

# **Sustainability Innovation**

## **The Environmental Benefits That Domestic Garbage Sorting Cans Can Bring To Us**

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# Summary

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In recent years, metropolitan cities within China, such as Shanghai and Shenzhen, are promoting garbage classifications within many districts. The classification scheme is proven to be effective in some of these districts. Therefore, we also wanted to adapt this system to Foshan. However, in most of the districts, the Foshan government does not require garbage classification. Thus, to promote Foshan citizens to adapt to this garbage classification system, we introduce a domestic garbage sorting bin, which saves time and energy at the same time. Our project has multiple benefits. Firstly, because in places such as Shanghai, the garbage disposal periods are stringent, classifying garbage at home is convenient for people to dispose of their rubbish in the district on time. Also, we divide our trash bin according to the four primary garbage classifications: renewable/non-renewable/harmful/kitchen waste by four cuboids within a larger one so that people can classify garbage according to the standard method. Additionally, we use symbolic and aesthetically appreciative logos to make our bin look more pleasant, and it is easier for consumers to identify different classifications.

Moreover, this trash bin has a lot of educating significance without interfering with their daily routine (people don't need to spend a lot of time sorting garbage just before they go out to throw them; the trash is already classified at home). Children, especially, are more dynamic and are more likely to develop an interest in our trash bin due to the colorful logos. Adults are willing to buy because it is not expensive (only made of ordinary but biodegradable plastic), and it serves their purposes of sorting garbage. The storing layer under the renewable/harmful waste section is especially useful due to the need for depositing clean waste papers, old clothing, and batteries, etc.

Furthermore, within our promotion plan, we utilize in many ways toward the government or different stakeholders.

Although we cannot guarantee that all citizens follow the rules of garbage classification and that some recycled garbage may still end up in incineration power plants, we can contact the district government and set up an ID for each resident to check whether they had thrown the garbage appropriately. We can also encourage the government to construct more garbage collection stations, rather than continue using garbage incineration plants. In this way, if people have classified their garbage correctly in their districts, good garbage recycling stations can also enable these garbage to be recycled.

In a nutshell, the design of this domestic garbage sorting bin is convenient, practical, and cheap for domestic purposes, and it is highly likely for this product to be popularized.



# Identify the Challenges

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## Challenge 1

### Unclear Garbage Classifications in New Garbage-Classifying Cities

In fact, in many cities (except Shanghai and other cities that implemented garbage classification first), garbage classification has not been strictly defined; at least there are no legal standards or norms (or the norms are so complicated that people often sort garbages intuitively). The recyclable and non-recyclable garbage classification changes with economic and technological levels. For example, people have different ideas in whether plastic bags are recyclable or not since they have little value for recycling due to high recovery cost and processing costs, which are higher than the material cost itself. Another circumstance is that the pet feces classification. It would be other waste because it does not strictly refer to each category. However, some said it would not be in the garbage classification system and process. Like human waste, it should go into the city's fecal disposal system. Although cities like Shanghai had already implemented clear rules for garbage classification, it is still a huge challenge for other regions.

## Challenge 2

Some towns in Foshan are hard to manage.

There are some tiny urban villages with many detached houses in Foshan.

According to the internet, there are over 40 little "villages in the city" remain in Foshan. These areas are hard for the government to manage because they are not close to each other. Besides, no one will drive miles away just to through their garbage, and the government can't set up classified dustbins for every detached house because it cost too much to collect the trash.

## Challenge 3

### No Awareness of Garbage Classification

People don't have the awareness of garbage sorting. Although garbage classification is well known necessary, there are still a large number of people who don't take it seriously. Some people already know the importance of this, but they think it is too inconvenient to remember the rules of classifying the garbage. And some people don't realize the importance of garbage classification. They believe that a piece of trash wouldn't have too much impact on the environment. We extracted a group of survey data from the Internet. In the survey of "Do you have the habit of sorting garbage?", 20 per cent said "often", 31 per cent said

"occasionally", 31 percent said "rarely" and 17 per cent said "never". Therefore, people's attention and participation need to be improved.

