are put forward for harmless disposal cost, transport sealing and processing timeliness.

ii) Disposal volume is large. On the one hand, there are many catering enterprises. Chengdu is the capital of food, with a long history of food culture and rich food products. Chengdu people are also famous for their love of food. According to the statistics of the Chengdu Urban Management Committee, by 2018, there were about 18,000 catering enterprises and canteens in downtown Chengdu. According to the investigation and calculation by the competent authorities, catering enterprises in the downtown area of Chengdu city produce about 1,000 tons of restaurant kitchen waste every day. As the catering

industry continues to develop, the amount of food waste will continue to increase. On the other hand, Chengdu has a large permanent resident population. According to the statistics bureau of Chengdu, the permanent resident population of Chengdu in 2017 was 16,044,700, among which the urban permanent resident population was 11,528,100. In terms of the number of restaurants and permanent residents, Chengdu ranks first among new first-tier cities, following Beijing, Shanghai, Guangzhou, Shenzhen, Chongqing and other big cities. This is a severe challenge to the disposal capacity and investment cost of food waste in Chengdu.

The difference in food waste between Chengdu and western cities

i) The quantity is large. First of all, the number of urban population is the basis of food waste generation. With 16 million permanent residents, Chengdu has a large population, more than other foreign cities, and a large amount of food waste. Secondly, due to the food culture and dining habits, Chengdu people like to dine out. In addition, Chengdu's complex and diverse food processing technology, as well as the pursuit of color and flavor, etc., means that Chengdu's per capita generation of kitchen waste far exceeds that of Western countries.

ii) Differences in composition. Chinese food waste has the characteristics of high organic content (organic content accounts for more than 80% of dry matter), high water content (80%-95%), high oil, high salt, and so on, especially in Chengdu. Due to the different diet compositions, the water content and oil content of the kitchen waste in western countries are much lower than that in China.

iii) Differences in basic conditions. People in Western countries have a stronger awareness of environmental protection, and waste treatment started earlier, and the related facilities are relatively supporting. In the United States, the use of garbage disposals has been promoted since 1927, and more than 50% of American households have installed kitchen garbage disposals. After decades of exploration, the United Kingdom has mature technology and practices in source management, standardized classification, and the combination of government and business. Germany began to use anaerobic technology to treat kitchen waste in the 1960s, and was promoted in the 1990s. Chengdu and even China's kitchen waste treatment has just started. At present, the treatment capacity can not meet the needs, disposal technology, operation mechanism, management system, supporting facilities and other aspects are still in the exploration stage. Therefore, for the disposal of kitchen waste, the contradictions in Chengdu are more prominent and more difficult.

3.4 Conclusion

In terms of the current state of waste recycling, the overall recycling policy and technology base in Chengdu and China is lower than that of developed Western countries. Moreover, due to Chengdu's multi-soup eating habits, it is difficult to promote the paper cutlery commonly used in the West, while the large proportion of oil also makes it difficult to recycle take-out waste.

In terms of garbage recycling treatment. There are three main difficulties to be solved:

i)The first is the difficulty of odor removal, which is due to the residual food fermentation and oil, food spoilage, including the entire recycling process caused by some of the more difficult to handle and attached odor.

ii)The second problem is that there is more residual oil and grease, which makes the whole recycling and sorting more difficult. In the process of cleaning and processing the oil caused by the relatively high cost of environmental protection of wastewater treatment.

iii)The third major problem, the main component of plastic lunch boxes is PP, but there are things including lids, in fact, are other types of plastic, so in different environments, the operator needs to go to the first identification of different types of materials.

4. Historic waste policy changes

4.1 Current situation of Take-away waste in China

Phenomenons of takeaway food in China

Since 2019, Shanghai fully implemented household garbage classification. Subsequently, Chongqing, Hangzhou, and other cities also issued household Garbage Management Regulations successively and began to enforce household garbage classification systems, which has arisen public attention.

With the continuous development of China's economy and the continuous advancement of urbanization, urban areas and population-scale are getting larger and larger, and the garbage produced by residents is increasing explosively. Chengdu, for example, incinerated and buried about 4 million tons of domestic waste in 2016. Due to a large amount of urban solid waste deposition will greatly affect the environmental protection, residents' life, health and epidemic prevention, city image, and other aspects of the problem, in addition to the waste disposal has a large investment, high cost, difficult planning, high coordination requirements, waste disposal has become a common "urban disease" in various cities.

Concepts related to food waste recycling and disposal in Chengdu

Take-away waste classification

According to the definition of take-away food waste in Chengdu Restaurant -Kitchen-Garbage Management Measures, "The take-away food waste mentioned in these measures belongs to the category of household garbage, and refers to the kitchen waste and waste edible oil and other wastes generated in the process of food processing, catering service, livestock and other activities other than the daily life of residents". The Measures also make it clear that "these measures are not applicable to the generation, collection, transportation, treatment and related management activities of kitchen waste and waste edible oil and other wastes generated in the daily life of households" (Food Regulation Center, 2013). Therefore, the takeaway waste studied in this paper not only includes food waste, such as leftovers generated by citizens' lives while ordering the take-away food, but also includes plastic waste from takeaway packaging, including plastic lunch boxes and plastic bags.

Food waste is very perishable, stinks, and spreads bacteria and viruses. Food waste usually consists of staple foods such as rice and flour, non-staple foods such as vegetables and fruits, meat and bones, condiments such as animal and vegetable oils, Chinese prickly ash and salt, as well as discarded utensils, plastics, and paper towels. In physical form, restaurant waste is a mixture of solid and liquid with high viscosity. Its main component is water, and it also contains chemical components such as starch, cellulose, protein, lipids, and inorganic salts.

Recycling and disposal treatment

According to Chengdu Restaurant Kitchen Waste Management Measures, recycling treatment refers to the collection of restaurant kitchen waste from the restaurant kitchen waste-producing unit, transportation of restaurant kitchen waste to restaurant kitchen waste treatment enterprises, and harmless treatment of restaurant kitchen waste (Food Regulation Center, 2013). These three links are the main activities of the government to deal with restaurant kitchen waste. Respectively involving the production, transportation and disposal of kitchen waste units (enterprises). Taking kitchen waste as a

reference, this paper studies the production, transportation and treatment of takeaway waste in order to reduce the impact of takeaway waste on the environment.

4.2 History of policy change

On August 20, 1998, the Chengdu Municipal People's Government issued the "Chengdu Municipal Household Garbage Bag Management Measures"(Chengdu Municipal Household Garbage Bag Management Measures, 1998), which mainly required individuals, units and managers to use special garbage bags, classify household garbage according to the provisions, seal it tightly, and deliver it to the designated place on a regular basis. Special vehicles will carry out closed transportation or transfer. So as to strengthen the management of municipal solid waste, and improve the quality of urban appearance and environmental sanitation.

