Sustainability Innovation

How To Design An Effective Food Wastes Composting Participation System In The Community

Yutong Li, Guangdong Country Garden School

Yihao Zhang, Guangdong Country Garden School

Xinfei Huang, Guangdong Country Garden School

Manxi Wu, Guangdong Country Garden School

Xinyuan Ji, Guangdong Country Garden School

Haoran Yu, Guangdong Country Garden School

Yuanchen Li, Guangdong Country Garden School

Zitian Chen, Guangdong Country Garden School

Summary

Nowadays, people are making numerous household waste in daily life. Also, the restaurants are doing. Part of the waste is not efficiently utilizing. They are treated the same as other 'can not be reused' waste in burning or burial ways.
Most waste from households and restaurants can be easily degraded like pericarp, leftovers, and bones. All of this kitchen garbage is raw materials of types of composition.
However, this type of waste can be avoided: our team is solving the problem by planing a project that will collect the waste for an effective composting process system in the community. In our early team works, we have designed three composition processes that can be used as solutions to this situation. Unfortunately, none of them is possible for reality implementation. From our positions, three main difficulties hamper the progress we show in the part of the Root cause. Firstly, people lack awareness of composting. Nearly four-fifths person of our questionnaire answerers has not known the phrase of composition process before.
Secondly, the cost of classification waste products in community and typical scale restaurants is an extra burden of time and finance that the residents and restaurants owner would not satisfy with the process.
Moreover, the government has banned the purchase of waste from kitchens restaurants, which are significant suppliers of kitchen waste for companies that do not have licenses in some cities. The financial expenditure will stress the process's onset.
Nonetheless, we find another efficient way to connect the scores from the SWOT analysis method to the unique triangular composition progress, which is in the circulation between households, the whole community, and restaurants. The SWOT score in the Criteria part is in the evaluate solution. The score is much higher than the first three solutions we suggested.
In the previous conclusion, we have made a thoughtful list of conditions and field tests for the practicability of community composting:
In our process, we found that a community is a social unit (a group of living things) with standard norms, religion, values, customs, or identity. The community's drive needs to be considered first by complete an effective composting system. In our planning, we will establish the initial part through household Bokashi compost and other short-term composting. None of them form a noxious or smelly odor in the process of fertilizer composition. After collecting the semi-finished product from the household, the product will proceed the secondary fermentation in community gardens and eventually use for plantation. The proclamation of vegetable landscape architecture will provide fruits or vegetables to external management restaurant or

their ones, form green food and raw material supply chain, gain profit, benefit from selling the raw materials, and origin ingredients elements will promote the restaurant competition in the market.

Our community composting project is now mainly in the experimental stage, collecting the necessary data to support it with sufficient justification.
There are three components within the closed loop of our community composting program: the home, the community, and the restaurant. The family needs to undertake the material collection and preliminary composting in the early stage of community composting to prepare for the subsequent community composting. The community needs to provide enough land and orderly management to ensure the completion of the follow-up process of composting. Furthermore, to reclaim the land for vegetable planting, the planting results will be sold to the restaurant at a lower price than the market price. The restaurant is responsible for promoting the organic restaurant with healthy and green ingredients to attract customers' attention, promote consumption, and hand over the remaining kitchen waste to the community for the next round of composting.
In our experiment (which is Processing), we do the initial composting in the community, focus on the secondary fermentation in the campus, and contact the restaurant as our vegetable sales channel and source of compost materials. In addition, we are carrying out proportioning experiments on our compost and analyzing the composition of our compost according to national standards to ensure that the compost is suitable for the growth and development of plants and ensure that the plants are healthy and green.

By using such measures and methods, not only can it enhance the community staff composting drive, but the community can also benefit from it. Furthermore, effectively promote community composting. In the future, the community that proceeds the composting chain may form an industrial chain, developed into a park for schools or social organizations to visit the publicity community composting.

Choose the Topic

Identify the Challenges

Preface:
1. We identify the challenges from the aspects of participants' psycho, techniques, and economic cost.
2. The reason for our identification method is to focus on people's needs, as they are the smallest unit of participants of our project.

1. Mental
1.1 Unwillingness of restaurants
Collecting kitchen waste in residential areas means giving up the original treatment for some restaurants. Some restaurants already have perfect kitchen waste treatment methods, and can directly obtain economic benefits from them, like selling them to farms. Also, they may be reluctant to exchange kitchen waste for vegetables as they already have stable vegetable suppliers.