#### Challenge 4

##### Local Officials Exploit Garbage Classification Financial Aid

Some local officials don't pay enough attention to the recycling problem. They do not follow the required waste separation plan, and it is easy to get away with it. For example, if the government invested 100,000 RMB for the local government to purchase garbage sorting cans, the local governments might only use a small proportion of the money on garbage sorting. When the government checks their garbage sorting progress, they can make out fake data. Their casual attitude led to the garbage classification can not be strictly and effectively implemented. In the past two years, China has repeatedly emphasized the supervision of officials on garbage classification, which indirectly reflects the inaction and disorderly behavior.

#### Challenge 5

##### Hard to promote the garbage bin we designed

Everyone has a preference for garbage bin' styles. If we want people to use this classified dustbin, we should make them like it; although we can offer different colors of the bin, the shape is unchangeable. So there is a big chance that sales are not high. Also, we need to think of a way to let others know about our product. Advertising can be the right choice, but we need others to understand the specialty of our product. According to the data on "Jingdong," there are more than 500 kinds of bins for people to choose, and there are 200~300 of them only have few buyers. This can be a significant problem to convince others to buy our product.

# Identify a Root Cause

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## 1. Residents lack of environmental awareness

People didn't become aware that they didn't classify the garbage will bring how much effect to the earth. Besides, people need to cultivate awareness when they were a child. So the government should display the video in led screen outside the building or public places and operate the classes to the students in kindergarten to university. Student needs to throw the garbage and collect the credit to graduate. The content of the advertisement needs to show harm to pollution, and to establish that classifying the trash is essential.

## 2. Rapid increment of consumption

The amount of waste produced each day is an enormous number. Therefore, garbage will accumulate in the trash can. The trash will decompose and release some chemical gases into the atmosphere that bad for humans health. For example, landfill or some hazardous wastes will seriously pollute the soil after landfill, and a large number of harmful fumes will be generated after the incineration of untreated wastes, which will cause air pollution. Therefore, the root cause of the rapid increment of garbage consumption and pollutions is that there are not enough workers and machines to dispose these garbage safely.

## 3. The inconvenience of sorting;

When it comes to garbage sorting, it would often be a burden for citizens as the garbage collecting periods are critical, and the classification itself is elusive. For instance, Shanghai has a rigorous sorting time: there are only three to four hours a day when people can deliver, which is undoubtedly a hard time limit for busy shanghai citizens to meet. And sorting garbage also takes a lot of time. For example, a cup of pearl milk tea, different components, such as milk tea, straw, and bottle, belong to different kinds of garbage, which means that throwing a cup of milk tea can be very troublesome, not to mention other domestic waste.

## 4. The Modern Way of Living Emphasizes Convenience too Much

With the continuous development of the Internet, the pace of people's life has become faster and faster. The rise of various kinds of useful software and industries has made people's life very convenient, so they have become more dependent on technology products, and more dependent on the external service industry. Therefore, many people prefer to live in an environment that does not need their labor, and garbage sorting will be a burden for them.

#### 5. Lack of government restriction.

Many local governments do not pay attention to the classification of garbage and do not issue relevant laws and regulations to restrain people's disposal of waste. Even if the folk have garbage sorting bins, different kinds of trash are eventually mixed to deal with. Even with the enactment of relevant laws, the enforcement of penalties is difficult, as it is challenging to regulate individuals. Shanghai's primarily community-based supervision is carried out by volunteers. Also, many illegal actions of classifying garbage won't be punished due to oversight, so the enforcement of punishment is not very strong. Also, many countries will sell sorted waste to foreign countries for disposal by foreign governments.

