



## Does food sorting prevents and improves sorting of household waste? A case in Sweden



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### ABSTRACT

This paper analyses household behaviour as response to changes in waste management systems. The paper discusses the results of a case study from Vellinge municipality (Sweden), where the introduction of separate food waste collection is thought to have a role in reducing the total amount of household waste and improving the sorting of packaging waste.

The study relies on data from official waste statistics and a survey of 117 municipal residents focusing on households' perceptions, attitudes and self-reflected changes in waste sorting behaviour. The respondents mentioned the increased environmental awareness and the convenience of food waste sorting among the primary reasons for the perceived changes in personal waste sorting routines. The study also tested the significance of other variables, such as income, employment, economic activity, socio-demographics, infrastructure, waste tariffs, illegal dumping, and awareness raising campaigns. Most of the variables were static and none showed sufficient correlation to the observed reduction of waste collection rates and the improvements in sorting other waste fractions. The analysed case had particularly high income levels, which were the main dynamic variable under study. The analysis suggests that we may be observing an example of a decoupling between economic growth and waste generation rates. This observation is explained by the Kuznets phenomena and it is being discussed in this paper.

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### 1. Introduction

The EU Framework Directive on Waste sets requirements for the Member states to introduce waste prevention action plans, indicators and material recycling targets for different waste streams. Recently EU Commission adopted new, more challenging requirement. This, for instance includes, by 2030 reaching 70% and 80% of material recovery targets for municipal waste and packaging waste respectively, by 2025 banning the landfilling of recyclable and organic waste that could be recovered, or to introduce national food waste prevention plans, aimed at meeting an aspirational objective to reduce food waste by 30% by 2025.

Several EU countries have already made considerable improvements in increasing material recovery and diverting waste away from landfills, but many are still struggling to reach even

previous lower targets on waste recycling and restricting the landfilling of biodegradable waste. Source separation is crucial for improving material recovery rates and especially – an early separation of food waste, which facilitates the collection of cleaner recyclables preserving material quality and increasing their value for the recycling industry. Waste prevention, as the guiding principle of the waste hierarchy, is still a challenge even among the most advanced countries in waste management.

Sweden is among very few countries succeeding in the diversion of household waste away from landfills in favour of energy and material recovery. As of 2015, less than 1% of household waste in Sweden is landfilled while about half goes to energy and another half – to material recovery. Traditionally Sweden sets higher targets for waste recovery than those of the European Union and introduces targets for new waste streams. For instance, Sweden introduced a 50% food waste recovery target for household waste by 2018, whereas a 30% target for 2025 is only discussed on the EU level.

Despite the achievements in Sweden, the main goal remains to reduce the total amount of waste (prevention) and increase material recovery over waste-to-energy solutions. There are some interesting examples emerging from introducing new waste

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management practices on the local level, for instance, separate collection of food waste from households in more than half of municipalities in Sweden. In some municipalities, the introduction of food waste sorting at home coincided with observations of reduced total generation of household waste (HW) and improved quality of sorted packaging waste. The current paper discusses the results of a Swedish study on the effects of separate food waste collection in the municipality of *Vellinge* where the possibility of correlation between the improvements and separate food waste collection is explored.

The overall aim of the study is to contribute to better understanding of waste sorting behaviour among households and provide inputs valuable in municipal planning. A better understanding about what facilitates waste prevention and has positive effect on households' sorting behaviour would help spreading more effective practices among other municipalities. In the light of the recent governmental decision to retain the producers' responsibility for packaging waste and the management of other municipal waste – on the side of municipalities, this is a relevant topic to address for both actors. The external benefits of food waste sorting could nudge the other municipalities to introduce improvements and adjust the planning of their waste management systems.

## 2. Methods and materials

The study conducted a literature review to identify socio-economic variables that are significant for waste generation and sorting. A set of selected variables were analysed for correlations with changes in municipal waste management (WM) system using statistical data on waste generation rates and sorting, interviews with waste organisation and data from survey of municipal residents who expressed their perceptions on possible changes in waste sorting behaviour. The literature review was also used for planning and designing the interview questions and the survey. Fig. 1 explains the research process figuratively.

### 2.1. Literature review

In order to explore what could influence waste generation trends we performed a literature review trying to identify the main socio-demographic and other relevant variables. Summary of literature findings on variables affecting household waste generation and recycling quality is presented in Table 1.

