



Household participation in recycling programs: A case study from Turkey

Fuat Budak*¹ and Burcu Oguz²

¹Department of Environmental Engineering, Faculty of Engineering and Architecture, Cukurova University, Balcali - 01330, Adana, Turkey,

²Akdeniz Municipality, 123.st.93, Akdeniz - 33070, Mersin, Turkey

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Abstract: This study investigates the underlining factors that motivate households to participate in a pilot source separation and recycling program in Turkey. The data of this research were collected from randomly selected households in the program area via face to face interviews based on an inclusive questionnaire. The results of logistic regression analysis show that having sufficient knowledge regarding recycling and the recycling program is the most statistically significant factor in determining whether a household will participate in recycling. The results also imply that some of the socio-economic and demographic characteristics of household hypothesized to affect the household decision to participate in recycling, in the research framework, are not significant.

Key words: Recycling program, Household waste management, Logistic regression, Turkey
PDF of full length paper is available with author (*fbudak@cu.edu.tr)

Introduction

The objective of improving waste management is a priority in the environmental policy agenda of most developed economies and many developing countries (CEC, 2005; Dhande *et al.*, 2005). To conserve natural resources, reduce reliance on landfills, and minimize environmental and human health impacts associated with traditional waste treatment methods; most nations have turned to aggressive pursuit of recycling and other waste reduction policies (Kipperberg, 2007). Recycling is aimed at reducing waste in the disposal phases and reclaiming value from waste. However, in order to realize the benefit of recycling, the waste must be separated either at source or at material recovery facilities. Separation of the waste at source is the cheaper option but requires commitment and participation from the public (Meen-Chee and Narayanan, 2006).

In Turkey, waste management was considered as a critical environmental policy issue since the beginning of 90's. The amount of municipal solid waste production in last decade is continually increasing and creating serious management problems and environmental consequences (Kirkitsos *et al.*, 2000). According to the results of the municipal solid waste statistics, in 2004 the amount of solid waste collected from municipalities receiving waste collection services was reached to 25 million tones/year demonstrating an increase of 41% in comparison to 17.8 million tones/year in 1994. Only a small proportion of the municipal solid waste stream (1.5%) is composted. 29% of wastes are disposed in sanitary landfills, while the rest is disposed by using non-conventional methods. The average amount of municipal solid waste generated per person per day rose from 1.10 to 1.31 kg between 1994 and 2004 (SIS, 1994; TSI, 2004). Growth in production and consumption is the main reason behind the increasing waste volumes.

Recycling of municipal solid waste, for instance paper and glass, has been a commercial activity since 1950's in Turkey. It is mostly through the scrap dealers and individual collectors working

on the streets and waste dumps. The percentage of packaging waste recycled in Turkey was estimated 36% for paper and board, 25% for glass, 30% for plastic and 30% for metals (Metin *et al.*, 2003). Around 20-25% of municipal solid waste is recyclable. However, very low recyclable waste ratio (6.4%) was found in some studies conducted in local municipal dumping site (Atasoylu *et al.*, 2007).

Source-separated collection and curbside recycling programs at the local level has been started in 1993 (Kirkitsos *et al.*, 2000; Metin *et al.*, 2003). However, very limited number of municipal recycling programs (about 60) are operational nationwide. Opinion surveys conducted in some of this program areas have shown that the overall participation rate varies between 30 and 35% (Metin *et al.*, 2003). These figures clearly demonstrate that a great efforts should be made to increase recycling.

To promote recycling, at household level, requires clarifying the responsibilities of authorities, producers and waste disposers, developing a well-functioning market for recycled materials and increasing both household participation and recycling intensity (McQuaid and Murdoch, 1996). The Ministry of Environment and Forestry has introduced a new Packaging and Packaging Waste Control Regulation to align Turkey's legislation with the EU Directive 94/62/EC and came into force in 2005. The regulation imposes on municipalities an obligation to prepare packaging wastes management plan and establish a system of waste separation and execute and coordinate training activities aiming at informing the public and increasing awareness on separate collection at source, reuse and recycling of package wastes. The regulation also requires recovering at least 60% of their package wastes in terms of weight, within ten years after the date when the Regulation is put into force.

Recycling relies on individual participation (McDonald and Ball, 1998; Read, 1999; Tucker *et al.*, 2001; Williams and Kelly, 2003; Perry and Williams, 2007). Therefore, having sufficient

information of the underlining factors that influence people to participate recycling programs is very important to improve and develop new programs to promote recycling participation.

