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Factors Affecting Awareness of Recycling Symbol; The Case of Ankara

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Abstract: The present study was conducted to investigate awareness of the household about recycling symbol and their attitudes towards the recycle of packaging wastes in Turkey. The research data were gathered through questionnaires filled by 272 households in Ankara Province in February-March of the year 2013. Logit model was employed and model estimations were performed. According to the research findings most of solid wastes are collected from waste repositories and streets in primitive and unhealthy manners and only the half of packaging wastes are able to be recycled. Since these wastes are most of the time mixed with organic wastes, they are not able to be fully recycled. According to logit model results; age, level of education and income were found to be significant factors affecting awareness and attitudes of the households about recycling symbol. As the households get older, awareness of recycling symbol rate decreased. Level of education had positive impacts on awareness of recycling symbol. Increasing educational levels also increased the ratio of awareness households. Increased income has a negative impact on recycling symbol awareness.

Keywords: Ankara, household awareness, Logit Model, packaging wastes, recycling

Geri Dönüşüm Sembolü Farkındalığını Etkileyen Faktörler; Ankara Örneği

Öz: Bu çalışmada; Türkiye'de hane halkının geri dönüşüm sembolü farkındalığı ve onların ambalaj atıklarının geri dönüşümüne yönelik tutumları araştırılmıştır. Araştırma verileri 272 hane halkından anket yöntemiyle 2013 Şubat-Mart döneminde Ankara'da elde edilmiştir. Logit model kullanılarak model tahminleri yapılmıştır. Araştırma bulgularına göre, ambalaj atıkların çoğu çöp depolarından ve sokaklardan ilkel ve sağlıksız bir şekilde toplanmakta ve sadece ambalaj atıklarının yarısı geri dönüştürülebilmektedir. Bu atıklar çoğun zaman organik atıklarla karıştırıldığı için tamamen geri dönüştürülememektedirler. Logit model sonuçlarına göre; yaş, eğitim düzeyi ve gelirin, hane halkının geri dönüşüm sembolü hakkındaki bilinç ve tutumlarını etkileyen önemli faktörler olduğu belirlenmiştir. Yaşın artması, geri dönüşüm sembolü farkındalığı oranı azalmıştır. Eğitim düzeyi, geri dönüşüm sembolü farkındalığını pozitif etkilemiştir. Artan eğitim seviyesi aynı zamanda hane halkı geri dönüşüm sembolü farkındalığı da artırmıştır. Artan gelir geri dönüşüm sembolü farkındalığı üzerinde negatif etki yapmıştır.

Anahtar Kelimeler: Ambalaj atıkları, Ankara, hane halkı bilinci, geri dönüşüm, Logit Model

1. Introduction

Recycling is an environmental protection action and the primary objective is to prevent the redundant use of sources and to diminish the amount of solid wastes. Although recycling is a significant part of creating a sustainable future, it is still not common and widespread in Turkey. Well-management of packaging wastes is a significant issue for sustainable use of natural resources and it is an essential factor in providing more quality and sustainable living environment for future generations.

Collection and recycle of packaging wastes preserve natural resources, provide energy saving and ultimately provide great supports in environmental protection (Ünal, 2011). Separation of garbage and packaging waste significantly reduce the amount of waste send to waste repositories. For instance, reuse of scrap paper to produce new paper may reduce air pollution by 74-94%, water pollution by 35%, water use by 45% and cut of 20 trees may be prevented by incorporating one-ton waste paper into pulp-paper (Anonymous a, 2014). While significant progress has been achieved in recycling in the USA and Europe, the process of recycling has around 20 years of history in Turkey. The process started with the Solid Waste Control Regulation issued in 1991 (Yetim, 2014).

Environmental and economic impacts of solid wastes may reliably be reduced through a rationalist management including recycle and reuse of such wastes. Recycle of waste materials converts them into raw materials of the industry. In this way, wastes provide source efficiency in production in one hand and provide supports in natural resources and environmental protection on the other hand. In countries where people are aware of cautious use of natural resources, producers and households put a great emphasis on recycle and reuse of wastes to prevent waste of resources through either awareness or legal regulations.

