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Household recycling knowledge, attitudes and practices towards solid waste management

Ali Akbar Babaei [a,b], Nadali Alavi [a,b], Gholamreza Goudarzi [a,b], Pari Teymouri [c,d], Kambiz Ahmadi [e], Mohammad Rafiee [f,*]

[a] Environmental Technologies Research Center, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[b] Department of Environmental Health Engineering, School of Public Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[c] Kurdistan Environmental Health Research Center, Kurdistan University of Medical Sciences, Sanandaj, Iran
[d] Department of Environmental Health Engineering, School of Health, Kurdistan University of Medical Sciences, Sanandaj, Iran
[e] Department of Statistics and Epidemiology, School of Public Health, Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Iran
[f] Department of Environmental Health Engineering, Shahid Beheshti University of Medical Sciences, Tehran, Iran

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ABSTRACT

A questionnaire survey consisting of 2400 householders was performed on Abadan residents to evaluate their knowledge, attitudes, and practices (KAP) towards solid waste (SW) reduction, source separation and recycling, collection and willingness to pay (WTP) for SW services. The study has also covered the relationship between demographic variables and KAP towards SW management. The data analyzed suggests that the studied community had a very positive attitude to take part in SW source separation and recycling plans. However, the respondents not only showed low intimate knowledge of different steps of SW management, but were also weak to take practices about these steps. The KAP of SW source separation and recycling was influenced by demographic factors of age, education level, gender and occupation. It was further found that education level and occupation were two significant factors affecting residents' WTP ($\chi^2 = 24.083$, p-value <0.0001). In conclusion our study found that providing public with MSW infrastructures and improving citizens' awareness about SW source separation and recycling to promote SW recycling programs hold great promise for developing effective public campaigns and behavior-changing interventions. This has important implications in that the usual KAP of public proved inadequate in the case of SW source separation and recycling. The implementation of needs-based training programmes considering females as one of the main audience groups and determination of municipality needs are thereby highly advocated.

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1. Introduction

Household waste retains an absolute majority of municipal solid waste (MSW) sources to which most costs of municipal waste management are allocated (Karak et al., 2011). MSW constitutes approximately 10 percent of the waste produced, generating approximately 50 million kilograms of MSW in Iran annually (Jamshidi et al., 2011; Nasrabadi et al., 2008). Solid waste management (SWM), therefore, assumes a prominent role in municipal services (Ahmed and Ali, 2004). Keeping the view of serious

health problems associated with population growth, rapid development and urbanization, providing a suitable waste management is perceived a challenging task in many communities. Developing countries suffer greatly from these problems, where garbage collection operations do not occur at all or not enough (Ahmed and Ali, 2006; Sharholy et al., 2007). The best and most economical method for dealing with these setbacks is to minimize the generation of waste (Farrelly and Tucker, 2014; Koolivand et al., 2014). Recycling of previously used materials has also been found to alleviate deleterious impacts of increasing amount of waste (Ehrampoush and Baghiani Moghadam, 2005). Although, it has been reported that more than half of all solid waste is recyclable, it is interesting to note that a substantial amount of recyclable waste is dumped into the garbage (Donnini Mancini et al., 2007). Hence, people play a prominent part in SWM elements such as waste generation, source separation, storage, collection, recycling and disposal. However, owing to a lack of public participation in recycling programs and

also an apparent lack of funding for waste transfer, the waste management sector in the developing country of Iran is faced with a growing concern of household waste disposal (Nasrabadi et al., 2008). Despite the fact that about 60–80% of municipal solid waste is recycled and turns back to the consumption cycle in European countries and the United States, reports in contrary to the most developed countries demonstrating only 8% of household waste recycling in Iran; however, exist. The remaining MSW is buried using unhygienic methods (Jamshidi et al., 2011).

