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A NATIONAL SURVEY ON SOCIO-ECONOMIC FACTORS CONTRIBUTING TO INCREASED MUNICIPAL SOLID WASTE IN KUWAIT

Abstract:

The objective of this study is to investigate socioeconomic factors that contribute to increased waste generation in Kuwait. We surveyed over 800 homeowners on their waste quantities, practices, awareness and initiatives towards waste reduction and better management. The survey collected demographic information of participants including nationality, income, property type, individuals per household, individuals employed, educational levels, etc. The study also explored public opinion and awareness towards household waste recycling and amount of tariff accepted by the public to have residential solid removed and disposed more efficiently. Statistical correlation using the Spearman Rho correlation tests identified variables that are good predictors for the solid waste generated per household. All analyses maintained a 95% confidence level.

Keywords:

Municipal waste; solid waste; socioeconomic; statistical analysis; non-parametric correlation; Spearman Rho correlation; awareness

JEL Classification: Q01, Q59

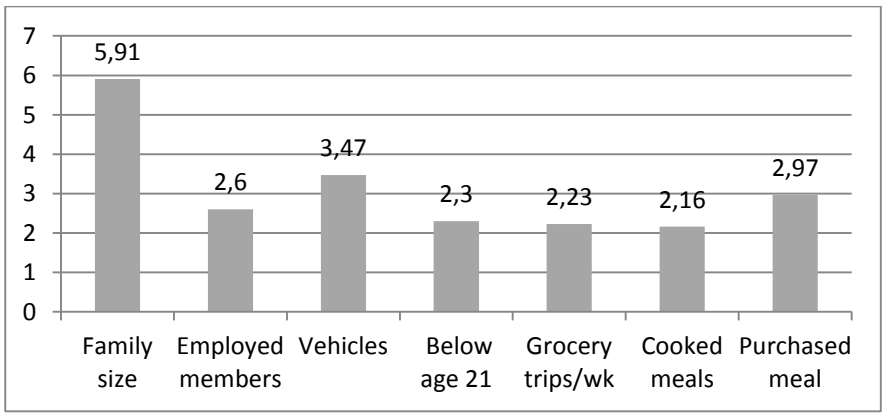
Introduction

Kuwait is a small country that occupies an area of land of 17818 km^2 located on the Arabian Gulf peninsula of the Middle East. Kuwait has a population of 2,818,042 as of 2011 (WBI, 2012). Along with an acute increase in resources consumption in Kuwait, which almost doubled during the last ten years, statistics indicate, that waste generation did as well (WHO, 2012). Alarming trends of increasing waste figures is provided in Al-Fares *et al.* (2009) and in Al-Jarallah & Aleisa (2013) as the daily average municipal waste has reached 1.4 kg/person (Al-Meshan and Mahrous, 2002). A study by Al-Jarallah & Aleisa (2014) indicate that the organic waste is dominant (44.4 %) followed by film (11.2 %), then, corrugated waste (8.6 %). The Kuwait municipality is challenged to accommodate the ever increasing MSW quantities. Understanding the factors that contribute to waste high rates is imperative, as it tackles the problem at its root cause. Economic and social dimensions, although often overlooked are key to develop informed solutions to this problem (Magrinho et al., 2006). In this study, we aim to investigate socioeconomic factors that contribute to increased waste generation in Kuwait. We accomplish that by surveying over 800 homeowners on their waste quantities, practices, awareness and initiatives towards waste reduction and better management. The survey collected demographic information of participants including nationality, income, property type, number of family members per household, number of employed family members, number of vehicles owned, highest educational level of guardian, number of members below 21, etc. The study also explored public opinion and awareness towards household waste recycling. It specifically addressed the public willingness to segregate their trash and pay tariff for better residential garbage collection and disposal. The analyses used the normality test to decide on a proper protocol to follow when proceeding with the statistical analysis. Statistical correlation analysis then identified variables that are good predictors for the Number of Waste Bags (NoWs) generated per household. All analyses maintained a 95% confidence level.