#### 6. Garbage classification management in Foshan city still need to improve

Although Nanhai Foshan green industrial service center project was jointly built by Hanlan environment co. LTD and German Ruimandis group, which have built waste disposal industrial park, to fulfill the capacity of four districts in Foshan, the industrial park is still on trial. Some factories nevertheless have pollution in the environment. In April,3,2020, secretary of Nanhai district went to the industrial park to emphasize the norms and increase the speed of full use of the industrial park. In the main public space, the government is starting to install advanced rubbish classification bins from the end of 2019. The government predicts it will be comprehensively used at the end of 2020. Recently, although some places set up the sorting trash can, in the collection transportation link, they are still mixed by transporting workers.

# Generate Solutions

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## 1. Community lecturing;

(corresponds to→environmental awareness)

There are various ways of lecturing residents into sorting garbage sensibly and correctly. Apart from the traditional method of handing leaflets (which many people may reject) or creating a lecturing website, physical lectures are more effective: Garbage sorting company employees can give lectures in primary or secondary schools with power-points or stimulation. Constructing a garbage sorting theme park with creative models is likely to enlighten children' s interests. As for the adult residents, they can get instructions from WeChat Official Accounts or the staff (who needs to be educated first to instruct the residents).

## 2. Generating Data;

(corresponds to→environmental awareness)

Some garbage sorting companies that generate data on the “Wulian Website ( 物联网 ) + Garbage Sorting” online platform. This measure corresponds to our “Big Data Era,” which promotes researchers and residents to get access to appropriate data, and these data help to adjust measures to local conditions. Different cities have different policies and conditions. Therefore a unitary data of an entire province is not enough for local governments to take appropriate measures. In contrast, generating data from neighboring districts as a reference is more useful for a small district. As a whole, all of these data generated can be analyzed and produce an accurate estimation of recent trends of garbage sorting in various cities. Big Data also helps to publicize data to evoke people' s awareness and provide them better closed-loop services.

## 3. Model districts.

Using model districts not only serve other districts as a role model district but also reduces the cost and effort of garbage sorting companies. Exerting restriction and providing financial aids for garbage-sorting facilities in a single district is much easier than in an entire city, and therefore is more likely to be successful. Once the model district becomes successful in garbage sorting, other districts are expected to accept its sorting model as well. If the model district is especially thriving, it may draw attention from environmentalists of different provinces.

## 4. ID cards with account/generating cash or other rewards;

Communities can use the garbage sorting Internet system through ID card interconnection. Each household has its ID, which is directly connected to the Cloud.



People can weigh their garbage in the community garbage sorting site and get credit on the Internet system each time when they classify garbage. They can use the credit to exchange for household items or even cash, which can encourage them to do garbage sorting daily. Users can also check the nearest time and place of dropping garbage on the network platform in advance, which helps them to plan their garbage dropping. Since each ID directly corresponds to the individual, in the process of dropping garbage, there will have real-time monitoring to ensure the accuracy of garbage classification and upload to the cloud at any time to avoid manual operation errors, and supervision is not in place.

# Identify the Criteria

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Identify the Criteria:

1. Convenience: Is it convenient for the public to accept the plan spontaneously?
2. Acceptability: Is the government/private companies and individuals willing to accept this solution?
3. Efficiency: Is it efficient for the public to apply this solution?
4. Popularity: Can this solution be popularized to a wide range?
5. Effectiveness: Can this solution effectively reduce garbage pollution?

# Evaluate the Solutions

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We evaluated our solutions in multiple aspects, including convenience, acceptability, efficiency, popularity, and effectiveness. By using a rank of 1 to 5, each of our team members gave a score to each aspect corresponding to the solutions carefully. We then calculated the average score and get the following result (listed in the photo).

 [Average Scores of Solutions](#)

# Make an Action Plan

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## 1. Designing our Project

### First Draft

Our first draft is documented in the name of “垃圾桶设计初稿1” within the attachments. After discussing about the design of our domestic garbage-sorting rubbish bin as a team, we concluded that our rubbish bin needs to have these features:

- four different sections for classification (renewable/unrenewable/harmful/kitchen waste)

- a storage box for renewable and harmful waste

(in order to preserve papers and old books, and harmful battery waste,etc.)