It is worth-noting therefore that, besides providing the MSW infrastructures (by local government), achievement of integrated municipal solid waste management starts with understanding public concerns, preferences, knowledge and behaviour (Chung and Lo, 2004). The most cost-effective way of reducing household waste include public education and citizen encouragement to share in the design of household recycling processes (De Feo and De Gisi, 2010). Moreover, citizens' participation in the source separation process strongly affects the success of household recycling programs (Keramitsoglou and Tsagarakis, 2013; Krook et al., 2007). Thus, there is a crucial need to test and carry out theory-based detailed surveys to fathom the mechanisms responsible for citizen participation in the waste management programs. Assessment of factors influencing these behaviours including knowledge, attitudes, and practices (KAP) has been conducted extensively across literature (Barr, 2007; Byrne and O'Regan, 2014; Ehrampoush and Baghiani Moghadam, 2005; Nasrabadi et al., 2008; Pakpour et al., 2014; Pearson et al., 2012; Rahardyan et al., 2004). Knowledge is a familiarity, awareness or understanding of a community, such as facts, information, descriptions, or skills towards the topic of interest, which is acquired through experience or education by perceiving, discovering, or learning. Attitude is a settled way of thinking or feeling about something and refers to the community thoughts which may have tended to it. Practice, on the other hand, is an action based on the community knowledge and attitudes. Knowledge and attitude are two factors determining behaviour of society and the people in it.

Research studies in this field have usually focused on attitude, action and behaviour toward different aspects of SWM (Al-Sari et al., 2012; Barr et al., 2005; Jabbari et al., 2012; Purcell and Magette, 2010). Nevertheless, in order to achieve the goal of better and more effective recycling programs in the community, and also to assist in informing governmental strategies for waste management and solving household waste problems, it is important to know the behavioural and psychological factors influencing household recycling activities (Kofoworola, 2007; Rahardyan et al., 2004). Various studies have been conducted in this sector on elucidating the relationship between demographic variables and recycling involvement (Pakpour et al., 2014). Complicated SWM programs, which may be misunderstood by some residents, can affect SWM participation rate in a negative way (Purcell and Magette, 2010). In this sense, gender, age, education and the individual's income level are being most commonly employed variables (Pakpour et al., 2014; Saphores et al., 2006).

Attempts to improve SWM in developing countries have mainly focused on cost-effective waste management practices together with source reduction, separation and recycling (De Feo and De Gisi, 2010; Krook et al., 2007). Despite advantages of recycling programs in these countries, their implementations have encountered social oppositions including lack of public awareness and participation in recycling activities (Jamshidi et al., 2011; Nasrabadi et al., 2008). However, only a handful of studies have specifically been published showing the whole integrated treatment of public interest including knowledge, attitudes, and practices. In this field, the overall goal of the present study was to investigate and comprehend which factors prevent and/or facilitate residents participation in wastes source separation and recycling programs. Furthermore, the sense
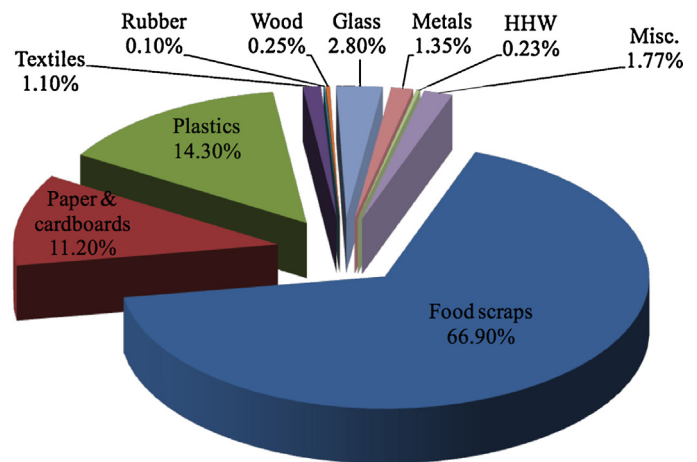

Fig. 1. MSW composition of Abadan city.

of citizens satisfaction towards SW collection system and their willingness to pay for SWM services were also noted. To achieve this goal, Abadan – a city in and the capital of Abadan County, Khuzestan Province in the Mediterranean region was selected as a model community in our study.

2. Area description and waste management in the city of Abadan

Abadan is located in the central west of Iran near the Iraqi-Iran border, with an approximate area of 2100 ha and estimated population of 228,409 in 2011. Abadan consists of 49,981 closely connected households (SCI, 2011). This city is an important industrial center in the southwest of Iran. The waste generation rate in this city, based on the data collected by local authorities, is estimated to be 0.70 ($\pm$0.10) kg per capita per day. In other words, about 290 kg of solid waste is generated annually by each citizen in Abadan city; which is comparable to other areas in Iran (Alavi Moghadam et al., 2009; Nasrabadi et al., 2008). Total amount of municipal solid waste is currently about 160 ($\pm$20) tons/d with a seasonal variation during the year.

