

## Sustainability Innovation

### Discussion On Participation Mechanism Of Community Kitchen Waste Composting

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### Summary

Our project of composting mechanism in community contains 5 parts, from identifying challenges to prototype & test, with clear theoretical logic and serious actions. First of all, for the challenges, we discussed about 5 aspects: environment, technique, cognition, economy and sustainability. Then, we analyzed the 4 root causes in depth: high money cost, low public participation, the purchase of the government for fee, and lack of education about the topic of composting. After that, we created 5 solutions in several different aspects. We considered to deal with the problem by 1)reducing composting area to decrease cost, 2)using new technique(biotechnology) to improve efficiency, 3)removing smell through deodorization measures, 4) classifying pre- and post-kitchen waste and 5)establishing community processing station to facilitate transport. All of them are explained carefully and logically.

In the next stop, we made a evaluating standard and after evaluating all of the solutions, we chose to classify pre- and post- wastes, combined with using a new composting machine.

Then we began to make an action plan, including seeking help of the gov., calling on people to classify and composting with a new machine.

Finally we made a survey and get some feedback. We'll improve our action later.

### Identify the Challenges

#### ENVIRONMENT

The environment is one of the most important factors and challenges for kitchen waste composting. On one side, analysis from the composition of kitchen waste, salt and oil in kitchen waste affected the quality of compost. To some extent, the quality of compost is affected by factors such as oil content and salt content in kitchen waste. High salinity compost products will inhibit the growth of plants, and will cause soil salinization if used for a long time. On the other side, kitchen waste composting also has requirements for the environment since traditional composting methods occupy too much space.

#### TECHNIQUE

The traditional urban garbage transportation mode is not conducive to the classification of kitchen waste. At present, the garbage classification and kitchen waste recycling and treatment executed by the community are all promoted by the cooperation between the community and enterprises. In the process of garbage classification and operation, although the community classifies the garbage, the garbage transportation link is not matched, and the garbage is mixed together after loading, which affects the classification enthusiasm of the owners. Furthermore, after the classification of garbage, storage process may produce some odor and breed bacteria, which may also exert a negative impact. These all require technological advances.When composting, do not put the material firm, to keep loose and breathable. The success rate of self-made bacteria is not high. Some kitchen waste cannot be composted.

#### COGNITION

Since many people in China don't have or lack of the concept of dealing with the kitchen wastes, the residents may not want to work in with us to do our task that tries to modify their garbage disposal system. First, they don't understand the importance of and what they'd benefit from garbage disposal, so they may think it's a waste of time. Besides, it is hard to make people trust us to do what we want them to do, especially for older people. The resistance of unwilling inhabitants may be one of the difficulties for us to start.

#### ECONOMY

The economic cost is one of the main contributors to the problem of kitchen waste. It is mostly because of the higher cost paid and longer time taken that stop people from doing this. There are demands for the relative equipment, which is quite costly, to process those wastes. Most importantly, developing new technology and arousing social awareness would require tons of human resources, money and time. On the other hand, Landfill tipping fees will create a competitive and tough market for advancing food scrap composting and limit the position as a leader in materials diversion from landfills.

#### SUSTAINABILITY

Sustainability is one of the most crucial factors contributing to the difficulty of the implementing kitchen waste in a long term. As in a short term, different kinds of measures like refund could be used as an incentive for people in the community to continue using the equipment to compose those kitchen waste, people would rather choose to give up in a long term since it's much more easier for them to disperse those kitchen waste into a random garbage bin than to gather them to a certain place daily; thus hardly can people realize the importance of composing kitchen waste and maintain the habit for months, or even years without a proper scheme to enact.

### Identify a Root Cause

There are four main obstacles for the success of composting kitchen waste. 1)Firstly, the high cost hinders the project of composting of kitchen waste---the high cost for garbage classification, the large scale area and reactors needed to compost the kitchen waste, and the potential cost for the technology used to clear the pollutants and stench, etc. All of these lead to the limitation of the development of composting kitchen waste since the high cost makes it less competitive in the market. 2) Besides, public participation is of great importance for the success of the widespread utilization of composting kitchen waste. However, problems like undergoing the stench of the fertilized kitchen waste and abandoning the traditional way of land-filling which costs a lower fee could be hard solve. 3 ) Moreover, the government has banned the purchase of the kitchen waste from the restaurant, which is a major supplier of kitchen waste, for those companies without a permit in some cities. And a garbage disposing fee is needed to pay for the restaurants. Thus a conversion from earning money to paying a fee has made most restaurants choose to discard the kitchen waste directly. 4 ) At last, a large number of people still haven't realized the significance of composting kitchen waste without a further recognition and education on this topic.