Although several empirical studies have been conducted in the past decade to explain the determinants of households recycling behavior in developed countries (Daneshvary *et al.*, 1998; Barr *et al.*, 2003; Do Valle *et al.*, 2004; Collins *et al.*, 2006; Saphores *et al.*, 2006) but limited research was found in this context carried out in developing countries (Meen-Chee and Narayanan, 2006).

The aim of the study is to determine the significant factors that influence on household decision to participate in recycling programs.

Materials and Methods

The research was conducted in a neighborhood of Akdeniz municipality of Mersin province. The neighborhood where the pilot source separation and recycling project carried out has a population of approximately 9,000 and 3,000 households. The pilot project was supported by four municipalities (Mersin, Akdeniz, Yenisehir and Toroslar), CEVKO foundation (authorized recovery organization by Ministry of Environment and Forestry) and the Environmental Commission of Local Agenda-21 for Mersin.

The data of this research were collected from randomly selected 224 of households in the pilot source separation and recycling project area using face to face interviews based on a pre-tested questionnaire. The sample represents about a 7.5% of the households in project area. The surveys were carried out during both weekends and weekdays between the hours of 10:00 am and 6:00 pm in the homes of respondents. In each household, one person the primary decision maker at home at the time of the visit was interviewed. The survey was carried out in September 2003.

The questionnaire contained a series of items focusing on recycling based on previous studies. The questionnaire has three main sections. The first section of the questionnaire gathered information regarding knowledge and awareness of household on recycling and the pilot program, current recycling behaviors, materials separated, reasons for non-participation in the current pilot program and willingness to pay for effective waste management practices. The second part assessed information about general environmental attitudes and behaviors of respondent using the eight items instrument. In the last section of the questionnaire, socio-economic and demographic characteristics of the household such as income, age, education, household size, household combination and home ownership were collected.

Of the households interviewed, nearly 59% participated in the source separation and recycling program. The average household size was 2.97. Approximately 85% of the households live in multi-storey apartment blocks. Home-owners represented 67.4% of the sample. Just about 37% of the households were consisted of two or more adults with children under age of 18. The mean age of adults in household was 43. Of the households, 52.7%

had at least one person hold a bachelor's degree. The households that participated in the pilot program generally separate combinations of four different materials from their waste stream. The highest proportion was of the households in the pilot program that separate combination of three materials, paper products, glass and plastic, almost 37%. Nearly 11% of the households participated in the pilot program separate only one item.

We used following logistic regression model to estimate the probability of household participation in the current pilot program:

$$\ln \left[\frac{P}{1-P} \right] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_i X_i$$

where P is the probability of household participation in the program, the Xs are explanatory variables which influence the probability of participation, the β are the coefficients of the explanatory variables which have to be estimated from the data.

The dependent variable used in the equation was in a binary scale and measured as a self-reported behavior. If the households participated in the pilot source separation and recycling program the value of the dependent variable is equal to 1 and equal to 0 otherwise.

Based on the previous studies, a set of explanatory variables was included in the model (Table 1). Mainly, we focused on the variables to be expected to effect the household decision to participate in recycling programs. Also, a number of variables derived from survey data related to the self-reported environmental attitudes of respondents were added to the model to find out the effects of personal attitudes to the household decision.

Various studies were conducted to investigate the relationship between recycling behavior and socio-economic and demographic characteristic including age, education, income, gender, household size and type and home ownership. Generally, the results of these studies are contradictory regarding the predictive effect of these variables on recycling (McQuaid and Murdoch, 1996; Garces *et al.*, 2002; Do Valle *et al.*, 2004). However, several studies have found a significant relationship between some of these factors and participation in recycling (Gamba and Oskamp, 1994; Collins *et al.*, 2006; Saphores *et al.*, 2006; Meen-Chee and Narayanan, 2006). For instance, the effect of age on recycling was found non-significant in some studies (Oskamp *et al.*, 1991; Do Valle *et al.*, 2004). However, others found significant association between age and recycling (Vining and Ebreo, 1990; Barr *et al.*, 2001; Garces *et al.*, 2002). Thus, the socio-economic and demographic characteristics of households that are briefly explained below were included to the model.