1.2 Interest Gap
Most residents who are willing to participate in community composting would likely gain benefits from it. It will be unfair for residents to compost the kitchen waste from restaurants and then return the harvested fruits or vegetables to restaurants or spend money in the restaurants. As residents may believe that they should get more benefit from the composting as they make more efforts.

2. Technical
2.1 Collection and preservation of waste
Food with oil, seasoning, or food like meat, dairy which contain high fatty and protein cannot be collected in community composting or it is easy to produce unpleasant smell gas and attracting pests or mice during composting. In this case, participant restaurants must classify the kitchen waste carefully. However, because of the large amount of food in restaurants, the sorting of food waste will be greatly troublesome for them, and it is easy to make mistakes. In addition, when the orders of restaurants are large, the kitchen waste will not be easily stored, especially in summer, when the temperature is hot. If there is no regular collection mechanism, it will easily make a mess.

2.2 Composting
Among various composting methods, some composting methods need to strictly control the ratio of carbon to nitrogen, air, sunlight, and water. Especially, an

anaerobic composting method like bokashi will produce a large amount of burnable gas like methane, carbon dioxide, and hydrogen, which could be a danger for the community. Also, if the selected composting method can not accommodate a large amount of kitchen waste from the restaurants, waste will be accumulated and bring pests and mice. Consequently, they could bring viruses and disease. Residents' health will be affected.

2.3 Planting

The soil produced after composting will be used for planting organic fruits and vegetables, which requires very skilled methods, including selecting plants and planting time, sowing season, etc. At the same time, it is hard to prevent insects and rats without chemical pesticides during planting, so that mature biologic defensive measure is required. According to an article from the University of Missouri Extension by Sanjun Gu, organic disease management is a key for planting organic food. Agents like fungi, bacteria, viruses or mycoplasms, or a stressful environment could affect plants seriously and appear as leaf spots, wilts, stunts, rusts, or lesions.

3. Economical

3.1 Land Resources

Planting land is difficult to choose. Community composting and planting will take up large space and it should not take up other people's land. The site should also be close to both restaurants and communities. On the other hand, obtaining consent from community managers may not be successful.

3.2 Labor Resources

It takes a lot of manpower to collect kitchen waste and give back food. It is difficult to find people who are often available, willing to participate and have planting experience.

Identify a Root Cause

We recognize several root causes that make composting action ineffective in the communities.

The first is that people lack awareness of composting, from the information we collected from 400 (till now) questionnaires, 81.1% of people have no or little knowledge about composting. We think that this situation might be caused by a lack of propaganda since compost isn’ t a popular activity after all. We are planning to make posters and spread information about composting in our community, and may cooperate with restaurants to inform people about the advantages of composting.

In addition, massive public participation is important. The most important thing of the success is widespread the benefit of composting of kitchen waste to the public effectively. However, experiencing the stench of fertilizer kitchen waste and abandoning traditional landfills, which cost less, can make this process difficult.

Moreover, the way to gather the waste is also difficult: the government has banned the purchase of waste from kitchens restaurants, which are major suppliers of kitchen waste for companies that do not have licenses in some cities. And you have to pay the restaurant for garbage disposal. This means that the shift from making money to paying has led most restaurants to throw away their kitchen waste.

Generate Solutions

Intro:
Our goal is to form a close loop. The first step in the loop is that we will get kitchen dumps from local restaurants; the second step is that we will use those kitchen dumps to do composition; the third step is that we will use the result fertilizers / fertile soil to plant eatable vegetables; the final step is that those vegetables will be sent back to the local restaurants.

1. Get kitchen dumps (food wastes)
1.1 The dumps we need are "uncooked" dumps. Because oils in cooked dumps will cause the composition to fail. We also don't want bones, meat (and fish), dairy, butter. The ideal materials for composition are fruits and vegetables (any part), eggshells, wood, papers, rice and grains, nutshell. Those ideal materials are common to find in many restaurants. However, we realize that different restaurants have different styles of cooking, and we made a "required list" that, we believe, is universal to almost every restaurant. They are eggshells, fruits and vegetables (any part), and paper.
1.2 There are many restaurants around our school, so it's not hard to find restaurants that we can cooperate with. As I know, there are at least

2. Do composition
2.1 Method of composition:
Find a bucket that is large enough;
Put some soil into the buck, the soil particles have to be as fine as possible, and absent of small stones. The soil cannot be too much, or too much soil and too little organic matter cannot improve the quality of the soil;
Put materials from the "require list" into the bucket;
Stir the soil and the materials, till they are fine-mixed;
Put a thin layer of soil on the top of the mixture, and cover with the lid.
2.2 We will use our school as the experimental field at first. Our school has an area of 330 thousand m3. With an untraversed, large field in the middle of the school (figure1 in the uploaded file). That is an ideal place of composition, where we believe that the odor of composition won't have any effect on people.