20 years later, with the improvement of people's living standard, more and more rubbish were produced, the phenomenon of "Besieged by Garbage" has arisen public attention. Shanghai has taken the lead in China in issuing and implementing a garbage sorting policy, while Chengdu has also taken corresponding measures, the government issued a new policy(Chengdu Municipal Household Garbage Bag Management Measures, 2019), The measures were not only applicable to jinjiang, Qingyang, Jinniu, Wuhou and Chenghua urban districts (including Chengdu High-tech Zone), but also to other districts. And The standard of garbage classification has been strengthened and improved.

With the development of the takeaway food industry and delivery service industry, Take-out waste can deteriorate rapidly as the industry expands. At the beginning of 2020, the National Development and Reform Commission and the Ministry of Ecology and Environment issued the Opinions on Further Strengthening the Control of Plastic Pollution, which is regarded as the first step in a comprehensive waste reduction policy. This new policy defined the tasks and objectives of strengthening the control of plastic pollution in three stages: 2020, 2022, and 2025. By 2020, China will take the lead in banning or restricting the production, sale, and use of some plastic products in some regions and areas. The revised Solid Waste Law, which took effect on September 1, 2020, also strengthens the requirements on plastic pollution control and clarifies the legal liability for relevant violations.

In response to national policies and the current situation of increasing waste during the coronavirus pandemic, The Chengdu municipal government has issued a "regulation on the management of household garbage in the city", aiming at a)the domestic garbage classification and treatment system can be improved, b)the atmosphere of social participation can be stronger, c)the accuracy of garbage classification can be constantly improved, d)the garbage classification industry will be gradually expanded.

4.3 Main measures and achievements of Garbage classification in Chengdu

Collection and transportation

Starting in 2019, Chengdu decided to upgrade collection points, drop containers, and transport vehicles of the "four categories" on the basis of streets (towns). By November 2020, classification facilities had been laid in public institutions and more than 13,500 residential areas in the city, and 2,872 classified transport vehicles with unified marks had been equipped. Among them, 1,580 are other garbage carriers, 872 are kitchen waste carriers, 266 are recyclable carriers and 197 are hazardous waste carriers.

Treatment and resource utilization

For food waste, Chengdu promotes resource utilization according to local conditions, and actively explores the formation of seven harmless treatment methods, such as aerobic fertilizer production and medium-temperature anaerobic fermentation. For recyclables, Chengdu has built more than 2,000 community recycling stations (points) for renewable resources, 28 recyclables sorting facilities, and introduced more than 70 waste-sorting enterprises. By October 2020, the recycling amount of recyclables in The city reached 2.3 million tons, the recycling amount of kitchen waste reached 650,000 tons, and the recycling rate of household waste reached 35 percent.

Innovation recycling mode

Chengdu vigorously develops the new recycling mode of 'Internet +', and promotes the construction of a renewable resources information service platform called 'Waste Bobo'. The company has successively cultivated a group of "Internet + recycling" new mode enterprises, such as scrapping, collecting and collecting, panda recycling, collecting waste craftsmen, Aobei environmental protection. By November 2020, 176 smart recycling houses and 417 smart recycling bins have been built in Chengdu. The city's community recycling service coverage rate reached 81%. The coverage rate of residential areas participating in household garbage classification has reached more than 90%.

4.4 Conclusion

Through changes in national and local waste disposal policies, such as the plastic ban, it can be found that the relevant departments are playing a leading role in environmental protection, and the state encourages relevant scientific research units and enterprises to develop and promote the use of disposable environmentally friendly tableware that is lower in cost, more easily degradable, and less polluting to the environment in the production process. At the same time, the state is gradually standardizing access to disposable lunch box manufacturers, prohibiting the production of disposable foam tableware, thus prompting enterprises to research and development, production of the biodegradable type of environmentally friendly tableware.

The local government further starts with waste separation, and the relevant departments strengthen the supervision of waste separation while further planning for waste transfer and recycling, thus reducing environmental pollution.

At present, the plastic waste generated by the food delivery industry has not yet entered the government policy horizon, explains Zongguo Wen[1]. “The waste plastic from food deliveries is actually only a very small part of domestic waste overall,” he says – it accounts for only 4% of all domestic plastic waste. Miao Zhang[2] says this means policy-makers have little choice but to focus on other problems, such as plastic bottles or bags that are easier to handle and are found in larger quantities. A ban on free plastic bags in shops, for example, has been in place since 2008(Chen Wang, 2018).

[1] Director, Recycling Economy Industry Research Center, Tsinghua University
[2] Founder of Rcubic, a social enterprise specialising in waste recycling solutions

5. Policy implementation and effectiveness

5.1 Front end- garbage classification

5.1.1 Current policy measurement and implementation

Garbage classification and treatment is a major development event to promote the construction of ecological civilization. On March 1, 2021, The Regulations of Chengdu Municip

al Household Garbage Management officially came into effect. Now, the implementation of household garbage classification has been nearly one year, and the comprehensive treatment of household garbage has achieved remarkable results.

It is an important measure for Chengdu city to promote the work of household garbage to close the garbage into the wing room and implement "removing the bucket and building the container room". For example, in pidu district, up to now, according to the principle of adapting measures to local conditions, 1,297 domestic garbage sorting and collection points are standardized in 699 resident communities, 1,040 rural domestic garbage sorting and collection points are upgraded, 10 "intelligent household garbage sorting museums" are built, 49 intelligent sorting facilities are set up, and renewable resource outlets are optimized. 65 recycling points for community renewable resources have been set up, and all facilities have been updated in accordance with the standards of household Garbage Classification Marks.

5.1.2 Public response

Citizen's attitude towards takeaway food waste

The survey pargets include three groups of people: college students, white-collar workers, and urban residents. According to the questionnaire, there are around 4 restaurants near the house of those surveyed, but they still prefer to order takeaway food. The main reason they choose to take takeaway food is that a)limit of break time b)unwilling to cook c)facing the bad weather. d)not good at cooking e) not good at cooking(Yixuan Li, 2020). And many people of those surveyed take the discount activities as the priority while they order takeaway food(Fig.02), the average score in this case is 6.66. And when speaking of food waste caused by discount activities of takeaway food restaurants, those surveyed think 52.81% of food was wasted.

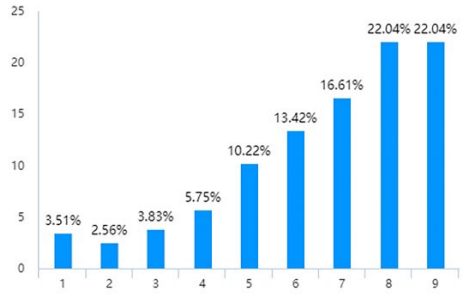

Fig.02 The extent to discount activities as a priority (Based on Questionnaire1-1, Q14)

Citizen's attitude towards environmental protection

Since 96.81% of those surveyed have higher degrees (senior high school degrees and above), they have strong environmental awareness towards takeaway food. Though 95.21% of people clearly know that food waste and packaging waste from takeaway food has a negative effect on the

environment, and they all feel that takeaway garbage has an adverse impact on their daily lives, more than half of them don’t know how to change this situation(Fig.03). Today, take-out platforms offer a "no cutlery option", but when environmentalists choose this option to place an order, they sometimes still receive cutlery(Fig.04), because the restaurant doesn't pay attention to this option for efficiency.