Parallel to developments in packaging sector and changes in consumption habits, use of packaged products is widespread and consequently the amount and ratio of package waste in domestic solid wastes is increasing. Packaging wastes constitute about 30% of solid wastes in weight and 50% in volume (Anonymous b, 2014).

Most of solid wastes are collected from waste repositories and streets in primitive and unhealthy manners. However, some of these wastes collected from waste repositories and streets are mixed with organic wastes and therefore not fully recycled. For healthier and more efficient recycle, wastes should separately be collected at source, i.e. at homes, work places, schools, hotels and holiday resorts. The basic provision to create such a system is to provide active participation of municipality-consumer-recycling industry along with legal regulations in that system and to assign specific responsibilities to each one of them. The households should gather recyclable wastes separately from the other garbage, municipalities should collect them separately from the regular household garbage and separate them based on waste types. The recycling industry should recycle these wastes collected and separated according to their types (Metin, 2014).

Two methods are used in collecting packaged wastes. The first one is to collect with plastic bags and the other one is to collect in bins and containers. For separate collection in residential areas, both methods can either be used together or separately. However, in most provinces of Turkey, neither household's separate wastes nor the municipalities collect these wastes separately. In Turkey, separate waste collection at source is implemented in 21 provinces as specified in packaging wastes regulation. However, such works are not widespread throughout the provinces and desired levels are not reached (Anonymous e, 2008).

In Turkey, especially in large cities, intensive business facilities and rapid pace of life significantly increase the amount of wastes. Collection and separation works, which were not fulfilled by municipalities and companies, are most of the time fulfilled by garbage collectors who are aware of such an economic value. Garbage collectors provide significant cost-advantage to municipalities and firms since they undertake the tasks to be carried out by municipalities and firms. Besides the support they provided to economy, almost all of them live and work under severe and uninsured conditions to live off. While these collection works implemented by Street garbage collectors are providing significant supports for the preservation of environment and economy, solid waste collection system of Turkey hasn't been institutionalized, yet. The efforts of municipalities in this issue are still not at sufficient levels. There are various studies carried out about recycling and

recyclable wastes in Turkey. Some of them are presented below:

Altuntop et al. (2014); current status was provided about separation of packaging wastes at source, reduction, collection, transport, recycle, conversion into energy and removal processes of municipality wastes and wastewater management. Economic potential of domestic wastes to be recycled by local administrations and environmental dimensions of recycle were also investigated, implementations of national and international good practices were assessed and the areas to be developed were put forth.

Apaydın et al. (2011); this study was entitled as 'Investigation of household attitudes towards separation of recyclable solid wastes at source in Beşiktaş and Üsküdar Towns' and investigated the household attitudes toward solid waste separation at source. The ratio of households indicating voluntary participation in solid waste separation at source was 33% in Üsküdar and 27% in Beşiktaş. The ratio of households indicating participation in solid waste separation at source in case of a legal enforcement was 48% in Üsküdar and 35% in Beşiktaş.

Avan (2011) carried out a study entitled as 'Investigation of student attitudes towards recycle and environmental impacts of plastic and plastic wastes" and investigated the attitudes of students towards environment, recycling, plastic and plastic wastes. The researcher concluded that female students were more sensitive about environmental protection and male students dealt with only the economic aspects of the issue. It was also observed that students living in housing complexes were more sensitive than the students living in single-detached dwellings.

Güner (2008) carried out s study entitled as "Recyclability of domestic solid wastes of Pendik Town" and investigated the supports of domestic recyclable solid wastes to country and local economy. Akçay Han (2008) carried out a research in İstanbul-Küçükçekmece about separate collection of packaging wastes at source and reuse potential of them and to determine alternatives within the scope of Regulations on Control of Packages and Packaging Wastes.

