Sustainability Innovation

Rotten Rubbish Done Right: An Effort To Recycle Kitchen Waste At The Community Level

Yuxuan Duan, Lead Learner

Jiarui Wang, Lead Learner

Kaihong Tang, Lead Learner

Xin He, Lead Learner

Siqi Xiong, Lead Learner

Summary

Our project is an attempt to find solutions to a common but often over-looked problem in our life: kitchen waste, which refers to the garbage that people produce during the consumption of food, such as leftovers, kernels, peels, rotten fruit, rotten meat, etc. Unlike the solid and dry recyclables, like paper, cartons, plastics, steel, etc., kitchen waste is recyclable to a large extent, but they're often mixed together with non-recyclable garbage and thrown away to the trash can before being sent to incineration, which not only increase the danger of pollution, but also is a waste of resources and energy. Kitchen waste is rich in organic matters, perfect ingredients to create useful resources such as fertilizers, and the waste oil could also be extracted to make biodiesel. Techniques used to recycle kitchen waste include aerobic digestion, which is often used in composting, and anaerobic digestion, which would produce methane to generate power. They each have their advantages and downsides, and our project aims to explore them and find an optimum solution to deal with kitchen waste at the community-level. That is to say, we want to the residents' everyday household kitchen waste to be handled properly.

To that end, we conducted a series of field research at various spots, looked up information online from reliable sources, and brainstormed several times to generate ideas for our project. The more we dug deeper into this topic, the more we realized that there probably would never be a perfect solution, given that the environment is never an isolated issue but a complex problem intersected with many factors. We must take into account the society, policy, people's behavior and psychology, economics, etc. and try to find a balanced way that works to the benefit of the environment and the people living in it.

We also realized that our project is by no means the perfect solution. Instead, there are many aspects waiting to be iterated, to which we also made a plan. Nevertheless, despite the imperfect present, the future improvement starts now.

Choose the Topic

Identify the Challenges

1.1 Producers of kitchen waste: residents in the community
Residents' lack of knowledge and awareness of sorting domestic waste is the main reason why kitchen waste is handled poorly.

The wet waste is usually flushed into the sewage system, and the dry waste is usually dumped together in one or two plastic garbage bags and are carried out once or twice a day to the garbage cans in the neighborhood, which would then be picked up by the garbage trucks and sent to the destination: the incineration plant, which would do harm to the environment. Prior to the picking up, poor handling of kitchen waste in the residential areas could lead to other environmental and health problems, such as unpleasant smell, mosquitos, midges, toxic chemicals, bacteria and germs.

1.2 government/municipal services

Our team did some research online and discovered that in November 2019, the government in Hefei decided to build a large complex to dispose kitchen waste in the city and had an open bid. However, although the result of the bid was revealed in January 2020, the project was called off in August 2020 without a public explanation.

Hefei is among the 46 cities in China to implement the waste sorting policy, and since 2017, the city has created several methods to better dispose and recycle waste, including kitchen waste. Some of the kitchen waste is collected by a truck and then sent to disposal or recycling centers where they would be decontaminated and recycled into useful materials such as compost. Some is composted near the neighborhood using government-funded kitchen waste disposal machines.

During our visit to Hefei Special Biological Technology Co., Ltd in July 2021, the head engineer, Mr. Li, told us that currently there isn't a centralized public or government-funded kitchen waste disposal or recycling center in Hefei that deals with kitchen waste collected from all communities. When we asked him about the source of kitchen waste that they deal with, Mr. Li said that most of them are collected from restaurants and kitchens at various organizations, public or private. As to the kitchen waste produced by residents at their living communities, Mr. Li didn't offer us any precise data, but based on his experiences in this industry, he said that it is very likely that they end up being lumped together with other solid

wastes and sent to incineration plant. Incineration of kitchen waste leads to problems: extra energy consumption, generation and release of toxic pollutants to the environment, which creates more problems to the public and the government.

