



# What keeps Chinese from recycling: Accessibility of recycling facilities and the behavior



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## ABSTRACT

In China, less than 2% of waste processed in the municipal disposal system is recycled. Past research has dedicated great efforts in identifying reasons for the country's low recycling rate. However, these studies are constrained for their over-dependence on survey methodology and ignoring the potential gap between reported intention to behave and behavior. In a controlled lab experiment, this study examines waste recycling behaviors, as well as the associated psychological behavioral antecedents, with varied levels of accessibility of recycling facilities. We confirm the hypothesis that lack of effective recycling facilities constitutes one of the obstacles that keep Chinese people from sorting and reusing most recyclable wastes. The results indicate that enhanced accessibility of recycling facilities would lower behavioral costs and encourage people to take that action. While this strategy directly changes behaviors, it has little impact on those behavioral antecedents. The study also confirms the gap between behavioral intention and behavior. While all participants in all scenarios showed equally strong willingness to recycle, the percentage of people who recycled is over 25% higher in the scenario with easily accessible recycling facilities, compared to those with hardly accessible facilities. All the above findings are relevant for making recycling promotion policies and cut through the vicious mixed waste disposal and collection cycle.

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## 1. Introduction

Pollution and the associated environmental damages were once considered as a necessary price for China's economic growth, but now emphasized as a major threat for the country's sustainable development (Tian et al., 2013). Among the various pollution sources, waste pollution has not received due attention in the past few decades, a fact especially true when it is compared with the vast efforts dedicated to mitigating air and water pollution in China. In 2004, China has surpassed the U.S. and became the largest municipal solid waste (MSW) producer. Since then, MSW production in this country has been rising, from 155 million tons in 2004 to 172 million in 2013, accounting for 70% of waste production among East Asian countries (China Statistical Bureau, 2014; Hoornweg and Bhada-Tata, 2012).

How wastes affect the environment depends on how they are processed. Landfill and incineration are the two major approaches adopted in China. Taking the year of 2011 as an example, 20% of the wastes processed in the municipal disposal systems were feed into incinerators, about 78% were landfilled with innocent

treatment, which added up to 98% of all municipal solid wastes (Chen et al., 2015).<sup>1</sup> However, neither of them represents an ideal waste processing model (Hoornweg and Bhada-Tata, 2012). Burying waste underneath in landfilling stations requires appropriation of the already scarce land resources, and imposes a great threat of soil and underground water pollution. On the other hand, burning wastes in incineration stations is boycotted by surrounding neighborhoods, even when these stations are demonstrated to be pollution free. Protests against incineration stations are not rare and sometimes arouse unrest emotions in a local society.<sup>2</sup>

<sup>1</sup> Some wastes with high residual values, such as paper and metal, were collected by junkmen and sold to recycle stations. However, this part is not statistically counted in China.

<sup>2</sup> Environmental performance of incineration facilities is not only determined by their technology design, but also how clearly wastes fed into the incinerators are sorted. The environmental-friendly incineration systems are superior to traditional facilities because it could adopt unique burning settings for each waste group. This advantage assures that all wastes could be sufficiently burned with the minimum environmental impacts. However, standards for municipal waste categorization have not been set up yet in China, and almost all wastes, even including kitchen garbage, are collected and processed together. In order to fully process those solid-liquid mixed wastes, even the environmental-friendly facilities have to adopt a low incineration calorific value that resulted in excessive energy consumption and unnecessary pollution. In other words, even the so-called environmental-friendly

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Compared to landfill and incineration, recycling and reuse represent a way to boost sustainable waste processing, and has been widely adopted in Japan, the US, and other developed countries. Till 1993, 41 out of the 50 states in the US have laws in field that forcefully require certain percentages of wastes to be recycled (Grogan, 1993). These laws have been effectively implemented and about 34% of MSW were recycled in 2010, including 71.6% of waste paper (U.S. Environmental Protection Agency, 2011). Similarly, the U.K. government set a goal to recycle 30% of its MSW in 2004 (Tonglet et al., 2004). Not surprisingly, Japan, an island nation with extremely limited resources, has very strict and detailed rules to govern its citizens' recycling activities, in order to minimize waste generation and maximize resource reuse. For example, the Japanese recycling law requires that all food producers use recyclable materials to package their products and encourages consumers to reuse these packages (World Bank, 2005).

In contrast to the developed countries, China lacks such institution that facilitates waste recycling. Less than 2% of MSW processed by public sectors is sorted and recycled (Chen et al., 2015). In order to solve the problem of abusive resource consumption, the Chinese government initiated a pilot project in 2000 to promote recycling in Beijing, Shanghai, Guangzhou, Shenzhen, Nanjing, Hangzhou, Xiamen, and Guilin, the eight pilot cities. This project involved huge investment in building waste sorting and recycling infrastructure, educating the public about why and how to sort and recycle wastes, and training waste management professionals. However, the effects of these pilot efforts are limited, and landfill and incineration are still the major approaches for MSW processing in China, including those pilot cities (Chen et al., 2015). It is of critical importance to identify the reasons for such a failure and to build an integrated system, including both physical structures and behavioral institutions, which makes waste recycling feasible, easy, and widely acceptable.