The objectives of the present study were to put forth the household attitudes towards the recycle of packaging wastes and their awareness of recycling symbol. Mamak Town of Ankara was selected as the pilot region and questionnaires were applied to families. The research was carried out in Ankara since it is a greater city with intensive population and businesses and various means of waste collection and separation. Mamak is a large cosmopolitan town in Ankara. Therefore, it was thought that the town could represent the general better. Ankara has about 7% of country population and Mamak is the 4th greatest town of the province. Although level of poverty in capital Ankara is below the country average, there are significant differences between income distributions of people living in towns (Anonymous c, 2013).

Mamak once embodied a large waste repository of the province. The bad image created with this large repository and awful odor was wiped out through "Ankara Solid Waste Project" implemented in Mamak and this project became a model project throughout the world as a sample good implementation. The project was implemented in an integrated approach and placed among the largest ones of the world.

2. Material ve Method

The primary material of the present study was the data gathered through questionnaires filled by the families living in urban sections of Mamak Town of Ankara Province.

Proportional approach was used to find the number of samples able to best represent the research population (Miran, 2003).

$$n = \frac{Np(1-p)}{(N-1)\sigma_p^2 + p(1-p)} \quad (1)$$

where, n= sample size; N= population size (assuming 4 people in each household), number of households in central town was determined by dividing the population living in central town in 2011 address-based census with 4; p= rate of estimation, 0.5 for maximum sample size; σ_p^2= rate variance, table value at 95% confidence

interval to reach maximum sample volume was taken as 1.65 and margin of error was taken as 5%. Since the characteristics of the households constituting the research universe were not known initially, p was taken as p=0.5 as to maximize the sample size and ultimate sample size was calculated as 272 households. The number of households to be interviewed was determined based on the ratios of settlement units within total population (Engindeniz and Çukur, 2003; Armağan and Akbay, 2007; Pazarlıoğlu et al., 2007) and sample households were randomly selected.

Socio-economic factors effecting recycling symbol awareness of families living in Mamak Town of Ankara Province were analyzed through Binary Logit model. In Logit model, dependent variable is Dummy and estimated probability values vary between 0 and 1 (Amemiya, 1983; Hatırlı et al, 2004; Cankurt et al, 2010; Greene, 2011).

General functional formula of logistic function (LOGIT) is provided below (Gujarati, 1992);

$$F_i(\beta X_i) = \frac{\exp(\beta X_i + \varepsilon_i)}{1+\exp(\beta X_i + \varepsilon_i)} \quad (2)$$

where,

F (βX_i) = Index function (Awareness level of recycling symbol observed in I^{th} household, j=1 for aware ones; j=0 for unaware ones)

β= Coefficient vector of explanatory variables

X_i= Explanatory variables representing household characteristics

ε_i= Error term

Probability of sufficient awareness of recycling symbol of individuals:

$$P_i = \frac{1}{\left[1+e^{-z_i}\right]} \quad (3)$$

P_i = Probability of dependent variable

e = 10-based natural logarithm and it is approximately 2.7182.

$$Z_i = \beta X_i Z_i \qquad Z_i = \beta_1 + \beta_2 X_2 \quad (4)$$

Probability of sufficient awareness of recycling symbol, (1-P_i) formula;

$$\frac{P_i}{1-P_i} = \frac{1+e^{+z_i}}{\left[1+e^{-z_i}\right]} = e^{z_i} \quad (5)$$

When the natural logarithm of formula for odds ratio of sufficient awareness of recycling symbol was taken, the following equation is reached;

$$L_i = \ln \frac{P_i}{1-P_i} \quad Z_i = \beta_1 + \beta_2 X_2 \quad (6)$$

Logarithm of odds ratio, L, is linear not only based on X but also on research universe. L is called logit and logit model is derived from this formula (Gujarati, 1995, translated by; Şenesen and Şenesen, 1999).