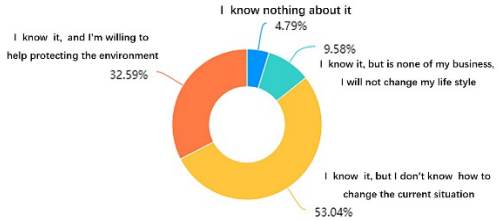

Fig.03 Willingness to protect the environment (Based on Questionnaire1-1, Q10)

Fig.04 The plastic packaging and disposable cutlery that comes with a typical food delivery when choosing "no cutlery option" (Wang Chen, Food delivery apps skewered for creating plastic waste, https://chinadialogue.net/en/business/10846-food-delivery-apps-skewered-for-creating-plastic-waste/)

5.1.3 Limitations and imperfection

Hardship of waste classification

In Chengdu Municipal Domestic Waste Separation Operation Guide (for trial implementation,2020), Chengdu city domestic waste implementation of the four categories, including recyclable waste, hazardous waste, food waste and residual waste. Although the policy encourages residents to recycle valuable items for renewable resources, it lacks more detailed classification criteria.

Takeaway waste can be devided into two parts-plastic packagings and food waste. If the residents can empty the contents and simply wash and dry it, after the manual process, the waste can be separately put into the recyclable waste bin and food waste bin. But in residual waste, it included contaminated paper, plastic bags, food packaging bags, etc., large bones, shells, etc. Since people used to put all the garbage together, the takeaway waste can be easily classified as residual waste, After simple treatment, the waste will be incinerated for power generation or be sanitary landfilled

Difficulties of waste collection

Plastic packaings used for takeaway food are classified as recyclable waste, but in the sorting guide, residents are required not to put items that are contaminated or too wet or stained to be removed into the recyclables container but to empty the contents and simply wash and dry them before putting them into the three-dimensional packaging (such as bottles and cans). Then residents need

to sell the recyclables to recycling sites, recycling operators, or put them into the blue recyclables collection containers or collection points. The main reason people order take-out is based on its convenience(Fig.05), but such a cumbersome and low-margin process leads to a reluctance to engage in environmentally friendly practices related to waste classification(Fig.06).

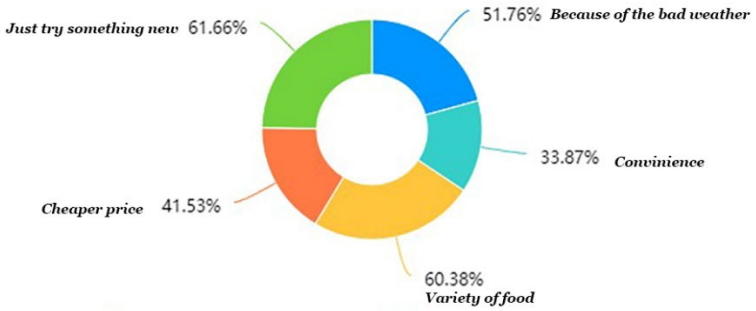

Fig.05 Reason for ordering take-away food (Based on Questionnaire1-1, Q7)

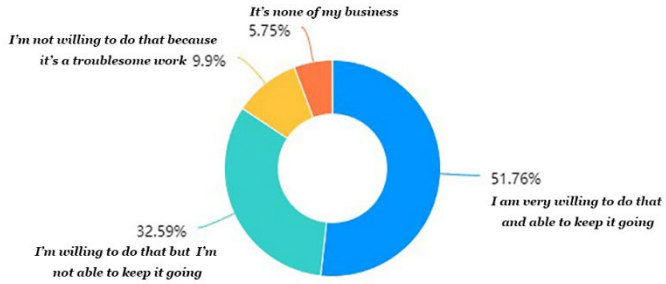

Fig.06 Willingness to clean the take-away cutlery (Based on Questionnaire1-1, Q17)

White waste recycling is difficult, take-out lunch boxes belong to the plastic system of take-out waste, theoretically belong to recyclable items, but because of its thin texture and cheap materials, the recycling value is extremely low, in fact, caught in an embarrassing situation of difficult to recycle. A staff member of the garbage collection station said, "Now the price of recycled plastic lunch boxes is about 0.3 euros per kilogram, the profit is too thin, and the used boxes are not clean, we generally do not recycle."

Although PP plastic lunch boxes can be recycled after cleaning(Fig.07), but some regular recycling enterprises are not willing to do "loss-making". At present, the market recycling disposable lunch boxes are a lot of small scattered mobile vendors. The consequence is that the driving rain grease of food waste may be illegally extracted, and the re-flow of food boxes to the market is not professionally processed, which is very easy to cause health and safety problems.

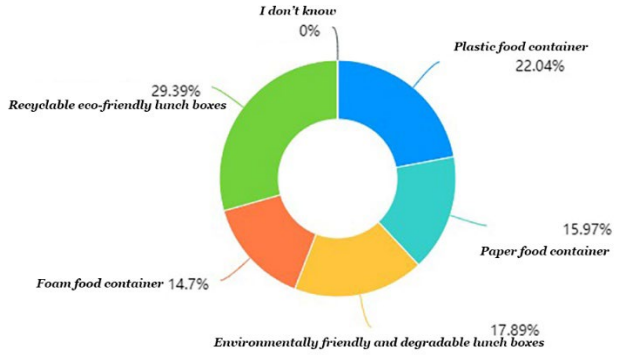

Fig.07 take-away food container categories (Based on Questionnaire1-1, Q10)

Negative effects on waste collection and transportation

According to the regulations, there are four types of garbage are not allowed to enter the compression station, respectively harmful garbage, kitchen garbage, landscaping garbage and furniture and other large garbage. But because garbage classification has not been forced "funny hard", 4 types of garbage will still be mixed in from time to time, more is the kitchen category. The liquid seeped out during the garbage compression process will enter the leachate pool through pipes, and the suction truck will take it away every day for special treatment. Large amounts of oil seeping out of kitchen waste can easily clog pipes in cold weather. "There was a small blockage 3 months ago, and we used a high-pressure water gun to flush it through." If the blockage is severe, high-pressure water trucks are needed to clear it. At present, the compressed garbage transferred from the compressor station is 23-28 cars per day. If the collected waste is strictly classified, besides solving problems such as oil clogging pipes, it will also reduce the workload of equipment, which means that the amount of garbage will be reduced accordingly. "It is estimated that at least three carloads of garbage can be reduced.

