Human Factors in Waste Reduction Design: A Case Study on Using Garbage Bags under Waste Charging Policy in Hong Kong

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Abstract. Hong Kong has an extensive amount of municipal solid waste (MSW) disposing of in the landfills. To reduce MSW, the Environmental Protection Department of Hong Kong had introduced two kinds of charging modes to the Legislative Council in 2018. Depending on the sizes and types of garbage, people can choose to be charged by designated garbage bags or weight. Considering the design and societal factors, this paper aims at investigating people's waste disposal habits in Hong Kong. Taking Hong Kong as a case study, the paper discusses the potential issues and the design consideration of designated garbage bags. Five human factors, conveniency, benefit, cost, responsibility and risk, are identified for the design of designated garbage bags and the implementation of waste charging policy.

Keywords: Garbage Bags · Waste Charging · Waste Reduction · Municipal Solid Waste

1 Introduction

Although Hong Kong has many well-established systems to maintain high productivity in society, the development of a waste management system has been overlooked by the government. Only until 2005, the Hong Kong government has adopted the polluter-pays principle of waste charging [1]. However, the implementation is slow that the Waste Disposal (Charging for Municipal Solid Waste) (Amendment) Bill was eventually introduced to the Legislative Council in 2018 [2]. Comparing to other developed cities and countries, the development of waste management in Hong Kong are lacking behind. The responsibility of waste management has been resting on the government, and Hong Kong people have not been educated to take up the role in waste management.

Hong Kong has an extensive amount of municipal solid waste (MSW) disposing of in the landfills. MSW primarily includes paper, horticultural wastes, glass, metals, plastics and textiles generated by people living or working in households, offices, hotels, shops, schools, and other institutes [3]. On average, each person in Hong Kong disposes 1.53 kg MSW every day in 2018 [1]. It is much higher than the generation of MSW in the region of East Asia and the Pacific (0.56 kg per person every day) [4]. The high generation rate has been becoming an intolerable burden to the landfills if the situation persists. The MSW charging policy is one of the approaches to reduce waste disposal, as it offers an incentive to people and sends a message to them that the service is not free [5]. A similar policy has been adopted by several cities. For instance, Seoul had

adopted the MSW charging system since 1994, and the amount of household garbage disposed of decreased from 1.3 to 0.34 kg/person between 1994 and 2011 [6]. Sakai et al. have also studied the unit-charging programs known as pay-as-you-throw in Japan, and it was found that the MSW has reduced significantly after the implementation [7]. The results are promising, and it is convincing that a similar system and policy is feasible to reduce MSW.

The Environmental Protection Department of Hong Kong had introduced two kinds of charging modes to the Legislative Council. Depending on the sizes and types of garbage, people can choose to be charged by designated garbage bags or weight [8]. These two are known as quantity-based methods, and it is suitable for developed countries or cities because of higher service cost compared to other methods [9]. While it is easier to charge by weight because the garbage will be weighted at a site operated by waste collectors, charging by designated garbage bags requires public's self-discipline and autonomy, as people have to purchase and use the designated bags for waste disposal.

To avoid people using undesignated bags that is against the waste charging policy, the designated garbage bags should have anti-counterfeit features. Besides, considering the environmental issues, the material used for the bags should be biodegradable. The bags also have to be inclusive for people with different capabilities to use. Having the anti-counterfeit and inclusive features and being biodegradable, the bags have to be affordable for people to purchase at the same time. Designers have to find creative solutions to resolve these tensions and dilemmas. However, societal issues should also be considered, and the emphasis on designing the designated bags should not just rest on technical issues.

Considering the design and societal factors, this paper aims at investigating people's waste disposal habits in Hong Kong. The habits of how and where they dispose of the waste are investigated. Taking Hong Kong as a case study, the paper discusses the potential issues and the design consideration of designated garbage bags under the MSW charging policy.

2 Residential Source of MSW in Hong Kong

2.1 Overview

People living in residential buildings are chosen to be included in the study because these people are the largest group of people who are being charged for waste management after the implementation of the waste charging policy. Their reactions and responses towards the policy indicate the feasibility and are vital to the success of policy implementation. Therefore, it is essential to investigate how they manage their waste so that the waste management system, the design of the designated bags and other supporting facilities can cater to their needs.

In Hong Kong, people live in different kinds of residential buildings: public, subsidized, private, and other housings including village houses, squatter, and interim housing. Public, subsidized residential and interim housings are built by the government, and others are built by private property developers. Public residential buildings and interim housings are managed by the government, and subsidized and private residential buildings are managed by private property management companies. However, as

the government does not take the responsibility to manage private residential buildings, in some private residential buildings, no property management companies are hired. Village houses and squatter has no management, and the owners and tenants have to take care of the buildings. Table 1 below shows a summary of the management of different types of residential housings in Hong Kong.