### Generate Solutions


(1)Since a large part of the area needs to be occupied in the composting process, the composting cost will increase. We can decrease the fee of composing by reducing the area needed for kitchen waste composting. For example, we can improve the tools needed for composting so that more compost can fit into each piece of land, we can also improve composting technology to make composting more efficient and land use more efficient.

(2)If the techniques during composting process can be improved then the efficiency can be enhanced to a large extent. Using biotechnology is one of a possible solution as well. For instance, some microorganism that can break down garbage efficiently can be added into the garbage by the composting personnel. Putting some saprobiotic organisms, such as earthworms into the garbage may also enhance the composting efficiency.

(3)Since the collection of kitchen garbage can create quite a lot awful smelling, deodorization is also seemingly an appropriate solution. Some deodorant can be added by the composting personnel during the composting process. Therefore, the resistance among residents can be greatly reduced.

(4)Refining kitchen waste into pre- and post-meal waste is a way to increase the efficiency of composting. Then, pre- and post-meal waste should be composted separately. Pre-meal waste can be disposed of directly in the community. Because the amount of oil and salt contained in the pre-meal waste is very small, it will not have much effect on the composting. It is convenient to handle, and it can be directly crushed by machine, and then added to the compost. The formed compost can be used for greening of the community, and residents can also collect it. And post-meal waste should be sent to a large kitchen waste disposal site. Because the spices in the post-meal waste are rich in oil and salt, they are more complicated to handle, so they need to be concentrated and processed with more sophisticated machines. Chemical substances that can dissolve oil and fat can be added before composting to reduce the burden of composting and ensure good composting effect. Also, we may use a kind of machine in the garbage-disposal sites. In order to achieve the separation of oil and post-meal waste, we envision such a machine (there is a picture template below). The machine is inspired by ways to deal with leaking oil from the sea. Its key components are three, two-layer filters and an oil skimming machine. First, the post-meal waste is poured into a large barrel, and there is a blender above the barrel that allows the post-meal waste in the barrel to rotate and move constantly, thus ensuring that the mixture of water and oil in the garbage can be fully filtered out by the first layer of filter (the first layer of the filter is a common filter that filters out water and oil liquids). The mixture of water and oil then enters the skimming machine along the pipe. In the skimming machine, the mixture of water and oil flows slowly through the oil collector, and the oil floats on the surface because of its smaller density than water. At this time, the oil collection belt has a certain material can be in the water oil particles affinity adhesion treatment, so that the oil in the oily water adsorption on the surface of these materials, the formation of oil film. When the oil film gradually thickens, under the hydraulic push conditions, it will become a larger particle size of the oil particles, and immediately float to the liquid surface. Afterwards, the infusion pump will suck the oil slick away for recycling. And the rest of the water will flow down another pipe to the second filter. The filter was developed by scientists Moura and others, a hydrophobic porous material made of CH4 as a reaction gas, which has a high adsorption effect on all types of oils. We want to make the final filtration of the water through this filter, which ensures that the oil in the water is completely removed. After passing through this layer of filter, the water will also be recycled. So finally, water and oil can be separated from the post-meal garbage and recycled, and then the post-meal garbage without grease, compost will be much more convenient than before, the loss is much smaller, can carry out the basic composting treatment. Besides, in order to change people's inherent views on kitchen waste composting, and in order to appeal to more people to classify kitchen waste, in the neighborhood, we should seek help from the Shenzhen Municipal Government or local streets to carry out measures to promote the waste of Shenzhen kitchen waste. In addition, we should find local schools for collaboration. At the same time, in order to avoid secondary pollution caused by kitchen waste for a long time, it is inconvenient for residents' lives. It is also possible to limit the opening time of the provision of kitchen waste in the community. For example, the opening hours are set from 11:00 am to 2:00 pm, and from 7:00 to 10:00 pm. After two o'clock and ten o'clock, workers will go to the community to collect garbage from the kitchen for treatment. This not only avoids the excessive residence time of kitchen waste in the community, but also reduces the possibility of secondary pollution.