However, after drawing out the first draft, we do not consider it as aesthetically appreciative because it looks too ordinary and plain.

Changing its shape from a cuboid to a column may seem better.

### Second Draft

Our second draft is documented in the name of “垃圾桶设计初稿2” within the attachments. Although a column is more aesthetically appreciative, the storage box can no longer be used. Because the storage box shapes like a quarter-of-circle’s prism, it cannot be plugged out from under the trash can. However, if we soften the corners of our original cuboid design, it will be aesthetically appreciative as well as practical.

### Third Draft

Our third draft is documented in the name of "垃圾桶设计初稿3" within the attachments. This draft contains two trash bin. The left one is for throwing the main category of garbage. The four different-color category each can be dismantled which will be easy to throw garbage with no waste of using garbage bag.

Furthermore, the trash bin have a mechanism of open the lid by stepping on the pedal. The next smaller trash bin is cylinder-shaped container to store kitchen garbage. The bin have a barrier layer to separate the juice gain by decomposed kitchen garbage between the upper layer of dirt with worms and lower layer of fragmentary papers. As time pass, there will gain some enzyme juice under the the barrier layer. The juice can flow from the movable tap.

### Fourth Draft (Final Draft for now)

Our fourth draft is documented in the name of "垃圾桶设计初稿4" within the attachments. There are many wonderful trash bins that has been design to use

outdoor. However we think if we want to solve the problem of garbage classification, it is necessary to design a household trash bin which can help classifying the garbage. If there is one in each home, it is like a reminder to people that they should classify garbage all the time.

As we can see, the bin is in a shape of cuboid. There are four sections for four different kinds of garbage. And there are mainly two parts of the bin; the upper part of it is the place where you through your garbage; the lower half is for containing boxes.

Here are the special details of this bin.

1)There are four movable wheels on the bottom. —Easy to change its position.

2)There are two containing boxes in the side of the lower cuboid area. —Design to put trash such as waste paper, plastic bottles and other recyclable garbage, and harmful waste such as waste batteries, waste medicine and other harmful waste. ( These waste are rare, once you have enough trash, you can deal with these special wastes. )

3)Garbage can lid for each section. —To prevent the smell getting out. The materials use to make the lids are also pretty light so that you can open the bin even though you have something in your hand.

4)The bottom of the bins( above the storage box) can do it with hollowed-out material since there is a supporting structure in the middle —Can save material.

5)The garbage bin itself can be rotated.---you can change its direction easily.

6)The material used to manufacture is polylactic acid(PLA) which is one kind of biodegradable material that made from plant's lactic acid. It can be completely degraded by the microorganisms in nature after use, and finally generate carbon dioxide and water, without polluting the environment.

[📁 垃圾桶设计初稿4-3D版正面](#)

[📁 垃圾桶设计初稿4-3D版侧面](#)

[📁 垃圾桶设计初稿4-3D版俯瞰图](#)

[📁 垃圾桶设计初稿4-3D版底部图](#)

[📁 垃圾桶设计初稿1](#)

[📁 垃圾桶设计初稿2](#)

[📁 垃圾桶设计初稿2](#)

[📁 垃圾桶设计初稿3](#)

[📁 垃圾桶推广计划 Promotion Plan](#)

# Prototype and Test

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## | Prototype Design

There are many wonderful trash bins that have been designed to use outdoor. However, we think if we want to solve the problem of garbage classification, it is necessary to design a household trash bin that can help to classify the garbage. If there is one in each home, it is like a reminder to people that they should classify garbage all the time.

As we can see, the bin is in the shape of a cuboid. There are two sections for four different kinds of garbage. And there are mainly two parts of the bin; The simple garbage bin and the containing box.

Here are the special details of this bin.

1)There are three sticky notes. —Easy to identify.