Table 1. Management in different types of residential housings in Hong Kong

Types of residential housings	With management	Without management	Included in this study
Public buildings	✓ (Government)		✓
Subsidized buildings	✓ (Private)		✓
Private buildings	✓ (Private)	✓	✓
Village houses		✓	✓
Squatter		✓	
Interim housing	✓ (Government)		

The property management parties, either the government or private companies, would provide municipal services for the buildings. In this study, investigations on how people manage their waste are conducted among the public, subsidized, private buildings and village houses. Squatter and interim housing are omitted in this study because they are ceasing to exist as the housing policies has been becoming more deliberate and established.

2.2 Field Visits

Field visits to the four kinds of residential housings were undertaken to investigate people's waste disposal habits. Figure 1 below shows the six locations selected for the field visits of different residential housings. These locations are well-known for the corresponding residential housings among Hong Kong people.

The refuse collection points and the places where people trash their waste in the residential buildings and public areas were visited in the six locations. Researchers had spent about three days at each location for investigation from June to December 2020. Photos were taken to record people's disposal habits.

Fig. 1. Locations selected for investigating people's waste disposal habits

3 Waste Disposal Habits

Waste generated from household is being managed differently in different kinds of residential housings. The ways that people manage their waste are affected by the types of residential housings, and people's habits change according to the municipal service provided by the property management parties.

3.1 People living in buildings with municipal service

Public residential buildings. A refuse collection room is provided for residents to dispose of the waste on each floor in public residential buildings (Figure 2). People pack the waste in a big plastic bag and leave it in the room every day for refuse collection. The government would outsource the cleaning jobs to property services agents, and cleaners from these agents would come to clean the refuse collection room and push the garbage bags into a chute located in the room (Figure 2). For larger chutes in some public residential buildings, the opening of the chute is locked to prevent people from falling into the chute. After the cleaners push the waste bags into the chute, they would collect them at the ground floor of the building and move them to the refuse collection point located in the housing estate (Figure 3).

Fig. 2. A refuse collection room (left) and the chute (right) in the room at a floor in a public residential building

Fig. 3. A refuse collection point in a public housing estate

In the field visits, it was found that some of the refuse collection rooms were in bad hygiene conditions. Sometimes the bags were not firmly tied. Residents used low-quality bags which were easily torn, and the wastes were being stomped into the bags. The wastes in the garbage bags were everywhere in the room, and the sewage could be found outside the room next to its door.

Subsidized residential buildings. Similar to people living in public residential buildings, people living in subsidized residential buildings also have to take their garbage bags to the refuse collection room.

Fig. 4. A refuse collection room (left) and garbage bags in the corridor (right) in a subsidized residential building

The refuse collection rooms are similar to those in public residential buildings but with better hygienic condition (Figure 3). However, in some buildings with a large shared area on each floor, some of the residents would put the bags in the corridor or the lift lobby (Figure 4).

Generally speaking, the hygienic conditions in subsidized buildings were better. However, it was also observed that residents just leave bulky wastes outside or next to the refuse collection point. They would not dispose of them at the collection point (Figure 5).

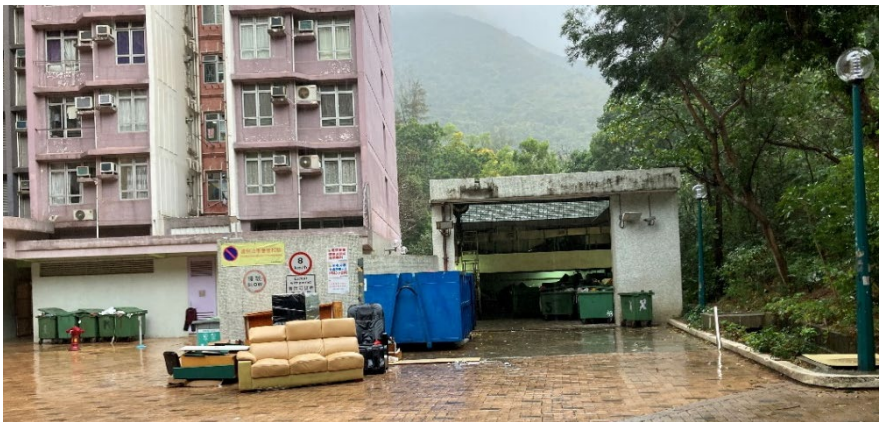

Fig. 5. A refuse collection point in a subsidized residential estate

Private residential buildings. Some newer private residential buildings also have a refuse collection room on each floor. The operation is similar to those subsidized residential buildings (Figure 6).