1.3 Waste disposal/recycling plants

For the waste disposal or recycling centers, such as the plant where Mr. Li works, they’ re on the receiving end of supposedly sorted kitchen waste. However, according to Mr. Li, at the beginning of their business, they often received poorly sorted kitchen waste with bizarre things mixed into the mush, such cutting board or trash cans, which brought them extra burden at work. Another challenge lies in the composition of the waste and could be attributed to the eating habits and living standards of Chinese people: high moisture content, high lipid content, high organic content and high salinity. Lastly, although the organic fertilizer is an environmental-friendly option, it isn’ t an economically appealing product and thus isn’ t popular in the market. Mr. Li told us that their plant is not making a lot of profit, and they’ re surviving because the government subsidizes environmental-friendly businesses. How to thrive in the market is still a challenge for the local kitchen waste disposal and recycling plants.

1.4 In the Context

The Ministry of Housing and Urban-Rural Development has included 46 pilot cities to promote the trash-sorting policy, among which Shanghai and Beijing are the two pioneers in introducing compulsory waste-sorting, which certainly contributes to more effective disposing and recycling of kitchen waste. According to the website of the State Council, by the end of 2020, the capacity of the 46 cities to handle kitchen waste has increased from 34700 tonnes in 2019 to 62800 tonnes. As much progress as that is, there is still plenty of room to improve. According to Liu Lifeng, an official with the ministry, the sorting system is still not mature or systematic enough. Each city should hold responsible for its own waste-sorting problems. Citizens and residents still need to be better educated in the knowledge related to waste-sorting. More facilities need to be built, and policies and regulations should also be enacted to support the endeavor.

News related to policy on waste sorting

Identify a Root Cause

The root cause for the kitchen waste problem is waste of food and inadequate sorting at the community level.

2.1 Waste of Food

According to a recent article (dated July 15, 2021) in Nature magazine, around 350 million tonnes (about 27%) of annual farm product is either thrown away or disposed of, among which 45 millions tonnes is produced by out-of-home eating. A lot of factors contribute to the problem, such as waste and loss in each stage of the supply chain, people' s attitudes towards the consumption and waste of food, external forces that might interrupt the food production and transportation, such as COVID-19 pandemic and weather disaster. At community-level, reducing the waste of food in each household, restaurant, and canteen, whether it is to improve storage conditions or promote responsible rational purchasing and consumption (such as China' s Clean Plate Campaign), would undoubtedly ease the burden of handling kitchen waste. In May 2021, China passed a law to prevent food waste through banning binge-eating videos, competitive eating, and excessive leftovers. The last one would be implemented through allowing restaurants to charge extra fees from consumers who leaves excessive amount of unconsumed food, and fining vendors who allure consumers to buy excessive amount of food and restaurants that waste large amount of food. A stricter law would deter some people or organizations from wasting food, but it would also increase administrative costs and the public' s dissatisfaction with the government interfering their personal choices. It is therefore better to combine legal measures with other methods, such as education and advocacy through volunteers, educators, community workers, business leaders, etc.

2.2. Inadequate Sorting at the Community-level and Lack of Effective Support System for Kitchen Waste

Waste sorting, or trash sorting, has existed in China since the turn of the century. According to the website of the Ministry of Housing and Urban-Rural Development, in its open work plan in 2003, the Ministry said that cities should "expedite the work of household waste sorting." In the years following, waste sorting has been a part of the Ministry' s annual work and has been promoted to provinces, regions, and cities. And it is indeed a stressed cause being pushed forward: new and functional waste collection facilities have built and installed in towns and cities;

volunteers, community workers, and schools have adopted various forms to educate people about sorting garbage; even in rural areas of some more developed provinces, waste sorting has been put on the agenda and successfully implemented in some places. However, it was not until 2019 did Shanghai, as the first city, to introduce compulsory sorting of domestic waste. Writing trash sorting into law is certainly a game changer. In November 2019, 90% of the city’ s residential communities met the city’ s trash-sorting standards – the most recent target set by Shanghai municipal government is 95%. In 2018, the number was 15%. In the meantime, the number of recyclables has also risen 4.6 times, compared with the figure in 2018. Besides the administrative and legal force, volunteers and NGO workers have played a significant role in assisting residents to familiarize themselves with the trash-sorting standards and more importantly, to make waste-sorting a part of their daily life that they don’ t have to struggle with.

Following Shanghai, Beijing is the second city to introduce compulsory trash-sorting. The Ministry of Housing and Urban-Rural Development wants to spread the experiences of Shanghai to the rest of the country because proper sorting at the producers’ end is crucial to guarantee effective handling of the waste.