Survey Demographics

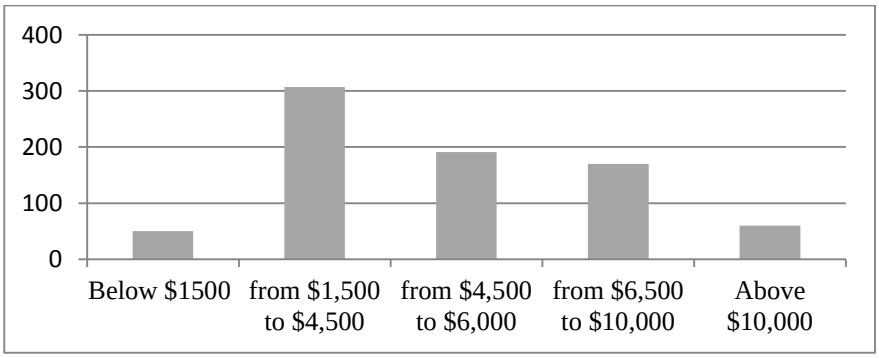
The subjects of the survey consisted of 806 households. Around 70% of the participants were males (566 recipients) while the remaining were females. An overall demographic summary of the data collected in shown in Figure 1.

Figure 1: Descriptive statistics on the survey demographic information



Monthly income per household in Kuwait is provided in Figure 2. The survey results also show that over 55% of family guardians hold a university level degree or above. Residential areas are classified into three categories according to price per square meter of residential property. From highest to lowest these are classified as: Zone A, B and C. Nationalities of recipients covered various ethnic groups however the vast majority were natives (77.5%) and Caucasians.

Figure 2: Monthly income of household guardian



Number of Waste Bags Generated per Household

The main response in this study is a composite variable that consists of number of NoWs disposed daily at residences. Table 1 shows that regardless of guardian income, the locals will dispose the same NoWs. This might be attributed to the fact that food is an affordable commodity, as basic food materials are supported by governmental sustenance program. Similarly, Table 2 shows that the NoWs appear to be slightly affected by the number of individuals (regardless of age group here) per household. Later, we shall show that NoWs is correlated to number of individuals above the age of 21.

Table 1: Cross-tabulation of Number of Waste Bags (NoWs) versus household income in (KD)

		Below 500	From 501 to1500	From 1501to 2000	From 2501to 3500	Above 3500	Total
	Count	50	307	191	170	88	806
	% within NoWs	6.2%	38.1%	23.7%	21.1%	10.9%	100.0%

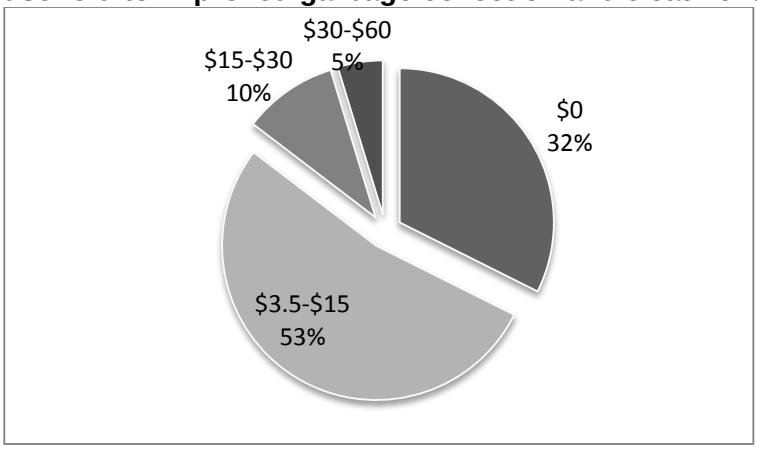
Table 2: Cross-tabulation of Number of Waste Bags (NoWs) versus number of family members per household

		Number of family members									
	Number of Waste Bags	1	2	3	4	5	6	7	8	>9	Total
	% within NoWs	4.0%	4.7%	7.9%	17.1%	20.0%	16.2%	10.5%	8.3%	11.4%	100.0%