3. Planting vegetables
3.1 The field in our school mentioned above is also a place where we can plant vegetables. The place circled by red is the place that we can use as planting (figure3 in the uploaded file).

3.2 We want to plant some quick-growing plants, such as garlic, shallot, or coriander.

4. Sent vegetables back to restaurants
4.1 The ripen vegetables will be sent back to the restaurants that give us kitchen dumps.
4.2 We will make posters that propagandize that the restaurants are using vegetables that from the organic planting approach. (figure2 in the uploaded file)
4.3 We believe that the advertisement about organic food will attract more people to come to the restaurants (in fact, 70.6% of people who done our questionnaires said that they prefer to go to restaurants that use organic food), this action can attract more restaurants to join in our project as well. So far, we create a close loop of composition in the community.

Generate solution:
After identifying the challenges, we designed a solution for them. Our solution is a process involving multiple groups, which forms a closed loop to ensure its effectiveness.
First of all, we go to each vegetable market in the community. Because there are many foods in the vegetable market that cannot be sold in time on the same day, we will buy these foods that will rot at a low price. At the same time, we will also contact some small restaurants and try to establish cooperative relations with some restaurants, because restaurants will obtain uncooked or residual food waste more effectively than we collect fertilizer at home.
After successfully collecting some wastes, we intend to transport them to the school, but considering the limited planting space in the school and the smell generated by composting, we decided to compost in the suburb of Taiping Town, Conghua. After successful composting, we can get organic fertilizer, which will be used for vegetable planting. The food waste from the restaurant will be returned to the restaurant again in the form of vegetables.
When restaurants get vegetation, they can use "organic" food as a selling point to attract more customers. At the same time, it may also attract more restaurants to join and expand our activities.

appended document

Identify the Criteria

The project: Recyclable and SWOT model calculation

1 Recyclable(30)
1.1 Do the project actually relate to a specific restaurant and get raw material of composing from it ?
1.2 Whether the composing program system actually produces and markets all by itself?
2 Strength (20)
2.1 Weather the technique of composing in the early state available to solve all difficulties?
2.2 Weather the vegetable price is preponderance upon the competition?
2.3 Weather the process under survey to determine the tenor or not?
2.4 Weather the composition available for plant growth?
3 Weakness (20)
3.1 Weather the employee expenditure will cause the project economic deficit?
3.2 Weather the composing pace are suitable to match up the plantation speed?
4 Opportunity （ 10）
4·1 Weather the consumer prefer the vegetable planted in an organic or an eco-friendly way.
5 Threat （ 10）
5.1 Weather the weather will affect the composing program completeness and plantation growth

Evaluate the Solutions

(Please notice that in this section pictures without saying the attachment number refers to pictures in attachment 1.)
1 Recyclable(30)

1.1 Do the project actually relate to a specific restaurant and get the raw material of composing from it?
We collaborated with one specific restaurant and got raw material composing from it.
(pic.1 the restaurant that we found)
(pic.2 the leftover that we got)
[15/15 points]

1.2 Whether the composing program system actually produces and markets all by itself?
The result shows that the composting part works really well but the planting part still needs some improvement. We need more area, more labor, and more time for our plants to grow.
(pic.3 the composing progress)
[10/15 points]

2 Strength (20)
2.1 Weather the technique of composing in the early state available to solve all difficulties?
Until now, our project is progressing normally and efficiently. Most times the technique helped us a lot. But for the vegetables, they need more time to grow. This could be a problem in the future. This project needs a relatively long starting period.
[9 / 10 points]

2.2 Weather the vegetable price is preponderance upon the competition?
According to the owner of the restaurant, our vegetables have a relatively competitive price compares to those in the markets.
[8/10 point]

2.3 Weather the process under survey to determine the tenor or not?
There were some people who object to our project, but the majority support us. Our project progress quite well but need more time for the plants to grow.