However, in terms of the disposal or recycling kitchen waste, Shanghai isn’ t exactly the perfect role model for other cities to follow. Although Shanghai has been a pioneer in sorting the domestic trash, according to the “report card” issued by Shanghai municipal government in July 2019, the amount of kitchen waste turned into useful resources, such as compost, was unknown. The report card only covers the daily capacity of incinerating dry and wet waste (24,350 tonnes), but based on other figures in the report, it is safe to conclude that almost half of the wet waste/food waste is not properly handled, meaning how it’ s handled (incinerated or used to compost, etc.) is not recorded in the report. Lack of facilities to properly handle the kitchen waste, whether through composting or anaerobic digestion, contributes to the majority of the kitchen waste being incinerated.

Generate Solutions

3.1 Existing solutions

Kitchen waste is not a new problem to the environment. However, it had long been clustered and handled together with other types of waste. It wasn’ t until the last five years that China began to take this issue seriously and make concrete actions to deal with it, such as the regulation of compulsory sorting and building more waste sorting and collection facilities.

The current solutions to dispose of kitchen waste in Hefei’ s communities are as follows. First, garbage trucks pick up the kitchen waste from the garbage sorting centers and deliver them to a disposal and recycling plant where the waste is usually converted into compost. However, according to our interview with the expert at Special Biological Technology Company, currently, most of the kitchen waste collected by garbage trucks is not from residential communities; rather, a majority of them are from restaurants and dining halls at various organizations, such as schools and companies. The reason is that the regulation of sorting and delivering kitchen waste in these organizations is much stricter. Also, they have stronger and comprehensive support systems, such as a sufficient budget and people to deal with the sorting problems, and stable and solid connections with the parties involved: the garbage delivery company, the waste disposal, and recycling centers, and the government. In contrast, there are fewer restrictions on waste sorting for people living in communities. At least in Hefei, it’ s still an environmental-friendly idea being promoted step by step, inch by inch. Waste sorting facilities are being installed in communities, but not all of them are utilized by residents, some of whom may protest the installation of such facility because they think that it might cause problems, such as overwhelming smells because all nearby residents would throw their garbage in the facility. Even if residents in the community sort their kitchen waste at the facility, they’ re still likely to be thrown together with other household garbage and sent to the incineration plants because the current garbage disposal system excludes the food waste in the residential communities from the kitchen waste category.

Besides the picking-up-by-garbage-truck-and-being-sent-to-recycling-center mode, another solution is installing kitchen waste disposal equipment in the neighborhood where residents could bring the kitchen waste and turn them into compost by themselves. One residential community (Nanqi Residential District) in Hefei installed such equipment in 2019, but it has been the only case since then. Individual

disposal units are widely used in commercial buildings such as office buildings or shopping malls. During our visit to the office building of Anhui China Mobile, the head chef of the staff canteen introduced us to the kitchen waste disposal equipment located on the basement floor next to the parking lot. It is a relatively compact machine, much smaller than the complicated system that we had seen at Special Biological Technology, fitting perfectly in a small room under the building. When asked about who pays for such equipment, as they are usually expensive, the head chef replied that the owner of the building is required for installing it.

3.2 Our Solutions

Our solutions are basically improvements based on the current methods to handle kitchen waste in Hefei, and the logic should be: better waste sorting system and flexible choices to handle the sorted kitchen waste, which include: first, sending the sorted kitchen waste to disposal factories for aerobic composting, or anaerobic digestion, a method that would turn the kitchen waste into methane gas, and second, recycling within the residential community by installing and running a compact kitchen waste disposal machine.

Before deciding on which method to propose, we sent out online questionnaires covering a wide range of questions related to waste sorting in general and kitchen waste in particular. We got 201 pieces of feedbacks. The willingness to waste sorting is high, but the knowledge of how to sort them is clearly limited. What's especially worth noticing is that the majority of the respondents (87.6%) prefer professionals to handle the disposal of kitchen waste rather than composting by themselves, partly explaining why the aforementioned installing composting equipment in the residential district wasn't followed by other communities. For most urban residents in China who live in apartment buildings where gardening is nearly a luxury, the need to compost is naturally low. However, 70.2% of the respondents also showed their willingness to compost by themselves, under the circumstances of user-friendly and convenient tools and methods.