Lack of effective and convenient recycling facilities is one of the primary reasons for China's plight in residential waste recycling. First, China has not established a national standard to guide MSW sorting, which lead to varied sorting standards in local communities. As an incomplete list, we can find communities that separate wet garbage from the dry, that separate recyclable wastes from non-recyclable ones, and that separate recyclable wastes from kitchen garbage, hazard garbage, and other garbage. Such variety may confuse people and deter them from developing a consistent perception and habit about how to sort wastes (Wu, 2012). Second, the superficial waste separation facilities become useless when all kinds of residential wastes are in fact mixed. Such ineffectiveness results from the lack of efforts from both individual residents and municipal waste management departments. From the perspective of individual residents, it is almost always true that only wastes sent to commercialized recycle stations would be finally processed in an environmental-friendly way, and possibly reused. Otherwise, even they put recyclable wastes separately in recycle facilities (e.g. recycle bins), they would be mixed with non-recyclable ones by the municipal staff members who collect them. As one of China's most prominent environmentalists Ma Jun said, "it has not helped that some cities have encouraged garbage sorting, only to have residents discover that the trash all ends up in the same place" (Vanderklippe, 2010). In other words, mixing recyclable garbage with non-recyclable ones would make individual waste sorting efforts meaningless, and they would abandon those efforts when the pilot program run for a while and their passion dismissed.

However, the municipal waste management department should not be blamed either. In their perspective, sorting wastes requires additional inputs of vehicles, labor, and financial resources, which would definitely be wasted if they were used to process wastes that have already been mixed by residents. A vicious cycle formed when the residential and the municipal behavior rules reinforced each other, and it finally makes recycle bins in most residential communities or public areas means nothing more than a trash bin. With a general lack of effective public recycling facilities in China, market mechanism helps recycling some wastes with high residual values, such as paper, plastic bottles, aluminum cans, and other metal products made of copper and iron (Mo et al., 2009). However, the majority of recyclable wastes with little residual value cannot escape the destiny of being filled or burned with other non-recyclable ones.

How to break the vicious cycle of mixed waste disposal and mixed collection? Supplying individual residents with factually effective recycling facilities and changing their waste disposal behaviors is the key starting point. Recycling wastes can be considered as an environmental behavior undertaken with specific waste management institutions. As we will discuss in the following section, the behavior can be analyzed with Ajzen and Fishbein's Theory of Planned Behavior (TPB) (Ajzen and Fishbein, 1980; Ajzen, 1991), which predicts that implementation of a behavior is a direct result of people's intention, but at the same time limited by the physical and institutional possibility of implementation. Accessibility to recycling facilities is a key factor that determines such possibility. Lack of effective facility not only physically limits the possibility to recycle but also lower people's expectation about how possible their recycle intention can be materialized. In other words, accessibility to effective infrastructure influences the realization of recycling behavior both physically and psychologically.

The influence of facility accessibility on recycling behavior has been repetitively tested and confirmed in many empirical studies. These studies are undertaken against a variety of social backgrounds, including that of China. As quite an incomplete list of the examples, Dai and his colleagues (2015) find that provision of a doorstepping waste collection service in sample communities in Shanghai, China, produced a 12.5%, statistically significant, increase in recycling rate among local residents. The results of Qu's survey in Dalian, China (2011) show that how people process their residential wastes depends on how they perceive the ease to recycle. However, current empirical studies on the connection between facility accessibility and recycling behavior may be compromised for their over-dependence on survey methodology. It would not be surprising to observe that people reported a positive attitude and intention to recycle their waste, if in the same interview they said they recycled their waste during the past few weeks or will do in the near future. Please refer to Section 2.2 for detailed discussion about the potential discrepancy between observed and self-reported behaviors.

Our study is one of the first trails that examine how facility accessibility affects recycling behavior, in a rigorous lab experiment. Specifically, we take the accessibility of recycling facilities as an intervention approach, and investigate how the service of waste recycling infrastructure affects individuals' decision about waste sorting and recycling. We further analyze the characteristics of effective recycling facilities, in hope that this would cast lights on China's recycling policy design. The results indicate that: (1) when easily accessible recycling bins are present, even people who already get used to the practice of mixed waste disposal would use that option, sort their garbage, and put the recyclable ones in the recycle bins; (2) the possibility that people recycle their wastes is not linearly related with facility accessibility, it sharply decreases once recycling requires additional efforts; (3) enhancement of facility accessibility alters individual's recycling behavior,

incineration stations would not eliminate hazard emissions if wastes were not at first fully sorted. That possibly explains why Chinese households resist incineration station building around their neighborhoods (Yang and Zhu, 2013; Wang et al., 2014; Huang, 2010; Guo and Chen, 2011; Chen, 2012).

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