(pic.4 the volunteers are working hard preparing for composing.)
[7/10 points]

2.4 Weather the composition available for plant growth?
From our experiment, we can see that the composition is nearly neutral and perfectly ideal in the fertility rate.
(attachment NO.2 our experiment)
[10/10 points]

3 Weakness (20)
3.1 Weather the employee expenditure will cause the project economic deficit?
We used volunteers for the classification and composing. Our project is progressing but the classification is really a big problem. For those restaurant employees, it is difficult to separate garbage correctly when they are really busy. As a result, volunteers need to classify lots of garbage. It is really tiring and labor-demanding.
(pic.6 the volunteers are working hard preparing for composing.)
[9/ 10 points]

3.2 Weather the composing pace are suitable to match up the plantation speed?
The plantation speed is slow while the composing pace is very fast. This two can hardly match in our percent stage. We planned to change the kinds of vegetables which we plant.
[4 / 10 points]

4 Opportunity （10）
4·1 Weather the consumer prefers the vegetable planted in an organic or an eco-friendly way.
Due to our investigation, 70.6% of people prefer to eat in a restaurant which uses vegetables planted in an eco-friendly way than the other restaurants.
(pic.7 our survey)
[9/10 points]

5 Threat （10）
5.1 Weather the weather will affect the composing program completeness and plantation growth.
For the effects of weather, or to be specific, temperature, on the composting process, we figured out a solution. The two methods we used are the Bokashi method and Vermicomposting. Since vermicomposting is very sensible to the temperature and can not bear with cold temperature, we use the Bokashi method instead of when the weather is cold and in winter.
For the vegetable growth part, we are still observing the growth of some of our vegetables.

[8/10 points]

[79/90 points]

attachment 1.docx attachment 2.pdf

Make an Action Plan

Aug 8:
What?
Our jobs including composting, contacting restaurants, planting vegetables, and collecting questionnaires.
How?
For composting, we searched information on the Internet and found that the Bokashi method and composting method that use earthworms are effective enough for us to do since they require a short period (composting with earthworm requires 2-4 weeks to finish and the Bokashi method requires about 1 month to finish) to be a success. Therefore, we don’ t need to wait too long for the result.
For contacting restaurants, we want to cooperate with restaurants, which provide uncooked food wastes, and we provide spaces and labors for composting. This plan is still being “planning” we will make effective contacts with restaurants soon. We tend to choose smaller restaurants since they won’ t provide too much food wastes
For planting vegetables, we already got permission from our school, but since it’ s the summer holiday, we cannot begin planting actions until the school is open. Our school has a club working for vegetation planting in a garden. The garden will be our “space”, and members from the club will be our laborers.
For collecting questionnaires, we already completed the questionnaires, until this composition was uploaded, we already collected about 400 results and it’ s still growing.

When?
You can check in the uploaded PDF

Sep 1 uploaded:
1. Begin planting.
1.1 Our planned time for planting was Aug 23 since it’ s our school returned day. However, our school lagged it to Aug 29, which means we have to begin planting vegetables later. We will use soil after composting to grow plants and we already got results from team members, but some of our teammates forgot to take the result with them, which force us to wait until Sep 6 to begin our planting.
1.2 The day (Sep 6) is about a week from the deadline, so we may not receive very fine results, but we will keep recording the process of growing to prove that our plan is feasible. Moreover, we will choose some relatively fast-growing vegetables (coriander, scallion with roots, or pakchoi cabbage) to make sure that we and the restaurants can see the results soon.

1.3 Our school has a field in the middle of the campus, which provides us with a place to grow our vegetables, and we contacted the principal successfully. She allows us to plant in the field, also provides us with tools and some volunteers.

2. Contact restaurants.
2.1 We already contact a restaurant in our community successfully. They agreed to provide us with uncooked food wastes for composting, and we also promised to provide them with vegetables after harvest
2.2 We are making posters for restaurants to propagate that the restaurants are using “organic” food.

3. Soil tests.
3.1 Since we have composting results, now we have to “prove” that the soil condition meets the requirement of plants growing. We borrow our teacher’s lab for testing, but because we can only receive soil (results of composting) after Sep 5, we may start our test after that time.