Public Opinion and Awareness towards Household Waste Recycling

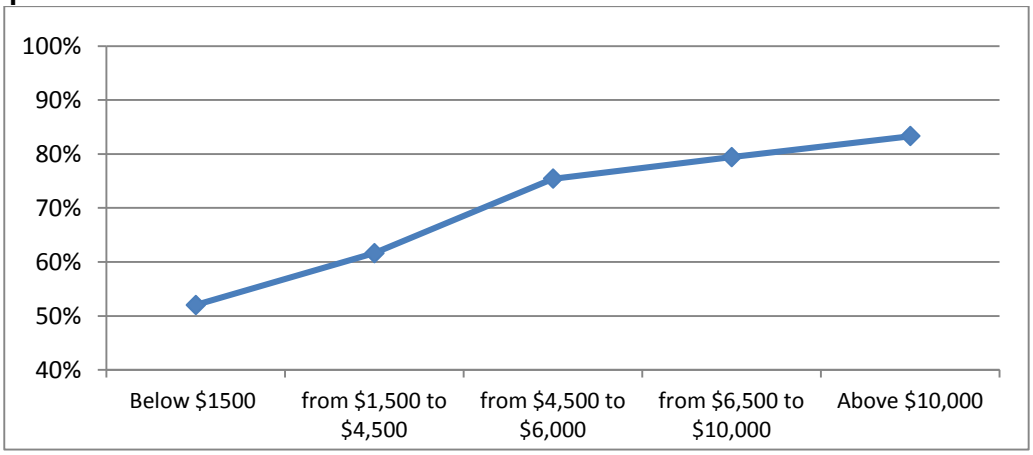
It is interesting to learn that the public didn't believe that they are generating excessive waste; actually, they thought it is adequate. The vast majority of the public (92%) did not recycle their garbage waste. Seven percent of recycled waste is between paper and plastic, the remaining is glass and other material. The public is highly motivated to segregate their trash, as the staggering majority (91.1%) favored the idea of being supplied with special containers for waste-type classification. Even better, 84% of the public agreed to pay a tariff to have residential solid removed and disposed more efficiently.

Figure 3: This figure shows amount of monthly tariff that the public is willing to pay per household to improved garbage collection and treatment



The majority accepted to pay $3.5-$15 per month to serve the waste treatment/recycling cause (see Figure 1). Public awareness of environmental issues related to garbage collection was more obvious in household with higher monthly income as opposed to lower income. Figure 4 clearly shows this relationship. Awareness and pro-activeness towards environmental protection compared to income undergoes an interesting phenomenon. Families in the middle range income (which are the vast majority) do have the initiative in sorting their garbage and paying tariff for better garbage collection and disposal. The conclusion is that the public are ready to cooperate and are awaiting legislations from authorities in this regard.

Figure 4: This chart exhibits how surveyed entities with higher household income showed more awareness to environmental adverse reaction of improper treatment and disposal of residential solid waste



Non-Parametric Correlation

This section emphasizes variables that are sound predictors of NoWs generated per household. The Spearman Rho correlation tests indicate the degree and direction of the association between two variables that are not normally distributed. A correlation coefficient ranges between a value of -1 and +1. It reveals magnitude and direction of association. A value closer to zero implies no correlation. On the other hand, a value closer to +1 implies a strong positive correlation, while a value closer to -1 implies a strong negative correlation; the case when the increase of one variable results in the decrease of the other one. Table 9 provides a matrix of correlation of all variables, two at a time. A conventional threshold of α=0.05 is customary to prove or disapprove the correlation. A significance value below 0.05 supports the presence of correlation while, higher values imply the contrary.

A highlighted cell of Table 9 indicates possible correlation between two variables with significance level enough to support the hypotheses (below α). These are as follows:

1. The NoWs is mildly positively correlated (around 30%) with the following variables:
    a. The number of vehicles (34%): Interestingly enough, the number of vehicles per household has the highest magnitude of correlation with NoWs generated. Perhaps this is due to the fact that this variable does correspond to the number of individuals over the age of 21 in the household. This result also comes to an agreement with Gomez *et al.* (2008).
    b. The number of family members (32%): this is an expected positive correlation, the more the family members the higher the waste generated.
    c. The type of resident (28%): elite type residents generates more waste than those residing intermediate or economical type properties. Unlike the aforementioned three variables, this one does not associate to number of individuals residing the property.
    d. Monthly income (20%): Monthly income of household guardian is positively correlated with NoWs generated.
2. The willingness to pay tariff has a small *negative* correlation (around 10%) with number of grocery shopping trips per week, number of NoWs disposed and monthly income. This implies that the vast majorities of individuals who are willing to pay tariff are not those of higher income nor are those that dispose more NoWs or those who have more trips to grocery stores. Nevertheless, it is mildly positively correlated (10%) with families that make more homemade meals.