As we dug deeper into the research, we realized that there isn’ t one solution to the kitchen waste problems in the residential communities. Instead, there should be several flexible ways.

First and foremost, sorting kitchen waste properly at the producers’ end. It is good news that Hefei government is speeding up the process of installing waste sorting equipment in residential communities. The next step should be persuading residents to properly use these facilities. It would only take them a few minutes to walk through the facility and understand that it is scientifically designed, thus wouldn’ t cause the alleged bad odor problem, and the system would eventually work to their benefit. Also, the regulations and laws are catching up. Since August 7,

2021, any individual or entity who does not sort the waste properly could end up being fined from 200RMB to 50,000RMB. Stricter waste sorting regulations would greatly alleviate the problem of poorly sorted kitchen waste at the beginning.

The sorted kitchen waste could either be picked up by the garbage truck and sent to kitchen waste disposal plants such as Special Biological Technology Company, where they would be properly handled and converted into organic fertilizers, or plants that use anaerobic digestion to handle the kitchen waste, which would turn it into methane that could be used to generate power. In one community (Hefei National Hi-Tech Industry Development Zone) where one of our team members lives, the latter is the current option. Our team members went to visit one of the waste sorting facilities installed in a residential community one morning and witnessed a garbage truck coming to pick up the sorted kitchen waste. The driver told us that the sorted kitchen waste would be sent to a disposal center using the anaerobic digestion to turn the garbage into methane. Our research on the Hi-Tech Zone Administrative Committee's website also shows that the government stipulates that one truck only delivers one type of garbage, and it specifically points out the sorting and collection of the household kitchen waste. along with the kitchen waste from sources other than restaurants, the staff canteens of companies, hospitals, school, etc., and other types of non-recyclable but harmless waste, should be the responsibility of the Urban Management and Law Enforcement Bureau, and that the kitchen waste must be picked up by a specialized truck and sent directly to the terminal: the kitchen waste disposal factory. The policy explains the appearance of the truck that we saw the other morning: a large cylinder-shaped container on which printed "Kitchen Waste." However, it is still unclear where exactly the kitchen waste is sent to and how they are handled by whom. According to the truck driver, the gathered kitchen waste is sent to a waste disposal center in Shushan District, which is adjacent to Hi-Tech Zone. Also, we looked up online and found a piece of news posted on 27 August 2021 that recently the building of two disposal centers in Hefei have been completed and are in trial operation. It might be safe to conclude that the kitchen waste gathered in Hi-Tech Zone is sent to one of the two newly built disposal centers, possibly the one in Shushan District.

However, as the case in Shanghai has demonstrated, anaerobic digestion provides an alternative method for handling kitchen waste, but the facilities that use this technique still can’ t handle the entire city’ s kitchen waste, not to mention that methane gas might leak. Therefore, combining the two methods might be the optimum choice: namely, some of the kitchen waste should be sent to compost using aerobic digestion, and some should be handled through anaerobic digestion.

A less popular approach is to dispose and recycle the kitchen on-site in the residential communities. As previously indicated, the price of the equipment could be expensive, and people might not be interested in going through the trouble to

make fertilizers that they might not use. Therefore, to motivate residents to be a part of the composting action, there should be incentives. The government could offer to buy organic fertilizers from the residents and use them in public-funded projects such as gardens and parks. Also, the equipment to compost the kitchen waste should be funded by the government or businesses who want credit for environmental protection. Besides money, another critical factor to make composting in communities sustainable is to include more people in the process. Volunteers, government staff, environmental experts, business leaders, educators, and so on, their expertise and enthusiasm should be brought into play in making the system work.

In the residential communities where the waste sorting system is well-developed, the government could purchase kitchen waste disposal equipment from manufacturers at a relatively lower price than its market value because the government offers tax incentives to such businesses. Then, local communities could organize volunteers to teach residents about the benefits of recycling kitchen waste and help them to better distinguish kitchen waste from other types of household waste. In the meantime, the manufacturer or the government should also put people in charge of the equipment, namely, to guard and operate the machine, and take charge of converting the kitchen waste into useful materials, such as fertilizers or soil conditioners. The final products could be sold in the market and given to residents for free. Having incentives would motivate residents to be more actively involved in sorting the kitchen waste in their houses. In the long run, recycling the kitchen waste in the residential community would save the government some cost of collecting the kitchen waste from each residential community and transferring them to the disposal centers, which would also increase carbon emission to the environment.

