



More than financial investment is needed: food waste recycling pilots in Shanghai, China



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ABSTRACT

Household and municipal solid waste (MSW) are difficult problems worldwide, but nowhere more than in the rapidly growing cities and super-cities where over half of the world's population now lives. An important mitigation is the diversion of reusable materials through sorting "at source" in the household, and in countries where most meal preparations occur at home, this includes sorting out food waste. In this paper we examine results from an early pilot scheme for food waste recycling in 100 communities in the metropolis of Shanghai, China, that has had limited success (28% diversion rates on average) and is ready for reflective changes. We consider different approaches in the literature designed to support sorting and reduction of MSW, such as law enforcement, top-down policies, community involvement and financial investment, and then explore which of these are present and missing in Shanghai. We find that there is considerable government support and willingness to make financial investment – about 1.37 million yuan per district – but this is not as effective as it could be, apparently because of a traditional lack of rigorous use of data, of clarification of roles, and of supporting enforcement legislation. Even though financial investment is important and significant for the household waste sorting and reduction, it cannot produce results on its own. It should be targeted to appropriate stakeholders in the context of wider considerations to produce an overall environment for food waste recycling to become mainstream.

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1. Introduction

With industrialization and urbanization, the material and cultural life of urban residents is expanding, accompanied by a rapid growth of the amount of municipal solid waste (MSW). The global growth rate of urban household waste has been as high as 8.42% (Wang and Shi, 2009), and the amount of MSW is expected to rise from 1.3 billion tonne/year to 2.2 billion tonne/year in 2025 (Hoorweg and Bhada-Tata, 2012). China is no exception to these trends, and therefore, since the end of the 1980s, the reduction of household waste has always been a basic requirement of the sustainable development envisioned by the government. The integration of waste recycling into solid waste management systems, i.e. facilitating eventual reuse of waste diverted out through source-sorting, is a very effective way of achieving waste reduction.

Worldwide experience shows that there are several ways to encourage sorting and reduction of MSW, including law

enforcement, control and command and financial investments in capital, set-up of new schemes and public education. We provide a summary review in Table 1 of many reported in the literature.

First, the effective reduction and recycling of municipal waste seems to require clear institutional commitment, with clear allocation of responsibilities, guidance and mandatory instructions with associated effective regulatory and enforcement mechanisms. Such instruments have been introduced in many developed countries and regions such as the EU, Japan, South Korea, Taiwan, and China relevant to household appliances, packaging waste, and food waste. For example, Lu et al. (2006) stated that the success of Taiwan's reduction of solid wastes lies primarily in sorting at source (i.e. by residents), which is enforced by law. Khetriwal et al. (2009) points out that clarification of responsibilities of government, companies and residents is an important reason for Sweden's success of recycling electronic wastes. The Extended Producer Responsibility (EPR) system, which definitively put responsibilities on the companies which producer certain goods, is established in law in Germany, Switzerland and Japan (Fleckinger and Glachant, 2010). In the US, some household waste reduction targets are enforced by law. California, for instance, passed a law related to MSW in 1989, requiring the civil authorities in its cities and

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Table 1
Policies and measures reported worldwide in the literature for waste recycling.

Policies & measures	Targeted people	Functional mechanism	Principal features	Type	Countries implemented
Segment 1: waste producer					
Levy garbage fees	Waste Producers	Stimulate households to reduce waste generation through payments to government or garbage businesses (metering and charging); or providing funds for waste disposal (equal installments over fees)	Raise funds; reduce wastes; promote recycling	Charge policies	Germany, U.S., Switzerland, South Korea, Japan, Australia, Singapore.
Direct incentives (vouchers)	Garbage sorters and recyclers	Stimulate waste sorting among waste producers	Directly stimulate garbage sorting, collection and reduction	Incentive system	The US, Israel, South Korea.
Penalization	Violators of garbage sorting policy	Compulsory measures to correct omission or non-compliance to waste sorting	Enforce waste sorting among residents	Penalize system	Japan, UK.
Collateral-return system	Consumers of containers and packages	Urge consumers to sort and return collaterals	Help sorting, recycling and reusing	Collateral system	Denmark, Finland, Germany, the Netherlands, Norway, Sweden, France, Austria, Belgium, the US, South Korea.
Segment 2: waste recyclers and scavengers					
Incorporated policies and franchise	Operators of recycle and reuse, secondary sorters	Ensure profit through added value by waste recycle and reuse	Economic incentives from the market	Economic incentive	Developing countries, such as the Philippines, Malaysia.
Recycling credits	Waste collectors and sorters	The government is responsible for offering credit loans to recyclers and sorters, encourage the sustainability of their activities and the optimizing and upgrading of operation	Capital subsidies, guiding waste recyclers to sort garbage	Support measure	Japan, South Korea.
Levy garbage fees	Waste producers	Stimulate households to reduce waste generation through payments to government or garbage businesses (metering and charging); or providing funds for waste disposal (equal installments over fees)	Raise funds; reduce wastes; promote recycling	Metering and charging system	Germany, the US, Switzerland, South Korea, Japan, Australia, Singapore
Subsidy	Offer subsidies to communities that recycle and reuse wastes	Encourage recycling and reusing activities, offering technological and financial support	Facilitate utilization of wastes as resource	Environmental contract/agreement	Most developed countries such as Belgium, the U.S., Japan
Recycling credits	Communities with utilization of wastes as resource	Offered by charging bodies of the government to local eliminators and encourages the sustainability of their recycling activities	Capital subsidies, guiding waste producers to eliminate wastes	Ditto	Israel, the US.
Segment 3: manufacturers					
Extended Producer Responsibility	Consumers or producers	Reduce wastes	Reduce productions of high wastes at the source and lower their competitiveness	Charging policy	Germany, the US, Switzerland.
Native resource tax	Various manufactures	Lower the market competitiveness of native resource, and enhance that of renewable resources	Stimulate producers to use renewable resources	Ditto	Germany, the US, Japan.
Tax Relief	Ditto	Encourage the use of environment-friendly producing activities, technologies and new energy	Promote the development of the environmental protection industry	Incentive measure	Germany, the U.S., Japan, Denmark.
Recycling credits	Ditto	Offered by charging bodies of the government to local eliminators and encourages the sustainability of their recycling activities	Capital subsidies, guiding waste recycling and utilization activities	Support measure	Israel, the US.
Segment 4: sanitation and collection businesses					
Franchise	Private businesses	Private businesses are allowed by the government to enter the field of waste collection, utilize and reuse available wastes while providing service	Market mechanism	Economic incentive	Developed countries, such as the US
Tax relief	Sanitation and collection businesses	Encourage the use of environment-friendly producing activities, technologies and new energy	Promote the development of the environmental protection industry	Incentive measure	Germany, the US, Japan, Denmark.
Recycling credits	Ditto	Offered by charging bodies of the government to local eliminators to encourage the sustainability of their recycling activities	Capital subsidies, guiding waste producers to eliminate wastes by themselves	Support measure	Israel, the US.
Segment 5: terminal disposal companies					
Terminal disposal taxes	Garbage landfills and incineration stations	The government regulates the standards of terminal disposal fees, and promotes the transition of garbage treatment toward utilization as resource and reuse	Indirectly facilitate utilization of wastes as resource	Adjustment measure	the US, France, UK, Italy
Tax relief	Ditto			Incentive measure	Germany, the US, Japan, Denmark.

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