Total monthly household income was measured by three dummies representing income groups low, medium and high and named as income 1, income 2 and income 3, respectively. Two continues variable, number of people and number of adults in household was entered the model to capture the effect of large families on recycling participation. Mean age of adults and number of

Table - 1: Definitions and means of the explanatory variables used in the logistic regression analysis

Variable name	Type ¹	Definition ²	Mean
Participate (Dependent)	D	Household participated in the pilot source separation and recycling program	0.5893
Income 1	D	Low household income group	0.1339
Income 2	D	Medium household income group	0.7321
Income 3	D	High household income group	0.1339
Household type 1	D	Single-person household	0.1071
Household type 2	D	Household with two or more adults, without children	0.5134
Household type 3	D	Household with two or more adults, with children	0.3706
Household type 4	D	Household with one adult, with children	0.0089
Household size	C	Number of person in household	2.9688
Adults	C	Number of adults in household	2.4643
Homeowners	D	Household own their home	0.6741
Education	C	Number of person holds a bachelor degree in household	0.8839
Mean age	C	Mean age of adults in household	43.004
Knowledge	D	Household has sufficient information about the pilot source separation and recycling program	0.7813
Environmental concern	C	Respondents' average score on the eight item instrument related to environmental concern	4.0506
WTP	D	Respondent willingness to pay for effective solid waste management	0.4107
Custodial service	D	Household receives custodial service	0.4018

¹D = Dummy, C = Continuous, ²Dummy variable takes value of 1 if the specified definition is proper and 0 otherwise

persons in household who holds a bachelor degree were also included to the model. The influence of home ownership on recycling was tested by a dummy. Four dummy variables that represent different household combinations; single-person households, households with two or more adults without children, households with two or more adults with children and households with one adult with children respectively, was used to assess the effect of household type on recycling participation.

Knowledge and awareness of the recycling programs is also important to recycling. Information such as recycling benefits, how to recycle and participate have a positive influence on increasing recycling participation. Studies found that individuals who are aware of the local recycling program are more likely to be participating in recycling (Gamba and Oskamp, 1994; Barr *et al.*, 2001; Do Valle *et al.*, 2004; Meen-Chee and Narayanan, 2006). The dummy variable knowledge was used to verify this relationship.

Generally, in the residential areas of the big cities in Turkey, the administration office of the multi-storey apartment buildings hires a custodial staff lives in usually an efficiency apartment designed for them at first floor with their family. Common custodial duties include but are not limited to, cleaning general areas and collecting garbage bags from each apartment and taking them outside to large collection bins. In the pilot project area, normally, the custodial staff in the multi-storey apartment buildings arranges collecting the sorted recyclable material bags and delivering to the collection service of the pilot program on each collection day. It was hypothesized that living in a multi-storey apartment building where custodial service is available may affect the probability of the household decision to participate in recycling. The dummy variable custodial service representing the availability of this service was included in the model.

Whereas environment attitudes appear ineffective at discriminating recyclers from non-recyclers (Scott, 1999; Do Valle *et al.*, 2004), some research found that general environmental attitudes have a positive influence on recycling (Garces *et al.*, 2002; Meen-Chee and Narayanan, 2006). The variable environmental concern included to model was created using the respondents' average score on the eight item instrument that conceptualizes environmental concern as an unidimensional general attitude developed by Preisendorfer (1996) (cited in Bamberg, 2003).

It is expected that willingness to pay for effective solid waste management reflects the respondent attitude toward to environment. Respondents were asked to state their willingness to pay for improved solid waste management. Responses were converted in a binary dummy variable (WTP) to use in the model.

In logistic regression analysis all variables were entered the equation, than the backward stepwise procedure utilizes the likelihood ratio test was used to determine the final model in which all explanatory variables are statistically significant at least the 10 percent level.

Results and Discussion

Table 2 presents the estimated parameters of the final logistic regression model obtained including the odds ratio $\exp(\beta)$ and the marginal effects of each variable. Some diagnostic tests results for the overall model were also provided. The likelihood ratio test (chi-square test) statistic that rejects the null hypothesis that all the coefficients are zero was significant at the 1 percent level.