Problems affecting takeaway food waste of Chengdu residents

According to the 7th National census of Chengdu, the permanent population of Chengdu is 20,937,757(Chengdu daily, 2021). And Ii Media Research data show that in 2021, 35.2% of Chinese consumers will order takeout 1-5 times per month, 27% will order takeout 6-10 times per month, 14.3% will order takeout 11-20 times per month, and 5% will order takeout more than 20 times per month. Only 18.5% of consumers said they never ordered takeout. Based on the data, on average, Chinese people order takeaway food 6.61 times per month. If the average quantity of takeaway food waste is 275g/cap/order(H. Zhang et al., 2022, p. 7), by calculating, people from Chengdu produce about 1,269 tons of takeaway waste every day, and there are more than 0.46 million tons of waste a year needs to be disposed of.

According to Wen Zongguo's team's calculation of "the environmental impact of one take-out order in Beijing in 2019" - 97 grams of packaging waste in one take-out in Beijing generates 680 grams of carbon emission, based on this data, the carbon emission in the take-out industry in Chengdu will reach the level of 3.22 million tons in 2021. In addition, the destination of these plastic products, generally mixed with all kinds of domestic waste is sent to landfills or incineration sites. Landfills and incineration without professional treatment will undoubtedly bring serious pollution to the soil, water and air near municipal waste disposal sites, causing great pressure on the natural environment. This, however, is only the negative impact of plastic waste in take-out waste, not

including the environmental and social impact of incompletely sorted food waste.

5.2 Middle-end development- Garbage collection and transportation in historic city planning ordinance changes

After the garbage is collected, it is processed by transshipment, compression, etc., and then landfill or incineration. As an important link in the middle, garbage classification, collection, and transportation is very important

5.2.1 Chengdu Large domestic waste incineration power generation facilities (2013-2020).

Principles

In 2013, In order to implement Chengdu's strategic goals of "two industrializations" interaction, coordinating urban and rural areas, and building the core growth pole of the western economy, promote urban and rural environmental protection, further improving the level of garbage disposal, and form a regional sharing mechanism, so that the bureau and scale of garbage incineration and power generation disposal facilities in the city can be coordinated with the overall development of urban and rural areas, Chengdu Municipal Administration Bureau has formulated the special planning of Chengdu Large domestic waste incineration power generation facilities (2013-2020).

This plan plans to promote the city-wide incineration and power generation as the main method of domestic waste disposal (Fig.08), in 2013 to basically achieve the first and second circle of domestic waste all incineration and power generation disposal, more than 50% of the third circle of domestic waste incineration and power generation disposal; in 2017 the city's domestic waste basically achieve all incineration and power generation disposal.

The city's region-wide domestic waste is disposed of mainly by incineration and power generation technology. Sanitary landfills of domestic waste mainly as emergency waste disposal and disposal of fly ash after incineration, and no new landfills are planned in the city during the planning period.

In this plan, the planned new waste incineration plant capacity to match the amount of domestic waste to be disposed of, while taking into account the growth in the amount of domestic waste, the plan is to consider leaving a certain amount of spare capacity within the normal disposal capacity of the equipment.

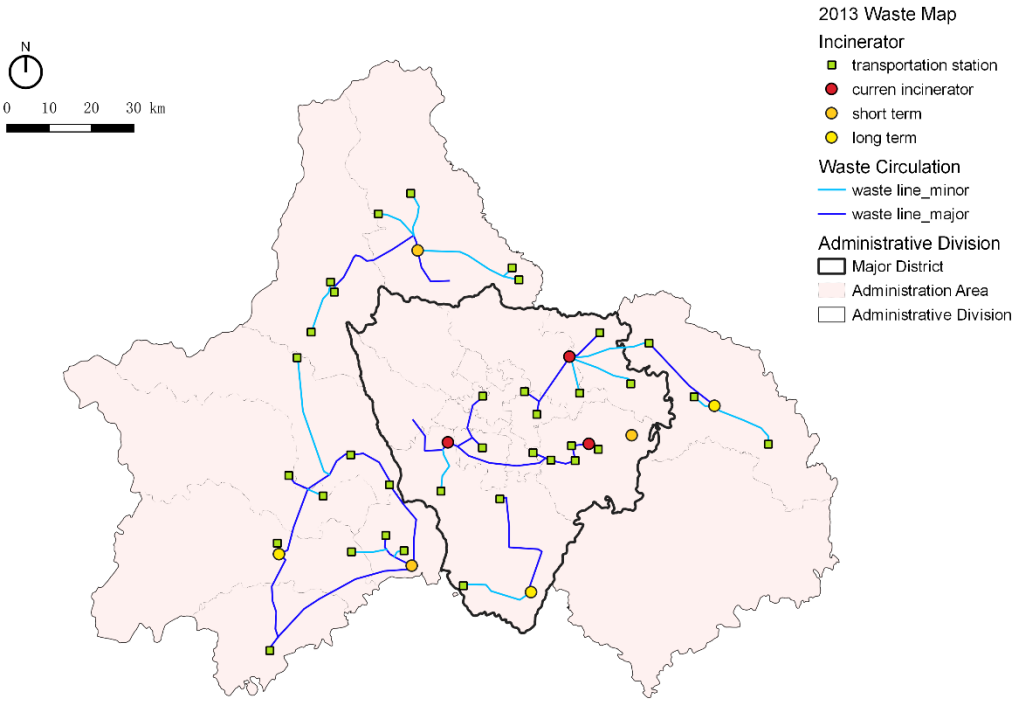

Fig.08 Chengdu 2013 waste disposal plants (Drawing by the author)

Highlights

In terms of waste treatment technology, the goal of solving the waste problem is to reduce the capacity, volume, resource, energy and harmless treatment of waste. At present, the common At present, the main technologies for municipal waste treatment and disposal are incineration, landfill and composting, in addition to RDF technology, anaerobic biomass In addition, RDF technology, anaerobic biomass technology, cement kiln co-processing technology and other treatment technologies have also emerged in foreign countries and applied to the treatment of MSW. In fact, most of these technologies are incineration, landfill and composting. In fact, most of these technologies are the extension, support and development of incineration, landfill and composting technologies. At the same time, due to the difficulties of land acquisition and demolition and the increase of land costs, the long-standing advantage of low investment in landfill technology no longer exists, so no more new landfills also reduce the impact of waste on the environment.

Despite the environmental impact of waste-to-energy incineration from the present perspective, in 2013, incineration power generation disposal methods have obvious advantages in terms of site selection, land use, cost, and pollution control. Due to the high level of resource utilization of incineration power generation, with a power generation capacity of more than 200 kWh per ton of waste, its comprehensive operating costs have become significantly advantageous with the increase in electricity prices.

Garbage transportation, this plan takes into account the special transportation of garbage and fly ash special transportation, garbage incineration power plant into the garbage must use special garbage transport vehicles, in addition to the garbage incineration plant is located in the district, city and county, as well as the closer area, domestic waste should be compressed, by sealed special

transfer vehicle to the plant. Districts, counties and cities should be based on the amount of transfer, transfer distance, etc. in the county, key towns around and near important transport nodes planning to set up garbage compression transfer station. Meanwhile, waste incineration power plant admission waste should be transported by designated routes, domestic waste transportation to avoid the traffic rush hour, there are fixed routes, fixed hours, which also reduces the waste generated in transit leakage.