4. Poster making
4.1 We also making posters to propaganda our project. One of our posters will be posted on our campus and community. It includes some information about composting, and its aim is to inform people that uncooked food wastes can be used to make fertilizers (or fertile soil) for growing vegetables, also encourage people to support our project.
4.2 One other poster we will make is for the restaurants. We aim to use this poster to inform people that the restaurants are using organic food. We believe that the word “organic” can attract consumers, which will attract more restaurants to join the project.
4.3 The last poster we are going to make will be posted in our canteen and the restaurants. Even though our composting project can “digest” some uncooked food wastes, but we are not able to deal with cooked food wastes (especially with oil) yet. Therefore, it’s necessary to propagate people to oppose the waste of food. This action, we believe, will help reduce both cooked food wastes, since fewer people waste them, and uncooked food wastes, since restaurants and canteens will cook less food.

action plan

Prototype and Test

Prototype Design

seen in the uploaded PDF.

Prototype Design

Feedbacks learnt from users

Due to our investigation, 66.08% of the residents support our program, 19.35% of the residents do not care about this. 14.57% of the residents object to continuing this project.
75.29% of the supporters are willing to be a volunteer of our project, others are not willing to.

Here are some feedbacks from residents:
1. Odor. Some of our volunteers are not following the steps strictly, which cause one of our test groups to fail and produced a smelly odor. We are now giving our volunteers more specific instructions.
2. Tiring work. Some of our volunteers are sad that the work is too tiring. So now we are changing our arrangement of volunteers. We arrange more people to work at the same time to reduce everyone's working load.

Improvement for next iteration

To make a real model and continue our experiment in wider spaces.

In our experiment, we used two types of composting: Bokashi and Earthworms composting. Bokashi doesn't need water or anything other than bacteria and fungi, it just uses sunlight to stimulate the rate at which microbes break down kitchen waste. But Earthworms Compositing needs to buy worms to help degrade its compost.

We will bring in more people and plan more land from the community for

composting. Compost twice at the same time, some from household waste and some from restaurant food. We are dedicating to providing continuous raw materials for composting activities.

In addition, we will also plan to launch an event: residents who provide compost materials can get a special discount in the restaurant.

But composition needs warm weather, if the weather is too cold in winter, we may searching for other methods or stop the project for a while.

Team Credits

Xinfei Huang is responsible for compositing tests and spreading questionnaires

Zitian Chen is responsible for data collection and summarizes, and spreading questionnaires, also the suggestion provider, summary credit, and conference file writer.

Xinyuan Ji is responsible for assign work (e.g. who will do the compositing test, who will collect information), make action plans, make questionnaires, and spreading questionnaires.

Yihao Zhang is responsible for composting tests, providing suggestions for the maker of questionnaires, identifying the challenge, and spreading questionnaires.

Manxi Wu is responsible for composting tests, spreading questionnaires, and evaluate the solutions.

Yutong Li is responsible for poster making and spreading questionnaires and being the advisor for the questionnaires.

Haoran Yu is responsible for spreading questionnaires, identifying root causes and composting tests.

Yuanchen Li is responsible for spreading questionnaires and being the advisor for the questionnaires.

Onsite Conference File

Most of our conference records were included in the uploaded PDF.

Some websites we used:
https://www.sohu.com/a/431122417_260616
https://www.cn-hw.net/news/202010/21/75727_2.html
https://www.wjx.cn/vj/mCUoD5j.aspx
https://www.sohu.com/a/431122417_260616
https://www.cn-hw.net/news/202010/21/75727_2.html
https://www.wjx.cn/vj/mCUoD5j.aspx

conference file

Judge Comments

" Thank you for tackling a very complex problem. Your summary is insightful and accurately covers the learning process as well as the complexity of environmental solutions - while some of the solutions sound simple enough, the complex systems that they inhabit make these solutions impractical. Congrats on the through and detailed work that the team undertook – 400+ sample size for a survey is remarkable.

The interest gap (1.2) you identify is a crucial gap – it would be hard to get consistent participation from residents without adequately filling this gap. See if this can be addressed through incentives – some options include identifying a revenue stream to pay the residents back, a community garden that directly feeds back into the community than as sales to restaurants etc. Food bank concepts have explored this somewhat.

I’ d also recommend doing some calculation to see the amount of food this effort will be able to produce and compare that with the demand from the restaurant side to see if your approach will be able to meet the demand. This will be crucial for restaurants to even consider switching suppliers. Some questions include – What vegetables can be grown? How long would they take? How much vegetables can be grown using this model? How much is needed by the restaurants of this particular vegetable? Depending on the answers you get, you might need to also target specific vegetables that work better.

Overall, I think the team did a commendable job in thinking through a complex problem and identifying a potential closed loop solution. I encourage the team to continue thinking through and working on practical social and environmental issues! Good luck!

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