Field Research Pictures 1
Field Research Pictures 2
Survey on Kitchen Waste
News of the two newly built kitchen disposal center in Hefei
Government's Policy Paper

Identify the Criteria

4.1 Feasibility
Can the proposed ideas be carried out in the real-world settings, such as in the community where the members of the team live?

4.2 Scalability
Can the proposed solutions be expanded or reduced in response to changes in application and other demands?

4.4 Cost and Effect
Will the proposed solutions be costly and will the cost bring substantial effects, such as change of people’ s lifestyles, waste reduction, and improvement of the environment?

4.3 Carbon Footprint
Will the proposed ideas reduce or increase carbon emission?

4.5 Durability
Can the proposed solutions last for a long time before an updated version appears and replace it?

Evaluate the Solutions

After carefully evaluating the two aforementioned solutions using the five criteria, we've reached a conclusion that the second solution might be a better option (see "rating sheet").

The deficiency of the first solution mainly lies in its inability to scale, or to flexibly adjust itself to the situation. Currently, there are only one kitchen waste disposal plant in Hefei that uses the aerobiotic digestion to compost the kitchen waste, and based on our field research, it mainly deals with kitchen waste from restaurants and canteens, which are more systematically collected and in large quantity. In contrast, kitchen waste from residential communities is more scattered, and it would be costly to collect them and send them all the way to the plant. We must consider the cost of truck drivers, oil, the maintenance of the trucks, etc, not to mention the pollution that driving trucks brings to the environment. It would also be highly possible that the collected kitchen waste from the residential community is mixed with other non-recyclable garbage, causing extra burden for workers in the disposal plant to handle the waste and reducing the efficiency. Building such disposal plants is expensive, and more importantly, because of its capacity of operation and its special technique, the risk of causing pollution or hassles with the residents living nearby would also be high. We've found residents' complaints about Special Technology's odor on Hefei government's website. Given that the plant is built in the suburban, far away from downtown, it's not hard to imagine what the situation would be like if more of this plant is built in the city.

The second solution is better not only because it costs less – it’ s less expensive to purchase a compact kitchen waste disposal equipment – but also because it involves more citizens to be a part of the kitchen waste recycling campaign by showing them how the recycling would be done and the benefits for the environment, society and for themselves. The first solution has the risk of slipping into a formulaic procedure, while the second one requires innovative and active participation. Protecting the environment is not simply the work of the government, or any business entity. It requires civil engagement and cooperation, an entrepreneurial mindset, and a scientific attitude and methodology. Therefore, although the second solution might seem “inconvenient”, it might change people’ s perception and behavior of handling kitchen waste, bringing a deeper and lasting impact on the environment.

News of one city in Zhejiang that uses kitchen waste disposal facilities in the community

rating sheet

Make an Action Plan

Our action plan is based on the field research, the literature that we have read, and the analysis of the status quo. We decide to form a non-profit organization called Green at Home Solutions, dedicated to help residents in the community to compost their kitchen waste, as an alternative method to anaerobic digestion or incineration. Our actions will be as follows:

1. Improve kitchen waste sorting

In general, we would assist the residents to better sort out the kitchen waste, and below are the specifics that we could work on.

Since the government is focusing on waste sorting in general, and there hasn't been many campaigns specific to kitchen waste, its sorting and recycling, we would try to improve that situation by starting campaigns to better inform the residents about the importance of separating kitchen waste from other types of non-recyclable waste and what we could do with kitchen waste to protect the environment. Our initiatives would be a supplement to the government's work (usually the work of the administrative committee in a specific community). We would resort to more creative forms such as making short videos about "the life of kitchen waste", cartoons of the damage of poorly sorted kitchen waste to the environment, handbooks or pamphlets on composting in the neighborhood and its benefits, business opportunities of certain kinds of food waste, and going door-to-door to demonstrate how to better sort kitchen waste, etc. During our field search, we contacted one of the administrative committees in Hefei Hi-Tech Zone and helped them organize a contest of waste sorting knowledge for children living in the neighborhood. The event was successful, and the staff at the administrative committee made it clear that they wanted more help from volunteers or non-profit organizations. The administrative committees have the resources at the residential communities that we could employ to carry out our campaign.