The average loose or bulk density of the MSW is relatively high (250 kg/m^3) primarily due to the high content of food scraps (67.0 wt%) and the high average moisture content (74.5% (w/w)), as well. The physical composition of the MSW in the Abadan city is given in Fig. 1. It is clear that food scraps make up the highest proportion at 67.0 wt%, followed by plastics and paper. As shown, the percentage of food scraps in the MSW of Abadan city is fairly high, which is mostly due to use of unprocessed foods in daily people diets. Potentially recyclable materials such as paper, plastics, glass, metals and textiles all together account for 31 wt% of the MSW (Babaei and Alavi, 2010). Excluding industrial and special wastes, Abadan municipality is responsible for waste collection, transportation and disposal in accordance with waste management law in Iran (Islamic Parliament, 2004).

Solid waste is stored in no uniform waste storage bins at the source of generation in different areas of this city. Generally, household waste is stored mainly in plastic bins together with plastic bags. These bags are thrown away near houses or in medium-sized stationary containers, which are recently located in main and sub-main streets in commercial locations and in densely populated areas by Abadan municipality. Collection schedule and frequency were set differently from one place to another. Overall, a daily collection service has been provided in Abadan, with while the market areas were provided with collections twice a day. Currently, neither systematic source separation nor waste recycling programs

Table 1
Structure of questions.

Component		Question no.	Items
SW reduction, source separation and recycling	Knowledge	Q_1	SW reduction
	Knowledge	Q_2	Source separation and recycling of SW
	Knowledge	Q_3	Backyard composting of putrescible and yard waste
	Attitude	Q_4	Participating in source separation plan
	Attitude	Q_5	The aim of participating in source separation plan
	Attitude	Q_6	The most convenient separation method
	Practice	Q_7	Source separation and recycling of SW
	Attitude	Q_8	The reason for not participating in source separation and recycling plan
	Practice	Q_9	Backyard composting of putrescible and yard waste
SW collection	Attitude	Q_{10}	The best time for setting out SW
	Attitude	Q_{11}	Your opinion about common stationary container system for comingled SW collection
	Attitude	Q_{12}	Reasons for disagreement with common stationary container system
	Practice	Q_{13}	SW setting out time
	Attitude	Q_{14}	Waste collection service satisfaction
	Attitude	Q_{15}	Who should pay for waste management services
	Attitude	Q_{16}	Willingness to pay for SW services

Choice for questions:

Q_1, Q_2, Q_3, Q_7, Q_9: Yes/no.

Q_4, Q_{16}: Yes, maybe, no.

Q_5: Responsibility, awarding, using more services, etc.

Q_6: Separating in two parts (dry and wet), separating in four parts (putrescible, cardboard, plastic and other).

Q_8: No accessibility to recycle bins, lack of awareness, lack of proper service by municipality, lack of financial incentives (rewards and penalties), etc.

Q_{10}, Q_{13}: Morning, afternoon and evening.

Q_{11}: Agree, have no idea and disagree.

Q_{12}: Aesthetic aspects, malodors, health problems, accessibility, etc.

Q_{14}: Satisfied, partly and not satisfied.

Q_{15}: Government/households.

has been introduced in Abadan. All household waste compositions are mixed and disposed together with many other kinds of waste from various sources. Curbside collection is the most commonly used method in Abadan. All solid wastes are eventually ends up in an open unsanitary landfill with a total area of 80 ha located in Shadegan wetland. The operation of the landfill site was in poor conditions and solid waste is usually open dumped and burnt in open air. Furthermore, at present, no special fee is charged for solid waste management by Abadan citizens (Babaei and Alavi, 2010).

3. Materials and methods

3.1. Sampling and conducting surveys

A pre-test was conducted to find out citizens KAP about SW source separation and recycling and finally 2400 householders were selected all over the city as the sample of study (see Supplementary material).