The results of the final logistic regression model show that having sufficient knowledge about recycling and recycling program, living in a apartment building where custodial service is available,

Table - 2: Results of the final logistic regression model

Variable	Coefficient	S.E.	Wald statistic	p-value	Exp (β)	Marginal effect
Constant	-2.8651	0.5384	28.314	0.0000	0.057	
Household type 3	0.7197	0.3546	4.119	0.0424	2.054	0.1698
Homeowners	0.6032	0.3454	3.048	0.0808	1.828	0.1475
Knowledge	2.8774	0.4793	36.040	0.0000	17.768	0.5968
Custodial service	0.7344	0.3479	4.455	0.0348	2.084	0.1739
	LR statistics (4 df)	73.8805	Probability	0.0000		
	McFadden R-sqd	0.2435				
	Number of observations	224				

Table - 3: Predictive accuracy of the model

Actual	Predicted			
	Participate	Do not participate	Overall	Predictive accuracy (%)
Participate	126	6	132	95.5
Do not participate	49	43	92	46.7
Overall	175	49	224	75.4

Table - 4: Reasons for non-participation in the current pilot program

	%
Lack of knowledge about the program	37
No motivation to recycle	13
Lack of time for recycling	11
Inadequate program design	11
Lack of space to store recyclables	10
Not interested in recycling	5
Others	13

household type (two or more adults with children) and home ownership are significant positive determinants of the household decision to participate in recycling programs. Among those, knowledge is the most statistically significant factor ($p < 0.001$) in determining whether a household will participate in recycling or not.

The estimated coefficients of the model was converted to an odds ratio using the $\exp(\beta)$ function to express the impact of each explanatory variable on the odds of household decision to participate in recycling program and given Table 2.

Base on the results, the odds of household participation in recycling increase by 17.8 times for households having sufficient knowledge about recycling programs. The results also show that living in an apartment building where custodial service is available increase the odds of household participation in recycling by 2.1 times. Similarly, the odds of household participation in recycling increase by about two-fold for households composed two or more adults with children, relative to other household types. And the odds of household participation in recycling are 82.8 percent greater if the household have own home.

To express the meaning of logistic regression coefficients in terms of probabilities rather than changes in odds, the partial derivatives of probabilities with respect to the vector of characteristics were computed at the means of the Xs. The probability of household

decision to participate in recycling increases by about 59.7 percent, holding all other variables at their means, if the household have sufficient information about recycling program. Likewise, if the household lives in an apartment building where custodial service is available the probability of household decision to participate in recycling increases by 17.4 percent.

The results also imply that some of the socio-demographic characteristics of household hypothesized to affect the household decision to participate in recycling in the research framework were not significant. Specifically, education, household income, household size, number of adults in household and mean age of adults in household were found insignificant. Additionally, in terms of environmental attitudes of respondent, neither general environmental attitude nor willingness to pay for improved solid waste management was significant predictors of the household participation in recycling.

The predictive efficiency of the final model is presented in Table 3. The overall predictive accuracy of the model was appropriate (75.4%) based on the cutoff value of 0.5 meaning that any household with a probability above 50 percent is predicted to be a case.

In our survey, we also identified potential barriers to participate in the recycling program. Householders who did not participate in pilot source separation and recycling program stated different reasons for non-participation. The most cited reasons were lack of the knowledge about the program and lack of the motivation for recycling (Table 4).

This study has some findings, at the household level, likely to be important for increasing the performance of current local programs as well designing future programs. Knowledge on recycling in terms of benefits of recycling and how to recycle and participate was found the most statistically significant factor in determining whether a household will participate in recycling or not. Well informed households on recycling and recycling programs are

more likely to participate in recycling. Therefore, a marketing communication campaign, with sufficient context, for increasing recycling rates and positively influencing recycling behavior of households should be designed and implemented by local authorities (Mee *et al.*, 2004). This is the key factor to reach the established targets.

Home ownership, household type and the availability of custodial services were also found important factors that influence the households' recycling behavior. As indicated in Meen-Chee and Narayanan (2006) these type of socio-economic and demographic information can be used by local authorities to segment the households for specific marketing communication campaigns. It will increase the efficiency of campaigns.

In addition, using existing literature, we suggest that policy instruments such as user fees based on pay-as-you-throw instead of cleansing tax can be initiated by local authorities. User fees constitute a source of financing for the overall waste management system, increase recycling participation and reduce the amount of waste generated through changing consumers' purchase patterns (Sezer *et al.*, 2003; Kipperberg, 2007).

The results of the study with regard to the significant factors influence on household decision to participate in recycling programs have some implications for the local municipalities that are planning to start source separation program to motivate households to participate in recycling. However, more studies should be done, in Turkey, to understand household recycling behavior. The information obtained based on empirical research has a crucial role in designing of effective marketing campaigns to promote recycling.

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