2. Collection of kitchen waste

Our staff would stop by the waste sorting facilities in the residential neighborhood, collect the kitchen waste, sort out the garbage that doesn't belong to kitchen waste, and carry the rest to the designated area where the composting is done. We could also go door-to-door to collect the kitchen waste from the residents, which, in theory, would be welcome, because it would save the residents the trouble to carry

the kitchen waste to the waste sorting facility, which could be located far from their apartment buildings.

3. Coordination between manufacturers of compact composting machines, government, property management, and residents

We would also act as the coordinator for the endeavor, negotiating and communicating between various parties. According to the two solutions that we proposed earlier to compost the kitchen waste at the community-level, we have mapped out the following steps to carry out our plans.

First, we would lobby the local administrative committee (the government) to outsource the task to us. We would propose a detailed plan showing that we have an efficient and cost-effective solution to the existing problems.

Once the government agrees to use our services, we would contact the company that makes the compact disposal equipment that could be installed in the residential community. We' ve looked up online and found the company that the aforementioned community in Hefei has been using. They provide several models, including a biochemical treatment equipment that could turn kitchen waste into organic fertilizer and waste oil, the raw material for biodiesel. A single machine could handle up to ten 10 tons of kitchen waste. It is difficult to estimate the average amount of kitchen waste that one person produces every day, and we couldn' t find any official data, but based on the capacity of the two newly built kitchen waste disposal plants (600 tons and 800 tons per day), it is safe to say that one biochemical treatment equipment could handle the daily kitchen waste from at least one large neighborhood. The government would purchase the machine from the company had they approved its quality and price.

The next step would be the daily operation of the equipment. We would have two staff to sort out and collect the kitchen waste and carry them to the equipment, where we would have one staff guarding and operating the machine. The staff would also be responsible for packing the converted fertilizer and the waste oil.

Our organization is also responsible for the allocation of the fertilizers. Most of them would be sold in the market, and the profit would cover our costs of daily operation. A few would be given to residents in the neighborhood for free, especially those who garden. This way, residents would have a more direct and clear vision of the little changes or inconveniences that they could do in their daily life to turn the waste into wealth. As for the waste oil, Green at Home would also be responsible for selling it to oil companies and the profit should also be used to cover the organization' s operational costs.

The essence of our project is to work with various parties, involve them in the process, and find the optimal solutions to better sort and recycle the kitchen waste. As a non-profit organization, we expect our work to be compensated by the government’ s support and the money that we make from selling the organic fertilizers and waste oil. However, the income should only cover the operational costs, such as the salary and benefit for the staff who collect and handle the garbage. We would also keep researching and developing newer and more efficient ideas, expanding our mode to other communities.

Website of the biochemical treatment equipment

Prototype and Test

Prototype Design

Our prototype is not a product, but a service. Therefore, we demonstrate the idea or the service in the form of a flow chart.

prototype-flowchart

Feedbacks learnt from users

Based on the design of our prototype, we created a survey containing questions that would elicit opinions and attitudes of potential users of our service. In these questions, we tried to cover each step of the project that might involve residents' participation, so that we would have a general idea of how the users of our service might perceive it and what we could do to improve. We surveyed 133 people, and below are the conclusions of the feedbacks.

When asked about whether they are willing to participate in activities about composting kitchen waste, 111 people (83.46%) showed their willingness. 97 people said that they would separate the kitchen waste from the non-recyclable garbage in their houses even if the work might be a hassle, and 36 people wouldn't want to go through the trouble to better sort out the kitchen waste. However, when asked about whether they would like a designated worker to collect the kitchen waste in their houses, 128 people said yes.

In terms of installing a kitchen waste composting equipment in the neighborhood, 120 people approved the idea, under the condition that we provide: a designated worker and odorless. Lastly, only 74 people would use the organic fertilizer produced by the machine in their own gardens, partly because not everyone could afford to tend a garden, even if it's a small corner in the balcony. 23 people said that they would give the fertilizers away. What's a little surprising is that 36 people would rather throw the free fertilizers away. Such a negative attitude towards the "product" of composting is worth thinking about.