Among known acceptable means of household survey (e.g. telephone interviews, postal surveys, web-based survey, etc.), the reliable face-to-face method due to its proposed more substantial response rate was employed to assess the KAP in this study. The similar interview surveys by Huang et al. (2006) and Zhuang et al. (2008) yielded a 95% effective response rate handed out in public areas. The response rate of 90% was also noticed in a door-to-door study conducted by Vidanaarachchi et al. (2006). In contrast, surveys conducted by mail were not considered to be efficient and reliable owing to the generally low response rate for this method. For example, in postal surveys by Wilson and Williams (2007), Martin et al. (2006) and Curran et al. (2007), response rates of 42.1%, 33.3% and 32% were respectively obtained. Similarly, telephone surveys were ruled out as it was deemed to be impersonal and intrusive.

3.2. Data gathering

A well structured questionnaire was used in order to collect necessary information in this survey. The questionnaire consisted of a set of open-ended and close-ended questions and the respected person in a house was asked to fill in the questionnaire about his/her knowledge, attitude and practice towards MSWM as well as their personal information in randomly sampled houses. Subjects younger than 15 years were excluded from the study.

It is worth-noting here that the selected questions were categorized into two distinct parts according to the type of data. Detailed information on demographics including gender, age, education level and occupation was contained in the first part. The subsequent second part containing totally 16 questions included two types of data: SW reduction, source separation and recycling as the first part and SW collection as the second part, as demonstrated in Table 1. A trained interviewer read the questions for the statistical population and made his/her records on questionnaire. All subjects provided their informed consent to participate in the study.

3.3. Statistical analyses

Statistical analysis was performed using SPSS software (version 20; SPSS Inc., Chicago, IL). The study participants' knowledge, attitude and practice were analysed using descriptive statistics. Quantitative variables were pointed out as mean ± standard deviation when the data was normally distributed, while variables were expressed as median (range) when the data was not in a normal distribution.

The influence of credibility and reliability of an investigation has been discussed to examine whether a study is credible in terms of Cronbach's alpha (α) (see Supplementary material). The α value was calculated 0.85 confirming that the employed measuring tool has had enough credibility.

The employed questionnaire in the present study was arranged by independent knowledgeable experts and the accuracy of questionnaire's data was confirmed using conceptual validity. The Chi-square (χ^2) test was used to compare categorical variables (see Supplementary material). A 2-sided p-value less than 0.05 was considered to be significant.

Table 2
Characteristics of the studied residents.

In depended group	Respondent's number and percentage	Total
Gender		2400 (100%)
Male	1985 (82.7%)	
Female	415 (17.3%)	
Age (year)		2400 (100%)
15–30	708 (29.5%)	
31–45	1061 (44.2%)	
46–60	475 (19.8%)	
>60	156 (6.5%)	
Occupation		2400 (100%)
Governmental	545 (22.7%)	
Self-employed	1368 (57%)	
Unemployed	487 (20.3%)	
Level of education		2400 (100%)
Under diploma	1087 (45.3%)	
Diploma holder	977 (40.7%)	
Higher educated	336 (14%)	

4. Results and discussion

4.1. Sample distribution

Demographic characteristics of respondents including gender, age, education status and occupation are given in Table 2. As it is clear from this table, 83% out of the total study group were male. Among the 2400 householders for whom the questionnaire filled out, 1061 participants (44.2%) were in the age-group of 31–45 years. A total of 1922 subjects (about 80%) were employed. Most of the participants had elementary and high school level education.

4.2. SW reduction, source separation and recycling

The public participation is a wholly accepted crucial element for the success of any waste management programme including source reduction and recycling, which due to its economic and environmental issues has gained more attention around the world in recent years. Results from this study demonstrated the low knowledge of respondents towards SW reduction, source separation and recycling, as well as backyard composting of putrescible wastes (1%, 10.3% and 5.5%, respectively). About 94.3% respondents were willing to participate in source separation plans due to their tendency to receive more services (85.7%), the responsibility (71%) and getting award (22.3%). Around 95% of the subjects expressed waste separation between two distinct parts (namely, dry and wet) is more convenient than its separation between four parts (putrescible, cardboard, plastic and other).

The results of the present survey indicate that 1.7% of participants did practice on source separation and recycling; however, the women's participation has been found to be reasonably effective in source separation and recycling programs (men: 0.4%; women: 1.3%). This observation is in agreement with the results obtained by Meneses and Palacio (2005), Nixon and Saphores (2009) and Saphores et al. (2006). The higher responsibility of women in being in control of domestic household has been noted as a potential reason for this behaviour (Meneses and Palacio, 2005). Accordingly, it is recommended to consider females as one of the main audience groups in training programs on waste source separation and recycling.