Limitations

This plan includes the city plan and its scope, and also estimates the production of domestic waste per capita, but the domestic waste referred to in this plan does not include recyclable waste, kitchen waste, hazardous waste, etc., which are collected and disposed of separately. However, in 2013, the separation of food waste was still in accordance with the 1998 Chengdu Municipal Household Garbage Bag Management Measures", which means that the waste does not need to be completely separated, but only bagged.

It was at the beginning of the rapid development of takeaway industry, when a large amount of take-out waste emerged, which led to a large amount of takeaway waste mixed with domestic waste. Whether it was eventually incinerated for power generation or disposed of in landfills, the plastic products contained in this takeaway waste had an irreversible negative impact on the environment

5.2.2 Chengdu food waste disposal facilities special planning(2019-2035)

Principles

In2019, To further promote the Chengdu city kitchen waste "collection - transfer - processing" system construction work, improve the utilization rate of kitchen waste resources and harmless treatment level, Chengdu City Planning Bureau specially prepared this plan. This plan makes full use of the big data platform and the "Internet +" concept to establish an open service platform for kitchen waste. Build a "separate collection - direct transport - centralized treatment" of kitchen waste collection and transfer processing system.,

Highlights

The planning coverage has been expanded. The planning area of this plan is the metropolitan area of Chengdu, including not only the central city, but also the regional central city and the newly established new eastern urban area.

Speaking of kitchen food waste transportation, Each district (city) county city axis, the main landscape avenue is not suitable for food waste transport vehicles. This plan to plan around the city highway, the second roundabout highway, the third roundabout highway, into the irrigation highway, Chengdu-Qingdao highway, Chengdu Jin Expressway, Chengdu-Wenqiong Expressway, Chengdu-Xinpu Expressway, Chengdu-Luo Road, Muhua Road, City Ring Road, Xinqiong Highway, etc. as the main food waste transfer channel(Fig.09). Kitchen waste should be contained in closed, anti-corrosion special containers, closed special collection vehicles for collection and transportation, special collection vehicles should be matched with kitchen waste containers so as to solve the problem of soup and water left behind in transit kitchen waste, reducing the impact on the urban environment.

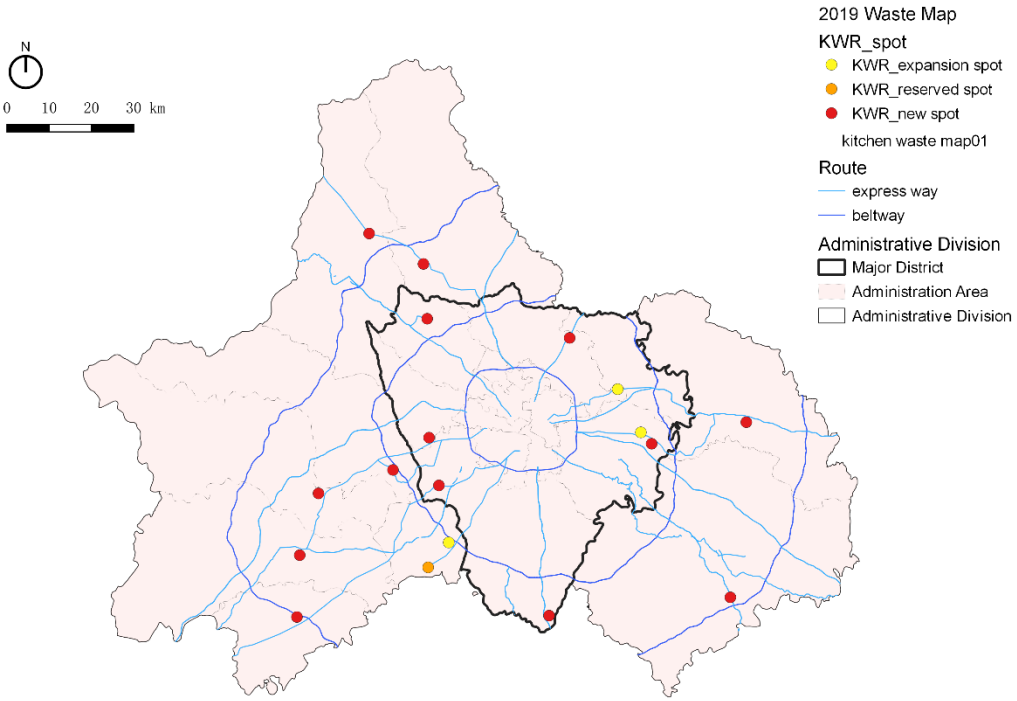

Fig.09 Chengdu 2019 waste disposal plants (Drawing by the author)

In terms of waste treatment, kitchen waste is no longer mixed with domestic waste for waste incineration and landfill treatment, but directly transported from the point of generation to the treatment facility, with the treatment mode of government-led kitchen waste treatment plant for centralized treatment, supplemented by small kitchen waste treatment machines, food waste shredders and other social units for decentralized treatment.

In terms of waste treatment, the high water content of kitchen waste makes the calorific value of kitchen waste less than 5000 kJ/kg required for incineration ("Progress in Household Food Waste Treatment Technology"), which reduces the incinability of kitchen waste, so kitchen waste should not be directly incinerated to avoid adverse environmental impacts and waste of resources; in addition, due to the high water content and high organic matter content, kitchen In addition, due to the high water content and high organic content, the food waste is prone to leakage and corruption, so the food waste is suitable for direct transportation and should not be transported in transit. The high organic matter content makes it suitable for biological treatment to realize resource utilization.

Limitations

As to food waste classification, the food waste in this plan mainly only includes restaurant waste and kitchen waste, but it does not mention the classification and disposal of takeaway waste. It can be seen that the government does not pay enough attention to take-out waste, which also leads to the misclassification of the public in the front section of waste classification. According to policy(Chengdu Municipal Household Garbage Bag Management Measures, 2019),issued the same year. Thoguh the standard of garbage classification has been strengthened and improved, the classification and disposal measurement of takeaway waste has not been clarified.

In the waste collection part, only Shuangliu District, Chengdu City, part of the pilot area through the front-end manual sorting way to collect food waste, and then unified collection, transfer, treatment, the rest of the district (city) county will be mixed into the collection of domestic waste, transfer, treatment(Fig.10). At present, the collection method of kitchen waste in Chengdu is mainly using kitchen waste collection facilities to collect kitchen waste individually and regularly. There are no clear requirements for kitchen waste collection facilities in Chengdu, so there are problems such as non-uniform classification standards and confusing specifications for kitchen waste collection facilities." The kitchen waste in the "5+1" area is mainly collected using the standard collection barrels issued by the Chengdu Urban Management Committee, which are configured with uniform specifications to match the collection and transfer vehicles. The kitchen waste collection facilities in other districts (cities) and counties are different types of collection buckets configured by private operating companies and local functional departments, with confusing and non-uniform specifications, poor overall quality and poor closure. The overall quality deviation, poor closure, and easy to cause adverse impact on the environment.