Explanatory variables are deducted from observed variables and estimated as their linear components. General estimation equation for J^{th} factor, F_j, is then can be written as follows:

$$F_j = \sum_{i=1}^{p} \left[W_{ji} X_1 + W_j X_2 + ... + W_{jp} X_p\right] \quad (7)$$

W_i: Score coefficients of explanatory variables

P: Number of variables (Norusis, 1988).

As dependent variables of the research, the households aware of recycling symbol are indicated with 1 and unaware ones are indicated with 0. The factors of gender (GEN), level of education (LOE), profession (PROF), marital status (MAST), frequency of shopping (FREQ) and total household income (İNCOME) were considered as the socio-economic factors effecting household awareness of recycling symbol.

3. Results

Questionnaires were applied to 272 households through face to face interviews in Mamak Town of Ankara. Of the participants, 38.24% was male and 61.76% was female. With regard to ages of participants, 36.76% was under the age of 25, 52.21% was 25-45 and 11.03% was over the age of 45. The average age of participants was calculated as 30.33. With regard to marital status, 47.06% was married and 52.94% was single.

Considering the educational levels of survey participants, 40.44% was high school graduates, 31.98% was university graduates, 18.95% was secondary school graduates, 7.72% was primary school graduates and only 1.10% had postgraduate level of education. With regard to professions of the participants, 35.29% was student, 29.78% was civil servant-worker, 23.16%

was housewife, 6.25% was retired and 5.51% was artisan (Table 1). Considering the total monthly household incomes of the families, majority of households (54.77%) had household incomes between 1 001 and 2 000 TL and only 1.1% had household incomes over 5 001 TL.

Table 1. Model variables and statistical characteristics
Çizelge 1. *Model değişkenleri ve istatistiksel özellikler*

Variables	Groups and Explanations	Frequency	%
Dependent Variables	Unaware of recycling symbol: 0	75	27.57
	Aware of recycling symbol: 1	197	72.43
Explanatory Variables			
Gender	Male:1	104	38.24
	Female:0	168	61.76
AGE	<25 years:1	100	36.76
	25-45:2	142	52.21
	>45 years:3	30	11.03
MAST	Married:1	128	47.06
	Single:0	144	52.94
PROF	Civil servant/worker:1	81	29.78
	Retired:2	17	6.25
	House Wife:3	63	23.16
	Student: 4	96	35.29
	Artisan:5	15	5.51
LOE	Primary School :1	21	7.72
	Secondary School:2	51	18.75
	High School :3	110	40.44
	University :4	87	31.98
	Postgraduate :5	3	1.10
INCOME	|<1 000:1	46	16.91
	1 001-2 000:2	149	54.77
	2 001-3 000:3	61	22.42
	3 001-4 000:4	6	2.2
	4.001-5 000:5	7	2.6
	>5 001:6	3	1.1
FREQ	1 in every 2 months:1	31	8.1
	1 in each month:2	65	16.9
	2 in each month:3	123	32.0
	4 in each month:4	133	34.6
	More than 4 in each month:5	31	8.1

With regard to household attitudes towards recycling, 82.35% indicated that they supported recycling, 17.28% indicated that they didn't find the issue significant and 0.37% indicated that they didn't support recycling. With regard to recycling opportunities in their districts, 74.26% of households indicated that they had recycling opportunities and 25.74% indicated that they didn't have recycling opportunities in their districts. Of the participant households, 47.06% indicated that they separated recyclable garbage and 52.94% indicated that they didn't separate recyclable garbage.

Logit analysis was performed to assess the factors effecting household attitudes and awareness of recycling symbol. In this analysis, household awareness of recycling symbol was taken as the dependent variable. To explain household attitudes towards recycling and awareness of recycling symbol; GEN, AGE, MAST, LOE, PROF, FREQ, İNCOME, attitudes towards recycling, recycling opportunities in them districts and separation of recyclable wastes were considered as independent variables. AGE and INCOME were considered as continuous variable of the analysis. While recycling opportunities, recyclable waste separation and household attitudes towards recycling were subjected to analysis through grouping among themselves; level of education, gender, marital status, profession, frequency of shopping were included

into analysis as dummy variables. Logit Model results are provided in Table 2.