(5)Kitchen waste contains extremely high quantity of water and organic matter, which is easy to rot. What' s more, kitchen waste the easiest to be secondary pollution and secondary pollution of garbage. We can reduce the transport process of kitchen waste by establishing this community source processing functional space. The kitchen waste within the community can be transported to the treatment station from a distance, which can achieve small-scale transportation and daily cleaning, avoid secondary pollution in the transport process, and truly make "source emission reduction" come true. Reducing the amount of garbage collected and transported can reduce the traffic congestion caused by garbage delivery vehicles. At the same time, it also reduces the pollution and corrosion of kitchen waste to the vehicle collection container, and avoids the phenomenon of sewage dripping and leaking in the process of transportation.

 [prototype](#)

### Identify the Criteria

1. Does the scheme solve our problem?
2. Is the scheme feasible (both in technique and economy)?
3. Is the scheme justified by the policy of Shenzhen government so that we can get support from it?
4. Is the scheme reasonable enough to ensure residents to accept the requirements of it?
5. Do we use new techniques to find out the most effective and efficient approach for each step?

### Evaluate the Solutions

 [Evaluation](#)

### Make an Action Plan

Firstly we will seek help from the Shenzhen municipal government or local streets committee to carry out activities like fun fair for children and poster creation programs to boost awareness of such ideology and establish a reward mechanism to reward citizens who are actively involved in composting activities included buy not limited to small amounts of subsidies and coupons for local supermarkets. We will collaborate with both primary schools and high schools. For primary schools, we can ask pupils to draw hand-made posters for relevant topics and send out pamphlet with simple specific cartoons discussing about kitchen waste. For high schools, it is beneficial to invite different people like students who are involved in kitchen waste programs and teachers who are interested in this topic to deliver speeches. It is also possible to film and play videos for them to boost awareness of the new generation.

Secondly, refining kitchen waste into pre- and post-meal waste is our way to increase the efficiency of composting. Pre- and post-meal waste will be composted separately. Pre-meal waste can be disposed of directly in the community. In the community, there will be two buckets set by us with the words "pre-meal waste" and "post-meal waste" hanging on them. After residents sort out the pre-meal waste and post-meal waste by themselves, they will put them into two recycling bins. It should be noted that residents tend to use plastic bags to hold the food waste, and plastic bags will pollute the environment during the composting process. Therefore, a small bucket will be set aside to collect the plastic bags or plastic boxes left by residents after they empty the big bucket. To prevent the kitchen waste from stinking, the bins are shipped at least every other day to the community's small compost stations and nearby large waste treatment plants, where they are cleaned for later replacement. Two empty buckets are placed in the previous place. Buckets used for collecting plastic are regularly emptied and the plastic is taken to a nearby recycling facility.

In addition, we concern about the supervision and the efficiency to collect the waste. In the beginning, we will encourage the volunteers to teach communities to use the buckets. It also works as a watchdog. Day by day, communities will understand the steps to collect wastes. The formed compost can be used for greening of the community, and residents can also collect it. And post-meal waste should be sent to a large kitchen waste disposal site. At the same time, in order to avoid secondary pollution caused by kitchen waste for a long time, it is inconvenient for residents' lives. We will also limit the opening time of the provision of kitchen waste in the community. For example, the opening hours are set from 11:00 am to 2:00 pm, and from 7:00 to 10:00 pm. After two o'clock and ten o'clock, workers will go to the community to collect garbage from the kitchen for treatment. This not only avoids the excessive residence time of kitchen waste in the community, but also reduces the possibility of secondary pollution.