Fig.10 Food waste collection bins in different areas of Chengdu (Source: Chengdu food waste disposal facilities special planning(2019-2035))

5.2.3 Current garbage transportation measurements

measures of garbage transportation

In order to avoid the problem of "mixing at the front and mixing at the back", Chengdu has unified the marks of transport vehicles, gradually reformed the existing vehicles according to the classification requirements, equipped with renewable resources and harmful waste transport vehicles, and promoted the food and kitchen waste transport system with vehicle-mounted barrels and closed direct transport. At the same time, we will make overall arrangements for the classification and transportation routes, time periods, and operation forms, establish a classification, collection, and transportation system that matches and connects with household garbage classification, and clarify the responsibilities of the government, sanitation enterprises, property management and renewable resource enterprises in the collection and transportation links.

supervision of garbage transportation

Comprehensive law enforcement bureau of Pidu district environmental protection health superintendent Li Geng is introduced(Tianfu Pidu, 2022), the government by installing GPS, using the digital urban management and other modern technological means to living garbage classification of transport vehicles running job information, track real-time monitoring, joint law enforcement, rectification, such as a variety of ways, to strengthen the living garbage flow

regulation, continue to implement 'points before mixing' special projects, Strict law enforcement to investigate and correct the "mixed loading and transportation" and "dropping and leaking" behavior.

Garbage transportation facility

Up to now, the pidu district is configured with 33 recyclable collection vehicles, 23 special transport vehicles for recyclables, 41 kitchen waste collection vehicles, 16 special transport vehicles for kitchen waste, 10 hazardous waste collection vehicles, one special transport vehicle for hazardous waste, 192 other garbage collection vehicles, and 118 special transport vehicles for other garbage. At the same time, these vehicles sign classified collection and transportation contracts, unify signs and identification, formulate the schedule and route map of household garbage classification and transportation, and conduct real-time monitoring of the operation information and driving track of household garbage classification and transportation vehicles through GPS, digital urban management and other methods.

5.3 Back end- Innovative terminal treatment of household garbage

In terms of waste treatment, the high water content of kitchen waste makes the calorific value of kitchen waste less than 5000 kJ/kg required for incineration ("Progress in Household Food Waste Treatment Technology"), which reduces the incinability of kitchen waste, so kitchen waste should not be directly incinerated to avoid adverse environmental impacts and waste of resources; in addition, due to the high water content and high organic matter content, kitchen In addition, due to the high water content and high organic content, the food waste is prone to leakage and corruption, so the food waste is suitable for direct transportation and should not be transported in transit. The high organic matter content makes it suitable for biological treatment to realize resource utilization.

Chengdu has started to put garbage classification intelligent all-in-one machine in residential areas, which can open the door by swiping the card, automatically weighing, and exchanging points, so that residents can skillfully put recyclable garbage into the corresponding garbage cans.

As the community environment becomes better and the relationship between residents becomes more harmonious, the enthusiasm and accuracy of residents are getting higher and higher. At the beginning of the implementation of garbage classification, some residents did not understand that it happened from time to time to throw garbage everywhere. Through the joint efforts and efforts of property management, community grid members, and garbage classification volunteers, people began to accept and participate in it slowly, consciously releasing garbage before the point and consciously classifying garbage, and their living habits had a qualitative leap.

In order to reduce the amount of domestic waste and recycle it, we should not only focus on the end treatment but also pay attention to cultivating people's awareness of waste classification. In order to achieve the reduction of domestic waste and resource utilization, we should pay more attention to cultivating the awareness of garbage classification while focusing on the end treatment. The innovation of domestic garbage terminal treatment, not only reduces the pollution of garbage in the process of treatment but also stimulates the strong interest of the majority of residents in garbage classification. Only by reducing the amount of garbage produced by each community as much as possible can the concept of energy conservation, environmental protection, and green circular development be introduced into thousands of households.

Fig.11 Innovative domestic waste treatment device(Tianfupidu, Citizens from "I have to share" to "I want to share" Pixi are garbage classification on the anniversary of the answer sheet, https://www.cditv.cn/show-1171-1530647-1.html)

For example, in the daoxinmeijiayuan community, a "flower-faced" tubular device stands on the lawn, with the words "earthworm's home" and "Earthworm tower" written on it (Fig. 11). It is an eco-friendly device that takes advantage of the fact that earthworms feed on decaying organic matter. The fallen leaves, vegetable leaves, melon skins, eggshells, and other organic matter are put into the tower, which is decomposed by earthworms, and then organic fertilizer is produced, which can directly supply the surrounding plants as nutrients, thus forming a biological chain.

5.4 Conclusion

In the past year since the implementation of the "Regulations on the Management of Domestic Waste in Chengdu", the situation of waste separation in Chengdu has been good, but there is still room for development. On the one hand, from the policy perspective, the government still does not pay enough attention to garbage, for example, in “Chengdu Large domestic waste incineration power generation facilities (2013-2020)”, the main reason for Chengdu to replace landfill plants with waste incineration plants is that the former brings more benefits, rather than from the perspective of environmental protection. At the same time, the siting of waste treatment plants and waste transportation routes also show that Chengdu transports domestic waste from the main city (“5+1” district) to waste treatment plants in the surrounding counties. Such a measure facilitates the development of the city center, but increases the production of harmful gases during the transportation of waste, and also increases the environmental impact of waste leakage(Fig.12). On the other hand, waste separation is not yet complete, and some waste is still classified as other waste, which is eventually incinerated. Meanwhile, for the treatment of food waste, although biodegradation technology has been introduced and implemented in Chengdu to treat food waste, only a very small amount of waste can be treated at present, and a large amount of take-out waste is still disposed of by incineration. More environmentally friendly food waste sorting and treatment technologies need to continue to be developed and promoted.