Refsgaard and Magnussen (2009) and Keramitsoglou and Tsagarakis (2013) noted citizen's source separation and recycling attitudes and practice can be influenced by their accessibility to recycling opportunities and corresponding knowledge towards source separation and recycling.

Respondents stated several reasons for their lack of participation in separation and recycling programs; including in no particular order: not having easy access to the recycling bins (99.3%), lack of awareness towards recycling programs (89.7%), lack of proper municipality services (51.3%) and lack of financial incentives (rewards and penalties) (23.2%) (Fig. 2). In this sense, Gonzaílez-Torre and Adenso-Diaz (2005) published a comprehensive study of potential parameters affecting the success of a recycling programme. Based on the results of this study, when recycling bins were within walking distance of their home, citizens' willingness to waste separation and recycling increased. Similar excuses have also been shown to impose adverse impacts on citizens' involvement in recycling programs. Grodzińska-Jurczak (2003) reported that most of all non-recyclers (75%) in Jaslo city, Poland, were not well informed about the location of recycling bins in the immediate vicinity of their houses. This observation was clearly the most important imperative barrier for their involvement. In spite of these lacks; however, the residents of Abadan showed a high tendency to take part in SW source separation and recycling plan (94.3%) due to get better municipality services (85.7%) and to a sense of responsibility (71%). Thus, enhancement of the source separation and recycling services through supplying recycle bins and public education would be the most likely road to promote source separation and recycling programs than other interventions.

Despite the importance of backyard composting in waste reduction and recycling, only 0.3% of participants did practice this process. Reports in contrary to the above observation demonstrating a higher participatory of citizens in backyard composting programs do; however, exist (Purcell and Magette, 2010; Vidanaarachchi et al., 2006). A potential reason for the lack of focus on backyard composting is that it is, due to the best of public knowledge and lack of public announcements, generally considered to be an inefficient method of waste disposal, and as a result there seems to be a stronger focus on advanced methods of solid waste management which have shown to, or are considered to have the potential to be, more efficient methods of disposing organic and inorganic wastes.

The impact of demographic characteristics over knowledge, attitude and practices (KAP) of solid waste management is well known. However, only a handful of studies have specifically studied the effect of demographic variables in the case of solid waste management dependency upon KAP. By conducting investigations under some demographic characteristics of Abadan citizens in the present study, a poor correlation between demographic variables and SW source reduction was found when relevant demographic characteristics, i.e. age, education level, gender and occupation were studied (Table 3). However, the increase in respondents' education level provided the largest set of significant clusters of source separation and recycling knowledge as well as their willingness to recycling ($\chi^2 = 24.083$, p-value <0.0001).

Nonetheless, it was not possible to draw a meaningful conclusion relating to the impact of education level on the citizens' awareness about the waste management issues. It may be the case therefore that education enables development of general knowledge which consequently enhances the responsibility towards the environment. These results corroborate the findings of a great deal of the previous work in this field, supporting further the idea that there is a close association between recyclers and their education level (Guerin et al., 2001; Hornik et al., 1995; Saphores et al., 2006; Vining and Ebreo, 1990). However, the exact impact on recycling behavior as a result of education level remains unclear.

In the present study of a large number of city householders, we also evaluated the respondents' knowledge of SW source separation and recycling function with their occupation. According to our results, occupation was demonstrated to be of imperative use in the prediction of household awareness towards recycling
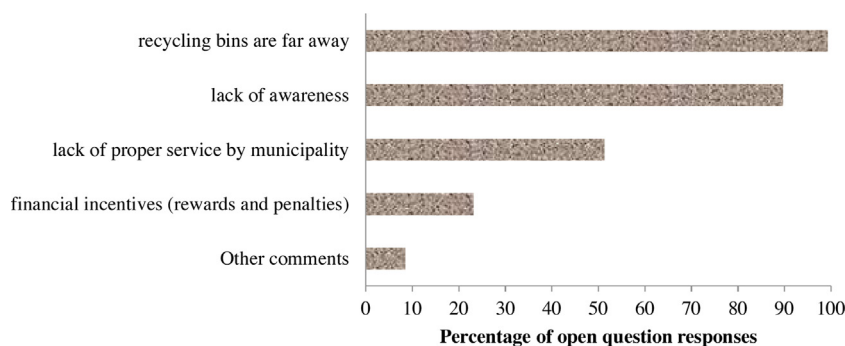
Fig. 2. Categorized responses ($N = 2359$) to the open question "the reasons for not participating in source separation and recycling plan?"