Feedbacks learnt from users

Improvement for next iteration

1. We should learn more from successful examples of composting in the community, such as the case in Tongxiang, Zhengjiang, and useful experiences in western countries, particularly in the United States where composting is more widely adopted. There are a lot of literature, mainly in English, on composting in the backyard of one's house, the whats, hows and whys. The website of EPA, United States Environmental Protection Agency, has a whole page dedicated to this topic. On the contrary, we couldn't find such information on the Chinese counterpart of EPA, the Ministry of Ecology and Environment. Anyone interested in this topic would have to look for scraps of information on websites like Baidu or Zhihu and often end up with questionable and subjective answers. To better inform people about this topic, we should build a website with comprehensive, authoritative, reliable, and reader-friendly learning resources on composting the kitchen waste. We would also resort to social media to spread our agenda. For instance, we should set up a WeChat Public Account, which users of WeChat could subscribe and receive fun and informative articles and news on protecting the environment of one's neighborhood.

2. Another improvement, based on the feedbacks of the survey, is that we need to find more efficient ways to use the organic fertilizers. Giving them to residents for free may sound like a good idea that no one would resist. However, the survey shows that some people don't know what to do with the fertilizers, and would rather throw them away. Since they're free, throwing them away wouldn't be a loss, but it would be a failure to our endeavor. Therefore, to avoid wasting the resources, we could either sell the fertilizers at a low price to residents, or sell them to the government, who would use the fertilizers on municipal projects, such as parks and gardens. For residents who don't know what to do with the fertilizers, we can hold workshops on topics such as "gardening in your own balcony". Better informed, some residents would develop the interest to use the fertilizers, thus more willing to compost.

3. As a non-profit organization, if we want to expand and make more impact, we must attract more funds to cover the costs and develop more projects. Besides selling the compost in the market and receiving money from the government, we should create new products or services that generate income while serving the public good. For instance, we could work with tech companies to improve the efficiency of kitchen waste sorting and shipment, reducing the pollution as much as possible by designing a biodegradable container to hold the kitchen waste. We can also do some research on how to eliminate the odor of kitchen waste during shipment, especially in the summer. Resorting to technology is definitely what we plan to go for in the next phase.

Website of EPA

Team Credits

Kaihong Tang is the team leader and responsible for making the surveys and the posters, planning and coordinating the field research, and writing "Identify the Challenges";
Yuxuan Duan is responsible for translating the survey into English, organizing the knowledge quiz on waste sorting, and writing "Identify a Root Cause";
Siqi Xiong is responsible for looking for information online about government policies, and writing "Identify the Criteria";
Jiarui Wang is responsible for taking pictures and videos for the field research and compiling them to a single file, and writing "Evaluate the Solutions";
Xin He is responsible for looking for literature and articles on waste sorting in China and cowriting "Evaluate the Solutions".

The team worked together on "Summary", "Generate Solutions", "Make an Action Plan", "Prototype and Test".

Onsite Conference File

Judge Comments

" Thank you for tackling a very complex problem – we as a society have not yet figured out how to effectively make waste more attractive. Waste management is an incredibly complex problem – I suggest the team better explore consumption and use habits in the household to get a better sense of why the waste management problem has persisted the way it has for decades – there are many social factors that need further exploration (convenience, not enough value to be gained from the waste, stigma etc.) (In the most efficient places in U.S., recycling rates are in the early 20 percents, and in Europe it is marginally higher.) Unfortunately, oftentimes the best available solution for most cities would be incineration/landfills – all other solutions tend to be prohibitively expensive to implement.
The team is also on the right track with solutioning by building in incentives and approaches like this – "The government could offer to buy organic fertilizers from the residents and use them in public-funded projects such as gardens and parks."
While I appreciate the commentary on how increased interest in the environment in itself is a value add and a good reason to support flexible solutions, it is worth exploring if the investment being made in the infrastructure is justified in the returns being created (the operational cost of going door to door to get enough usable waste is immense). A good way to start is by identifying what characteristics a pilot community where an effort like that is most likely to be successful through various parameters (also, a clear definition of what success means would be helpful).

P.S. The comment that generation of toxic wastes from burning organic waste might not be accurate – I suggest the team look into the specific of that further.
"