Table 2. Logit Model results
Çizelge2. *Logit Model sonuçları*

	β	S.E	Wald	Df	Sig.	Exp(B)
Constant	1.297	1.166	1.238	1	0.266	3.660
GEN	-0.088	0.472	0.043	1	0.835	0.915
AGE	-0.082*	0.148	14.663	1	0.000	0.922
MAST	0.319	0.121	0.481	1	0.488	1.375
LOE	1.114*	0.227	24.094	1	0.000	3.046
INCOME	-0.261**	0.460	4.621	1	0.032	0.771
FREQ	-0.053	0.148	0.127	1	0.721	0.948
PROF	0.190	0.425	0.162	1	0.687	1.209
-2 log likelihood 233,810		Chi squared [7 d.f.] 88,454		Nagelkerke R Square .400		
Significance level .00000,		Cox&Snell R-squared .278				
Note: ***, **, * ==> Significance at 1%, 5%, 10% level.						

Considering the significance levels of prominent factors in household awareness of recycling symbol, AGE and LOE were found to be significant at 1% level, INCOME was found to be significant at 5% level. Other variables were not found to be significant. The odds ratio of 0.922 for significant parameter AGE indicates 0.922 times increase in odds of awareness of recycling symbol per unit increase in AGE variable. Similarly, odds ratio of 3.046 for LOE indicates 3.046 times increase in odds of awareness of recycling symbol per unit increase in LOE variable. Again, odds ratio of 0.771 for INCOME indicates 0.771 times increase in odds of awareness of recycling symbol per unit increase in INCOME variable.

Hosmer-Lemeshow (H-L) test was employed to test the model goodness-of-fit by taking observed and expected frequencies into consideration. H-L test statistics were calculated under hypotheses of 'Ho: The model fits the data' and 'H1: The model does not fit the data'.

According to H-L test statistics results (DF; 8<Chi-Square; 10, 58), it was decided that the model was fit. Assessment of classification table is also another significant component of logit analysis; therefore, it is provided in Table 3.

Table 3. Classification table for the model on awareness of recycling symbol
Çizelge 3. *Modeli için geri dönüşüm sembolünün farkındalık üzerine sınıflandırma tablosu*

	Expected Unaware of Recycling Symbol	Expected Aware of Recycling Symbol	%
Observed Unaware of Recycling Symbol	41	35	53.90
Observed Aware of Recycling Symbol	17	179	91.30
GENERAL %			80.90

Considering the general success percentage of the model, accurate estimation percentage was calculated as 80.9% (Table 3).

4. Conclusion

The present study was conducted to investigate the factors effecting household attitudes towards recycling and awareness of recycling symbol. Some of the factors incorporated into regression analysis were not found to be significant. Among the prominent factors in awareness of recycling symbol, age, level of education and household income were found to be significant. As the households get older, odds of awareness of recycling symbol decreased. Level of education had positive impacts on awareness of recycling symbol. Increasing educational levels also increased the ratio of aware households. Household income had negative effects on awareness of recycling symbol since increasing incomes resulted in decreased ratio of aware households.

Present findings implied that socio-economic and demographic factors should definitely be taken into consideration while assessing the household awareness of recycling symbol in Turkey. Besides taking socio-economic and demographic characteristics of households into consideration in recycling plans and activities, awareness of households on recycling should also be raised. More public information should be provided to raise such awareness. Municipalities should also improve recycling services and perform implementations to motivate households to separate the wastes at source.

Consumption habits sometimes may disregard environmental aspects or ignore the hazards exerted on environment. People should think more environment-centered, improve their knowledge about environment, be conscious about environment and reflect such a conscious over the consumption habits.

Public participation and separation at source are essential to reach the targeted packaging waste collection rates. Supports of municipalities, non-governmental organizations and private companies will definitely provide significant contributions in progress of recycling. However, the other and highly significant element is the household awareness and conversion of this awareness into practice.

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