Also, in the treatment station we will use a kind of machine mentioned before, which is in order to achieve the separation of oil and post-meal waste, we envision such a machine (there is a picture template below). First, the post-meal waste is poured into a large barrel, and there is a blender above the barrel that allows the post-meal waste in the barrel to rotate and move constantly, thus ensuring that the mixture of water and oil in the garbage can be fully filtered out by the first layer of filter (the first layer of the filter is a common filter that filters out water and oil liquids). The mixture of water and oil then enters the skimming machine along the pipe. In the skimming machine, the mixture of water and oil flows slowly through the oil collector, and the oil floats on the surface because of its smaller density than water. At this time, the oil collection belt has a certain material can be in the water oil particles affinity adhesion treatment, so that the oil in the oily water adsorption on the surface of these materials, the formation of oil film. When the oil film gradually thickens, under the hydraulic push conditions, it will become a larger particle size of the oil particles, and immediately float to the liquid surface. Afterwards, the infusion pump will suck the oil slick away for recycling. And the rest of the water will flow down another pipe to the second filter. The filter was developed by scientists Moura and others, a hydrophobic porous material made of CH4 as a reaction gas, which has a high adsorption effect on all types of oils. We want to make the final filtration of the water through this filter, which ensures that the oil in the water is completely removed. After passing through this layer of filter, the water will also be recycled.

So finally, water and oil can be separated from the post-meal garbage and recycled, and then the post-meal garbage without grease, compost will be much more convenient than before, the loss is much smaller, can carry out the basic composting treatment.

### Prototype and Test


#### Prototype Design

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#### Feedbacks learnt from users

People respond well to community composting. In our survey, 79.78% of people thought that composting would have a positive impact. 80.15% of people are willing to pay money and other costs for this activity. And a whopping 92.88 percent said proper publicity would make people more willing to compost. Some people suggest that we had better have to the family as the unit of compost method, so found locally, fast and efficient, but also to intensify efforts to promote, can give children more popularize this knowledge, equipped with corresponding facilities and personnel management, timely away, avoid surface, some enterprises do to cope with checks. Some citizens also think that fixed areas can be arranged to avoid affecting the normal life of citizens. They can also provide more accurately differentiated garbage cans. The most important thing is to clean them in time.

Attached below are our questionnaire and results.

 [survey](#)

#### Improvement for next iteration

According to the feedback of residents, we're going to improve our plan in the following 3 aspects: recognition, management and versatility.

First, there are still something to improve though we've spent much of our time and energy on propaganda. Since still a lot of people doubt the benefits of composting, we should increase sites and frequency to propagate. Also, it may be useful to do the propaganda job in school and let the kids to teach their parents. Fostering the consciousness since one's childhood is important. Besides, we're gonna buy and distribute needed tools for residents to do what we require them to. If it's possible, we'll ask professional staff to come and teach residents about composting. That need us to get the government's support first.

In addition, it is really significant to develop the management. For example, we should make sure that the wastes get transported out of the community on time, or the smell will be terrible. What's more, we're going to modify and set clearly positioned (also not so complex) garbage classification system bins in the residential areas, to make a bin a functional facility but not just an object sitting on the ground. The most important thing is to improve the supervision system. There should be one in each community who checks whether and how our plan is working, or everything is meaningless.

Last but not the least, we can use the compost in various ways, such as making it fodder or fertilizer. Only with profit, the system can run for a long time. So it's really important for us to find a commercial usage of our compost.

### Team Credits

#### YANG FAN

Put forward a technical difficulty, find the corresponding root cause, propose a corresponding preliminary solution, and sort out the solutions and upload them. Discuss the action plan with Li YINUO. Make a questionnaire about the feasibility of kitchen waste compost, sort out feedback from users and integrate upload. Do PPT on user feedback. Yang Fan has performed well in this competition. Yang Fan is basically able to communicate and communicate with the team members in a timely manner, and since Yang Fan believes that Yang Fan's contribution is second only to Li YINUO, it is better if Yang Fan can complete the task in a timely manner.

#### ZHANG YIXIAO

Our group discussed together and decided the Project. Zhang Yixiao participates in the whole designing work--following the orders and opinions of our team leader. Also, Zhang Yixiao made the final PPT. Zhang Yixiao has a not bad performance in this competition. Yixiao is a good message receiver and performer to complete her share of the work. Zhang Yixiao thinks if the group finds a kind of communication, which helps improve our work efficiency and also helps to get along with colleagues, it will be better.

#### FANG LIN

Self-assessment: In this study, Fang Lin took on the task of thinking about challenges and summarizing, and often helped relieve some of the burden of teammates. But there is a lack of action.