In forecasting waste flows and planning future waste management systems different macro-economic indicators were found to

be relevant, including, for instance, GDP-based indicators (general GDP (Miliute and Staniškis, 2010), PPP-adjusted GDP (Bach et al., 2004)), per capita income (Mazzanti et al., 2008; Mazzanti and Zoboli, 2008; Abdoli et al., 2011) or real disposable income (Benítez et al., 2008; Abdoli et al., 2011) as well as the final consumer spending (Johnstone and Labonne, 2004). Other indicators of regional economic performance are also relevant, since several sectors in economy (e.g. tourism, retail, restaurant and catering) generate waste classified and managed as municipal waste. For instance, a measure of tourism intensity could be the number of overnight stays (Bach et al., 2004). Scale of employment can be another relevant variable in regions with dominating service sectors (Abdoli et al., 2011).

Several socio-demographic parameters of households are important variables for waste generation and its composition (Johnstone and Labonne, 2004; Abdoli et al., 2011). For instance, the degree of urbanization and population density (Johnstone and Labonne, 2004; Dahlén et al., 2009), education level (Benítez et al., 2008), share of immigrants (Hage and Söderholm, 2008), household size and the number of children have correlations with the total waste as well as shares of packaging or food waste (Johnstone and Labonne, 2004; Benítez et al., 2008; Abdoli et al., 2011).

The development level of WM infrastructure is rather important for collection rates of recyclables. Bach et al. (2004), for instance, show that the average distance to collection sites affect waste paper collection rates, although a “saturation” effect also exists, i.e. – at certain densities the increases in the collection rates slow down. Burnley (2007) suggests that even the type of containers has an influence on household waste collection.

Several studies in Sweden analysed the effects of food waste separation on waste prevention and the quality of packaging waste. Dahlén et al. (2007) observed that the introduction of in-house food waste separation and packaging kerb-side collection systems in Swedish municipalities may have resulted in reduced waste generation and better sorting of recyclables. Unfortunately, the effects of food waste sorting alone were not possible to discern. NSR (2012), on the other hand, did find that municipalities with food waste sorting reached a better quality of packaging waste sorting than those without one. However, the study did not explore the effects on the total amount of waste nor tried to identify the reasons for the observed improvements. Another study with similar focus found, that municipalities with food waste sorting have a tendency to collect less combustible waste, including food waste (Utveckling, 2011), which was explained by a higher degree of packaging and paper waste collected. This study, however, had a steady-state view and did not compare the effects before and after the introduction of food waste sorting. It also did not investigate which parameters influenced the results.

The effects of regulatory, economic and informational policy instruments on WM systems are also being explored. The so-called “Pay as you trough” (PAYT) is, for instance, often found effective in reducing waste generation and improving its sorting (Hanf and Batllellé, 2008; Reichenbach, 2008; Skumatz, 2008). However, the effectiveness of PAYT seems to vary in different countries – from significant (20–30% waste reduction in Japan (Sakai et al., 2008)) to insignificant (in the U.S. (Skumatz, 2008) and the Netherlands (van Beukering et al., 2009)) or inconsistent (in Sweden (Dahlén et al., 2007; Miliute and Plepys, 2009)).

Information, education and awareness raising are important factors for the effectiveness of WM systems and consumers' recycling behaviour. Miafodzyeva and Brandt (2013), for instance, also highlighted the importance of moral norms and convenience factors. However, overall there still little consistency among such studies, especially those exploring recycling behaviour.

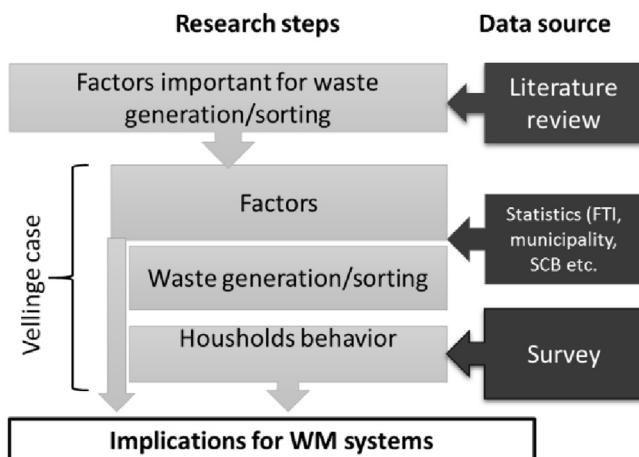


Fig. 1. The methods and research process.

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