2)There is a separate containing box. —Design to put trash such as waste paper, plastic bottles, and other recyclable garbage or harmful waste such as waste batteries, waste medicine, and other harmful waste. ( These waste are rare, once you have enough trash, you can deal with these special wastes. )

3)Garbage can lid for each section. —To prevent the smell from getting out. The materials used to make the lids are also pretty light so that you can open the bin even though you have something in your hand.

4)The bottom of the bins( above the storage box) can do it with hollowed-out material since there is a supporting structure in the middle —Can save material.

5)The garbage bin itself can be rotated.---you can change its direction easily.

6)The garbage bin has footrests --- more convenient to let the user throw garbage

7)Special groove---The garbage bin has a special groove that can fix the garbage bag.

# | Feedbacks learnt from users

Some of the aspects we need to consider while doing an investigation:

- 1.The proportion of different types of garbage consumed: The consumption of recyclable/non-recyclable/harmful/kitchen waste is not proportioned as 1:1:1:1. Although this proportion varies among consumers, from this investigation we will conduct a through result that fits the preference of the majority.
- 2.We need to know the classification systems in Foshan' s different districts. There are two main types of classification systems: recyclable/non-recyclable/harmful/kitchen waste; dry/wet/harmful/kitchen waste.
- 3.We have provided for sections for consumers to sort their garbage. However, we do not know they prefer to have how many sections for garbage sorting.
- 4.We do not know whether our consumers prefer cans that are more slender or more stumpy, so we provided them choices of proportion of side length: height of the bin;
- 5.We need to consider what colors they prefer for the trash bin;
- 6.We need to consider what type of logo they prefer.

(the survey' s template is listed below,

it is written in Chinese to allow our "consumers" to understand our purpose, we translated it into Englis as shown below:)

:: Questionnaire

Hello! We are the contestants in the academic competition of Guangdong Country Garden School Environthon (Environmental Protection Marathon). We've designed a garbage bin that allows people to sort their own trash at home, so you' ll need some suggestions for improvement from the survey below. thank you for your cooperation ~ love you!

1. Four categories of garbage discarded working days :(tick one of them)
  - a. Recyclable garbage: express packaging / waste paper / plastic packaging
  - b. Waste Plastic Products / Waste Glass
  - c. Scrap metal products/canned cans
  - d. Waste clothing / towels / shoes
  - e. Non-recyclable waste: tile dust/oil stains/dust
  - f. Paper towels/papers/dirty paper/cotton
  - g. Disposable tableware / underwear / plastic bags etc .(disposable anyway)
  - h. processed food/pet excrement
  - i. Kitchen waste: Unprocessed food / leftovers (less / less / medium / more / more)
  - j. Hazardous waste: Waste batteries/waste paint drums/waste machines
  - k. Expired food/drugs
  - l. Pesticides/thermometers (chemicals, etc.)
2. Four types of garbage discarded 2) weekends:
  - a. Recyclable garbage: express packaging / waste paper / plastic packaging
  - b. Waste Plastic Products / Waste Glass

- c. Scrap metal products/canned cans
- d. Waste clothing / towels / shoes
- e. Non-recyclable waste: tile dust/oil stains/dust
- f. Paper towels/papers/dirty paper/cotton
- g. Disposable tableware / underwear / plastic bags etc .(disposable anyway)
- h. processed food/pet excrement
- i. Kitchen waste: Unprocessed food / leftovers (less / less / medium / more / more)
- j. Hazardous waste: Waste batteries/waste paint drums/waste machines
- k. Expired food/drugs
- l. Pesticides/thermometers (chemicals, etc.)

3. which type of garbage do you think you usually throw more?

Recyclable / non-recyclable / kitchen waste / harmful

4. do you have any garbage sorting in your district? There's a jump to 5/ no ignore 5

5. may I ask which district you live in Foshan City:

Shunde District / Chancheng District / Nanhai District / Sanshui District / Gaoming District

6. your district garbage classification way is? (Selected answers)

- a. Dry / Wet / Hazardous / Kitchen waste
- b. Recyclable/non-recyclable (or other waste)/Hazardous / Kitchen waste
- c. Other \_\_\_

7. What kind of classification do you think is convenient and practical?

Not classified (because garbage sorting is meaningless)/2/3/4/4

8. do you think it makes sense to set up a storage box under recyclable / hazardous waste?