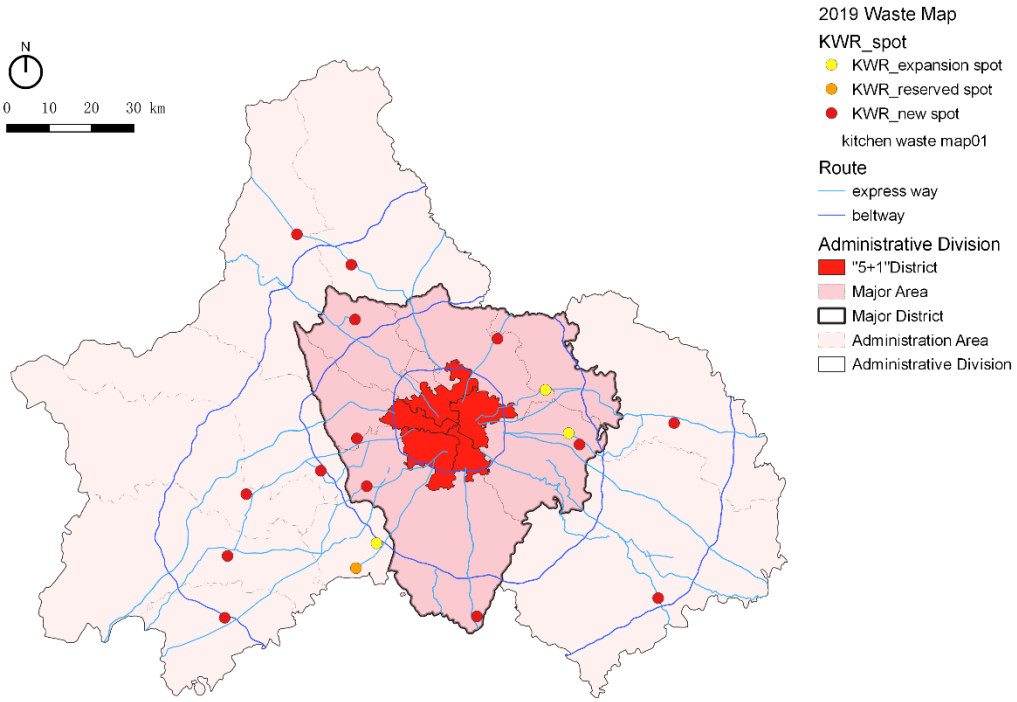

Fig.12 Chengdu 2019 waste transfer route (Drawing by the author)

6. Future vision-development of garbage recycling in post-coronavirus pandemic era

6.1 Development of takeaway industry during the coronavirus pandemic era

According to data from Eguan analysis, by the end of 2020, there were nearly 500 million takeout users in China, with 17.12 billion orders, up 7.5% year on year. Transaction volume rose 14.8 percent year-on-year to 835.2 billion yuan, 175 billion yuan more than the agency's previous forecast of 660 billion yuan. In 2020, online catering will account for more than 20% of the entire catering industry; According to Tianyan data, more than 670,000 takeout-related enterprises were added in China in 2020, up 1487% year on year.

In 2020, due to the impact of the COVID-19 outbreak, China's catering industry attracted a cold winter, and a large number of offline catering stores were forced to close down. China's catering industry also shrank for the first time, with industry revenue falling to 3.95 trillion yuan, a year-on-year decrease of 15.3%. Compared with the overall catering industry, which saw negative growth for the first time due to the impact of the epidemic, the online food delivery industry increased instead of decreasing. From the beginning of the development of the takeout industry, the online takeout industry has shown a trend of rapid growth. From 2011 to 2019, the market size of the online takeout industry increased from 21.68 billion yuan to 577.93 billion yuan, with a compound growth rate of 50.74% in eight years, and the proportion of the overall catering industry increased from 1.1% to 12.4%. In 2020, due to the epidemic, offline catering stores were forced to close down, but the online takeaway industry developed further rapidly, with the market size increasing to 664.62 billion yuan, up 15% year-on-year, accounting for 16.8% of the overall catering industry(FORWARD Business information Co., 2021)

Due to China's strict knock-down policy, the number of takeaways will also continue to increase in the coming years. Such a severe form also triggers us to think about the future of takeaway waste

disposal. This is not only a crisis for the Chinese government and people, but it can also be an opportunity to promote the generation of a take-out waste recycling chain that can be applied to other recycling chains.

6.2 Take-away waste disposal treatment in post-coronavirus pandemic era

Although more and more takeaway waste, but not uncontrollable, from the "who pollutes, who governs" principle, the generation and treatment of takeaway waste, takeaway platform is bound to bear its share of responsibility.

The country must start from the whole life cycle perspective, from the legal and regulatory level to do a good top-level design level to develop and regulate the standards and systems for the disposal of take-away waste. For example, the introduction of relevant treatment regulations, not only to limit the production and use of plastic, but also need to regulate the design and production of various types of packaging, including courier, ordering, while regulating the flow of waste, use and disposal issues, and thus provide a legal basis for the disposal of take-out waste.

At the same time, the government should further clarify the responsibilities of all parties in the process of classification and disposal of takeaway waste. In fact, at present, the policy on the classification and disposal of take-out waste is still missing, and the competent department is not yet clear, which makes it very easy to form a situation where the responsibilities of all relevant parties are unclear. Therefore, the responsibility of consumers, caterers, take-out platforms, government departments, recycling companies and other subjects and the way to fulfill their responsibilities need to be further clarified, for the failure to properly perform their responsibilities and the performance of the responsibility of the situation to be restrained or implement penalties.

Based on the questionnaire survey, it can be found that citizens are more motivated to participate in garbage sorting and related environmental protection, so the concept of collaborative governance can be introduced in garbage disposal. This will reduce the pressure on the municipal side through the participation of the citizens, and will also facilitate the deepening of the concept of environmental protection in people's hearts.

7. Conclusion

The treatment of take-out waste is a comprehensive management project, which involves multiple parties in the process and requires the joint participation of multiple parties to establish a common governance system. Caterers to meet consumer demand, to ensure customer experience, while balancing environmental issues; packaging manufacturers to meet the requirements of food packaging, taking into account the post-recycling issues; take-out platform in balancing the interests of businesses and their own profits, while encouraging businesses and consumers to use environmentally friendly tableware.

Government departments, takeaway platforms and businesses should also guide and educate consumers, so that consumers are aware of the hazards of takeaway waste, reuse and the practical significance of good waste separation. When the whole society has this environmental awareness, the environmental problems faced by the takeaway industry will certainly be improved.

Although the government has increased its efforts to deal with take-out waste, but take-out restaurant waste recycling is still difficult. The reason for this is the absence of the main body of take-out waste management, making the basic environmental principle of "who pollutes, who

governs" can not be implemented and reflected in the process of take-out waste disposal, which ultimately only allows the entire community to bear the cost of environmental protection for the take-out industry.

For the current take-out platforms, when they get a lot of profits in the take-out industry, they forget the fundamental bottom line of environmental protection, they also forgot that the public coffers for this huge take-out refuse should not bear the city sanitation expenses. This should not have been spent on public finance, it is time to pay attention, need to re-examine, need to take measures to share the takeaway platform.