Table 3: Spearman Rho correlation

		Test	A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14
A1	Area type	Corr	1.00													
		Sig														
A2	Property type	Corr	0.266	1.00												
		Sig	0.0													
A3	No. of family members	Corr	-.019	.458	1.00											
		Sig	0.599	0.0												
		Sig	0.0	0.0	0.0											
A4	No. employed family members	Corr	.047	.363	.495	1.00										
		Sig	0.181	0.0	0.0											
A5	Monthly income	Corr	.092	.506	.326	.321	1.00									
		Sig	.009	0.0	0.0	0.0										
A6	No. of vehicles	Corr	.158	.595	.587	.661	.445	1.00								
		Sig	0.0	0.0	0.0	0.0	0.0									
A7	Age of guardian	Corr	.001	.054	.043	.047	.192	.056	1.00							
		Sig	.976	.126	.219	.187	0.0	.118								
A8	Educational level of guardian	Corr	.143	-.032	-.099	-.006	-.015	-.019	-.040	1.00						
		Sig	0.0	.363	.005	.869	.66	.594	.261							

A9	No. of family members less than 21 years of age	Corr	-.058	.191	.504	.001	.153	.081	.073	-.028	1.00					
		Sig	.102	0.0	0.0	.983	0.0	.023	.037	.424						
A10	Number of grocery shopping trips /week	Corr	.030	.125	.094	.074	.127	.122	.065	.017	.099	1.00				
		Sig	.389	0.0	.007	.035	0.0	.001	.064	.625	.005					
A11	Number of homemade meals per day	Corr	-.075	.116	.217	.109	.135	.123	-.041	-.084	.188	.027	1.00			
		Sig	0.34	.001	0.0	.002	0.0	.001	.243	.017	0.0	.448				
A12	Number of delivered meals	Corr	-.032	.120	.128	.087	.10	.203	.014	-.046	.056	.149	-.029	1.00		
		Sig	.36	.001	0.0	.014	.004	0.0	.693	.195	.113	0.0	.418			
A13	Number of NoWs	Corr	.040	.278	.324	.262	.197	.340	.004	.039	.151	.133	.140	.147	1.00	
		Sig	.252	0.0	0.0	.0.0	0.0	0.0	.917	.265	0.0	0.0	0.0	0.0		
A14	Willingness to pay tariff	Corr	-.029	-.066	.005	-.003	-.099	-.059	.013	-.002	-.013	-.102	.096	-.025	-.098	1.00
		Sig	.418	.062	.883	.94	.005	.097	.722	.961	.709	.004	.006	.476	.006	

Discussion

According to Gomez *et al.* (2008), socioeconomic level has a direct effect of the MSW generation rate. This was proven true in our study; however, it was not the most significant factor influencing increased household waste. Recall, that through our study, we found that the NoWs generated per household is positively correlate with five factors. From strongest to weakest, these are: number of vehicles per household (interpreted to reflect individuals over the age of 21), the number of family members, the number of domestic servants, the type of property (zone A in particular) and, monthly income. Here, income comes in fifth place in correlation significance to excessive waste generation. In addition, Gomez *et al.* (2008) also found that there is a correlation between the age of the residents and the MSW generation rate. Households occupied with adults generate more MSW than households with the same number of occupants but with children. Our survey does in fact agree with this result. More precisely, our research supports the hypotheses that more waste is generated from families with more employed family members, or those with more owned vehicles. The obvious pro-activeness of the public to participate in waste segregation and pay tariff for better waste collection and disposal verbalizes authority to issue proper legislation in this regard. A study conducted by Dahlen *et al.*(2007) stated that the type of the waste collection system is one of the significant factors affecting the MSW generation rates. Their study showed that weight-based billing collection systems reduced MSW generation rate by 50% in Sweden, which make this type of system a powerful instrument that can be used to control the MSW generation rates.

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