Fig. 6. Refuse collection room in a newer private residential building (left) and refuse collection bin at rear staircases in an old private residential building (right)

For some older buildings without refuse collection rooms, the private property management companies would put a large garbage bin at the rear staircases for residents to dispose of wastes (Figure 6). Residents have to take the garbage bags from home and dispose of the garbage bags in the bin. Cleaners employed by the management companies or cleaners of the outsource cleaning companies would remove the waste from the bins/rooms and send them to the nearest public refuse collection point (Figure 7).

Fig. 7. A public refuse collection point

3.2 People living in buildings without municipal service

Private residential building. There were no management and municipal service in some private residential buildings, and no bins could be found at the rear staircases on each floor. As the public refuse collection point in the district (Figure 7) are often quite far from their living place, residents tended not to walk to the collection point for waste disposal. Residents would dispose of waste next to a public rubbish bin near to their building. Therefore, it was found that many plastic bags were placed next to the bins on the street (Figure 8). Although it is an illegal act, the residents received no penalty due to the inadequacy of law enforcement.

Fig. 8. Waste disposed next to a rubbish bin on the street by the residents in private residential buildings

Village housing. Waste management in village houses is challenging. As there is no municipal service, villagers had to dispose of the waste at the waste collection point at the entrance of their village on their own. Instead of having fixed premises for refuse collection, village houses only have a temporary collection point with larger garbage bins and skips as shown in Figures 9 and 10. Sometimes villagers would put waste on top of the bins or dispose of it in the skips without using a garbage bag.

Fig. 9. Garbage bins at waste collection point at the entrance of a village

Fig. 10. Waste skips at a waste collection point at the entrance of a village

4 Potential Issues and Design Considerations

The findings above suggest that the residents living in buildings with municipal service do not need to take much effort to follow the waste charging policy, as they just need to take one extra action, i.e., buying the designated bags. Sometimes the management companies also prepare the bags for the residents, if the residents have paid a substantial management fee. It is more likely that they would be able to follow the policy. However, those living in buildings without municipal service may be unable to do so because they need to take extra efforts in waste disposal. The extra efforts and issues are discussed below, and some of them also happen among people living in buildings with municipal service.

First of all, people have to buy bags. Although this is already known in a waste charging policy, it has many hidden issues. Without the waste charging policy, the residents may not have to buy a garbage bag. They can use the small bags as shown in Figure 8. They get those bags from purchasing goods. Although the plastic shopping bag charging scheme was implemented, some shops are exempted or found tricky methods to give plastic bags to the customers. Many elderlies living in public housing have also stored many shopping bags at home for this purpose. Following the waste charging policy means that people cannot use these bags for waste disposal, and many of these bags can be disposed of. Therefore, many people may not be willing to buy designated bags.

Besides, as the designated garbage bags have standard sizes, people cannot dispose of it in the garbage bins on the street. They can only dispose of it at the refuse collection point with a bad hygienic condition far from their home. On the other hand, the shopping bags they dispose of in the garbage bins are much smaller, and it is easier for them to stomp into the bins. The act of doing so is much less noticeable than disposing of the designated garbage bags. In addition, after they dispose of the waste bags into the garbage bins on the street, the responsibility will be fell on the government. Considering the consequences and the conveniency, it is more likely that people will take the risk to continue to use small shopping bags for waste disposal on the street.

Villagers living in village houses also have similar issues. The population density is much lower in the area of village houses, and very few people would be able to see how villagers dispose of the wastes unless CCTVs are installed to monitor how people behave at the refuse collection point.

Based on the discussion above, it is clear that five human factors are essential in the design of designated garbage bags and the implementation of waste charging policy. The five human factors are conveniency, benefit, cost, responsibility, and risk. A balance among conveniency, benefit, and cost should be attained in the design of the designated bag and the user experience of disposing of waste. It is essential to provide education for people to understand responsibility. It is also necessary to take measures to avoid people from taking the risk to break the law. These factors apply not only in Hong Kong but also in other cities where waste charging policy are going to be implemented. Designers, policy-makers and users have to cooperate to make the waste charging policy successful.

5 Conclusions

The amount of MSW generation and disposal is high, and it is foreseeable that the landfills will soon be unable to take the burden. The Environmental Protection Department of Hong Kong had introduced the waste charging policy to the Legislative Council, and the policy will soon be implemented. Wastes will be charged by designated bags, and its primary purpose is to reduce the generation and disposal of MSW. It is essential to understand how people dispose of waste so that the design of designated garbage bags and other supporting facilities can best fit the users' needs.

To understand people's waste disposal habits in Hong Kong, waste disposal habits of residents living in different kinds of residential buildings were investigated. It was found that the habits varied depending on the municipal service they received. Several

potential issues related to the usage of designated garbage exist among residents living in buildings without municipal service. Five human factors, conveniency, benefit, cost, responsibility and risk, are identified for the design of designated garbage bags and the implementation of waste charging policy.

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