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9. Attachment

Questionnaire 1-1: The impact of takeaway food waste

Part 1: Consumer group

Q1: What is your age? [single choice]

Options	Subtotal	Ratio
Under 18	9	2.88%
18~23	92	29.39%
24~28	30	9.58%
29~33	75	23.96%
34~40	53	16.93%
41~50	38	12.14%
Above 50	16	5.11%
Valid number of the answer	313	

Q2: What is your gender? [single choice]

Options	Subtotal	Ratio
Male	143	45.69%
Female	170	54.31%
Valid number of the answer	313	

Q3: What is your educational background? [single choice]

Options	Subtotal	Ratio
Junior high school education	10	3.19%
Senior high school education	85	27.16%
College education	95	30.35%
Bachelor degree	105	33.55%
Master degree	14	4.47%
Doctor degree	4	1.28%
Valid number of the answer	313	

Part 2: Influence of economic factors

Q4: how much is your monthly salary (or living expenses)? [single choice]

Options	Subtotal	Ratio
less than 140€	25	7.99%
141~210€	76	24.28%
211~285€	7	2.24%
286~430€	10	3.19%
431~714€	82	26.2%
715~1143€	72	23%
More than 1143€	41	13.1%
Valid number of the answer	313	

Part 3: Consumer's behavior

Q5: How much do you spend per meal when ordering takeaway food? [single choice]

Options	Subtotal	Ratio
0.7~1.4€	72	23%
1.5~2.1€	114	36.42%
2.1~2.9€	92	29.39%
Above 3€	35	11.18%
Valid number of the answer	313	

Q6:How many restaurants do you like and frequent around your house?[single choice]

Options	Subtotal	Ratio
1~2	72	23%
3~5	147	46.96%
Above 5	94	30.03%
Valid number of the answer	313	

Q7: Why do you choose takeaway food? [Multiple choice]

Options	Subtotal	Ratio
there was no delicious food in the canteen	162	

		51.76%
Takeaway food is convenient/ canteen is always crowded	106	33.87%
There is a wide selection of meals, takeaways can be served in one order	189	60.38%
Takeaway food is cheap and affordable	130	41.53%
I want to try a new takeaway food	193	61.66%
Valid number of the answer	313	

Q8: Have you ordered takeaway food more often than before the epidemic?

[single choice]

Options	Subtotal	Ratio
Yes	177	56.55%
No	60	19.17%
There's not much difference	44	14.06%
I don’t know	32	10.22%
Valid number of the answer	313	

Part 4: Environmental attitude

Q9: Does the increase of takeaway garbage have an impact on your daily life? In what aspects? [Multiple choice]

Options	Subtotal	Ratio
There's not much Impact	0	0%
Waste occupying too much land: if garbage is left to pile up simply, it will occupy a lot of lands	87	27.8%
Air pollution from garbage: The decomposition of organic matter during transportation and open stacking produces a foul odor	139	44.41%
Garbage pollution water body: the harmful components of garbage easily washed into the groundwater body by rain	105	33.55%

Garbage safety hazards: garbage contains a lot of organic matter	146	46.65%
Garbage transmitted diseases: garbage not only contains pathogenic microorganisms but also provides food, habitat, and breeding place for mice, birds, and mosquitoes	126	40.26%
Garbage impact on the environment: a large amount of plastic waste is produced in takeaway garbage, which is difficult to degrade	177	56.55%
Valid number of the answer	313	

Q10: Do you know that with the expansion of the takeout industry, the overflow of takeout packaging (such as white pollution) has a negative impact on the environment? [single choice]

Options	Subtotal	Ratio
Completely out of touch	15	4.79%
I know a little bit, but it's none of my business. It will not change my lifestyle	30	9.58%
I know something, but I don't know how to change	166	53.04%
I know something, and I'm willing to do some efforts to protect the environment	102	32.59%
Valid number of the answer	313	

Q11: Which food container do you use most for takeaway food? [single choice]

Options	Subtotal	Ratio
Plastic food container 	69	22.04%
Paper food container	50	

		15.97%
Environmentally friendly and degradable lunch boxes 	56	17.89%
Foam food container 	46	14.7%
Recyclable eco-friendly lunch boxes	92	29.39%

		
I don’t know	0	0%
Valid number of the answer	313	

Q12: In order to prevent food leakage, some takeaway businesses will over-pack the food. What is the total number of plastic bags and take-out boxes used by the takeaway food restaurant for each meal you contacted? [single choice]

Options	Subtotal	Ratio
Only 1	39	12.46%
2~4	130	41.53%
5~7	129	41.21%
More than 7	15	4.79%
Valid number of the answer	313	

Q13: Do you know the hygiene status of takeaway packaging and its possible impact on health? [single choice]

Options	Subtotal	Ratio
It has a great influence	169	53.99%
The impact is not big	99	31.63%
It has no negative effects	26	8.31%
I didn’t noticed that	19	6.07%
Valid number of the answer	313	

Part 5: Consumer attitude

Q14: Do you take the discount activities as the priority when buying take-out food? [Scale question]

The average score in this case is 6.66

Options	Subtotal	Ratio
No	0	0%
1	11	3.51%
2	8	2.56%
3	12	3.83%
4	18	5.75%
5	32	10.22%
6	42	13.42%
7	52	16.61%
8	69	22.04%
9	69	22.04%
Yes	0	0%
Valid number of the answer	313	

Question 15. Do discount activities of takeout restaurants cause part of your food waste? What is the proportion of wasted food?

[Slide bar]

The total value of the answer paper: 16529;

The average was 52.81(100)

Part 6: Attitudes towards future takeaway food

Q16: According to industry statistics, At least 400 million disposable packing boxes and 400 million plastic bags are produced in China every week, as well as 400 million pieces of disposable tableware discarded takeaway garbage, so will you feel a little guilty for your "contribution"? [single choice]

Options	Subtotal	Ratio
I feel guilty about that	184	58.79%
I don’t	129	41.21%
I told you I don't eat takeout!!!	0	0%
Valid number of the answer	313	

Q17: If you need to dispose of the uneaten food properly after eating takeout (for example, pour it into the recycling bucket in

the canteen), and then put the lunchboxes and plastic packaging in the fixed point for recycling, would you like to do that? [single choice]

Options	Subtotal	Ratio
I am very willing and able to keep going	162	51.76%
I'd love to but I might not be able to	102	32.59%
I'm too lazy to do it. It's a hassle	31	9.9%
It's none of my business siness	18	5.75%
Valid number of the answer	313	

Q18: if there is a company that is willing to produce more degradable takeout boxes and plastic packaging and sell them to merchants at a very affordable price, do you think that company should be encouraged and given some financial support? [Multiple choice]

Options	Subtotal	Ratio
No financial support	17	5.43%
Supported by government	124	39.62%
Supported by major takeaway food platforms	150	47.92%
Investment by other enterprises	22	7.03%
Valid number of the answer	313	

Q19 If the problem of “garbage siege” must be solved, who do you think should be responsible for the recycling and disposal of takeout food boxes, or who should pay for the huge cost of plastic waste disposal?

[Multiple choice]

Options	Subtotal	Ratio
Consumer	190	60.7%
Takeaway food restaurant	228	72.84%
Major takeaway food app platforms	202	64.54%
Through government funding	167	53.35%
Valid number of the answer	313	

Q20: If there is a professional organization or machine to recycle takeaway waste, but you need to pay an extra recycling cleaning fee, what price per meal is your acceptable range? [single choice]

Options	Subtotal	Ratio
0-0.1€	50	15.97%
0.11-0.2€	85	27.16%
0.21-0.3€	93	29.71%
0.31-0.5€	64	20.45%
0.51-1€	21	6.71%
Valid number of the answer	313	

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