Evaluation of teammates: Li YINUO and Zhang Liyu are the most active and efficient people in general. They spend the most time on it and are the most serious people. In addition, the action of Yang fan is very efficient. The rest of the people are not high enthusiasm, hope to improve.

#### ZHANG LIYU

In the early stage, she was responsible for organizing group members (setting up WeChat group) and mobilizing part of the enthusiasm of preliminary ideas.

In the later stage, she began discussing with other group members about their views and purposes. She also put forward some of her preliminary ideas in the process of concrete implementation, for example, a machine can be used to facilitate, and optimize the process of collecting kitchen waste.

As for realizing and describing the troubles this group may meet, she did some research about composing of several countries around the world and took charge in the technology part.

She was also responsible for the action description of the garbage collection part. After the action parts of each team member were completely written, she put them together to make them as smooth as possible.

Finally, she took charge of the remote control PPT in the link of defense presentation.

#### LI YINUO

The leader of the team. Responsible for assigning tasks to team members, mobilizing the enthusiasm of team members, following up on the progress of the task in real time, paying attention to each part and progress, and also responsible for coordinating the relationship between team members, avoiding disagreements between team members.

Also, as a member of the group. In this research project, at the time of the first proposal, LI YINUO was mainly responsible for collecting relevant reference materials online and providing the most core solutions among the eight possible solutions. And conceived the action. At the time of the second proposal, LI YINUO was mainly responsible for modifying and merging the solutions to finalize the solution. At the time of final submission, LI YINUO added a new grease separation machine designed by herself to the solution, and revised and reviewed the final draft of the solution.

In summary, LI YINUO played an important role in this project and played a role that cannot be ignored. As the leader, it can be said that the most conscientious and most dedicated of all the members of the team, the most worried, the most painstaking efforts, LI YINUO has done her best as much as possible, played the role of qualified leader. Of course, LI YINUO still has many shortcomings. Although she has benefited a lot from this competition, his ability needs to be improved through long-term study and more experience.

#### CAO YU

In this whole project, Cao Yu is mainly responsible for the propaganda part of the action, providing solutions to several problems, and the final improvement. Cao Yu felt that she had done her part in this process and tried her best to improve it. However, Cao Yu feels that she is still not perfect. If she has such an activity next time, she will think more positively, propose a plan, and enhance teamwork.

#### LI ZHUORAN

Li ZHUORAN developed evaluation criteria and evaluate the solutions. Discussing with other members and searching for information online, Li ZHUORAN sought for the best way to evaluate solutions effectively. As a result, she did her best and chose the most suitable solution for our challenges. However, Li ZHUORAN was not carefully enough, and caused some troubles for the team.

Li YINUO is a responsible team leader. She gave us missions and managed us reasonably. Also, she' s kind to everyone. Zhang Yixiao, Zhang Zhuomei and Zhang Liyu are smart people, which means they can always perfectly finish their work, so we' re relieved about their work. Yang Fan and Fang Lin are hard-working members. They did a lot. All the members are very good partners.

### Judge Comments

" General comment: This research looks at a very important topic and reflects on how to reintegrate organic waste streams through technological innovation and citizen involvement. It takes a very interdisciplinary approach.

Report: The report does a comprehensive analysis of the challenges, and root causes for kitchen waste composting are identified. A prototype machine is developed to solve the conflict of the scarcity of urban space and decentralized composting in the city. The evaluation criteria are concise and show that the problem should be assessed then does its feasibility in practice. The evaluation as such however is very short and not further explained. The plan of action is creative and comprehensive. The feedback against does not relate to how to put such a machine into use but on composting in general. Also related improvements hence are rather generic.

Presentation: The slides are very well structured, however, unfortunately, they were not used during the presentation. The first part of the ppts clearly show the challenges, based on your own research, and how your research links to these challenges becomes very clear. You spent a lot of thought on how to implement composting in an urban area, from the consideration of technical aspects to residents' attitudes. "

" Thank you for an excellent analysis of this challenging problem. The team approached the issue in a multi-dimensional manner -- looking at government' s role, the need to educate the citizenry as well as the role of technology. Better references and secondary research would make the report stronger (Some interesting questions that could strengthen your report include -- where else has community level composting been done? What were their successes and failures? What interesting schemes are likely to succeed in the long run? How do you increase participation and the quality of participation?

Overall, great job tackling a complex challenge!

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