Yes/No

9. what proportion do you think this trash can make it beautiful and practical? (Side length: high)

1:1.5:1/2:1/1:1.5/2:2.5(the longer the side length/high <1, the flatter the >1)

10. What kind of color matching do you prefer? (Multi-selection\*4)

Light green / dark green / grey green / light blue / dark blue / grey blue / light pink / peach / grey / light yellow / khaki / light purple / grey /

:: Data consolidation (including charts/survey)

Beauty and practicality of Logo?

:: Beauty: Concise/modern/cute/signal

(bones for kitchen waste, for example)

:: Practicability :(survey)

11. What form would you like your logo to take?

directly printed on the trash can / printed on the trash can with detailed classification guidelines printed on it / refrigerator magnet: I don't want to throw rubbish in the logo prescribed place, so I want to move my logo

Our survey will be posted on the Wenjuanxing website along with our introduction of our products. Due to the necessity of conducting a survey as complete as



possible, we will not post our survey results within the first draft of March 8th. The final result will be attached in the form of a charted document.

## | **Improvement for next iteration**

1. A separate bucket for recyclable garbage, a bucket for non-recyclable/kitchen waste, and a container for hazardous garbage;
2. Add a separate bin for recyclables and non-recyclables, and don't put it under the bin;
3. The shape of the garbage can remains the same, which is a rectangle with rounded corners.
4. The side length of recyclable garbage can is 25cm, not + the side length of kitchen waste garbage can is 30cm;
5. Draw a diagram of a colored trash can;
6. Logo: if it is printed on, it is better to add a word to prevent it from being thrown wrong.

# Team Credits

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Melody Zeng Lanzhen

Melody is responsible for organizing the time of the Environthon meetings, drafting the investigation (prototype) plan, our summary in this outline and the 1-4 parts of "Generating Solution" section, and is one of the designers of our project (the domestic garbage-sorting trash can);

Lily Feng Jiali

Lily is responsible for writing the 3rd and 4th root causes and the 5th and 6th solutions. She is also responsible for the part of the promotion solution.

Jeniffer Kwok ka yi

Jeniffer is responsible for providing an online meeting id for the team, drafting challenge 3 and the Root cause 1-2, designing our project and logos in a 3D platform and indicating the colors we may use for our final product;

Jerry Xie Lihong

Jerry is responsible for writing the challenges 1-2, and both writing and designing a draft of the product of the trash bins and its introduction.

Polly Chen Zhirui

Polly is responsible for writing a part of the challenges and the design concept. Also giving some advice for the designing of the garbage.

Sam Leung Chi Sum

Sam is responsible for analyzing the pros and cons in a preceding trash sorting case and identifying existing challenges from it. He is also taking the promotion part of the solution.

# Judge Comments

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" Overall Comments:

The team does an excellent job in setting up the proper context for recycling in the country as well as in the city of interest, namely Foshan. I also commend them for touching briefly on the economics of recycling – sometimes recovery and recycling costs are more than the cost of the product itself. The team does an excellent job in the prototype section where they designed a recycling bin and takes into account all crucial aspects during the design.

I recommend that the team strengthen this project further by conducting additional research into the economics of recycling. Some of the findings might also guide design or signage changes.

While trivial, it would have been useful to see cost considerations being brought into the design as well as the survey. What would the average user be willing to spend to have a recycling system in the house? What level of rewards will prompt them to sort their garbage into recyclable (and monetizable) and other garbage? Are there other incentives that would help change sorting behavior?

PS. It is unnecessary that the recycling bin be made from biodegradable plastic as it is less likely that large quantities of garbage cans themselves will become garbage!

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