of solid wastes and their occupation, which is similar to the previously study of Omran et al. (2009) ($\chi^2 = 14.655$, p-value = 0.001). In the present study respondents with governmental occupation were also more aware than self-employed or unemployed ones ($\chi^2 = 26.077$, p-value <0.001).

In our study, age was an independent factor in predicting the respondents' tendency for taking part in SW source separation and recycling plans, and respondents with ages more than 45 years old had an increased attitude towards the development of source reduction programs ($\chi^2 = 4.484$, p-value <0.05) (Table 3). This view is supported by the findings of previous studies that middle aged and older people are more likely to recycle (Martin et al., 2006; Meneses and Palacio, 2005; Nixon and Saphores, 2009). Similarly, Singhirunnusorn et al. (2012) found that the recycling behaviour of residents was slightly improved with their age and the elderly people showed more recycling practices than younger citizens. The findings of the current study are also consistent with those of Agwu (2012) who reported a significant relationship between solid waste management practices and Port-Harcourt residents' age.

4.3. KAP of SW collection

The common curbside waste collection service, in which all refuse are packaged in cans or plastic bags and that these are taken to the curb by the waste generator or the home owner, is employed in Abadan. Coordination between SW generators and collection system is an important subject worldwide, which has recently attracted great attention. More recently, municipality of

Abadan has supplied stationary containers in the main and sub-main streets in order to increase mechanization of SW collection system. Several householders dispose their SW to each stationary container. Synchronous drop off along with collection schedule is a noteworthy factor in municipal SWM. Thus, respondents were asked to comment on the best time to leave their SW bags on the curb for collection in the present survey. It is somewhat surprising that around 96% of respondents preferred to leave out their SW late in the evening. However, the remainder (3.6%) of the respondents asked for their opinion in this study showed their preference for waste collection in the morning. Compared with the results, it was noted that about 92% of respondents leave their garbage out in the evening, the announced MSW collection time in Abadan. Furthermore, it was noticed that only 30% of participants agreed with establishment of common stationary containers in main and sub-main streets for commingled SW collection. Moreover, some possible reasons including accessibility (69.7%), aesthetic aspects (63.1%), malodours (58.3%) and health problems (25.2%) were areas of respondents' disagreement with the time of waste collection (Fig. 3).

Therefore, as there were not a sharp public disagreement on the establishment of common container system for commingled waste collection in Abadan and considering fairly poor public services in developing countries such as lack of cleaning and disinfection of containers, aesthetic and health problems, etc., the successful implementation of these systems requires giving proper municipality services, promotion of public awareness, and modification of public attitude and behaviour.

Table 3
Variation in respondents answers based on their educational level, age, gender, occupation and marital status.

| Question			Yes	No	Chi-square	p-value
Q2 (Source separation and recycling of SW)	Education	Under diploma	10.3%	89.7%	24.083	<0.0001
		Diploma holder	23.0%	77.0%		
		Higher educated	45.5%	54.8%		
	Occupation	Governmental	35.5%	64.7%	14.655	0.001
		Non-governmental	13.5%	86.5%		
		Unemployed	23.0%	77.0%		
Q4 (Participating in source separation plan)	Age	<45 years	92.3%	7.7%	4.484	0.034
		>45 years	100%	0		
Q7 (Source separation and recycling of SW)	Gender	Male	0.5%	99.5%	16.308	<0.001
		Female	7.5%	92.5%		
Q14 (Satisfaction of the MSWM)	Occupation	Governmental	12.1%	87.9%	4.204	0.044
		Self-employed	21.0%	79.0%		
		Unemployed	64.1%	35.9%		
Q16 (Willingness to pay for SW services)	Education	Under diploma	17.6%	82.4%	32.438	<0.0001
		Diploma holder	34.7%	65.3%		
		Higher educated	92.3%	7.7%		
	Occupation	Governmental	65.5%	34.5%	28.034	<0.0001
		Non-governmental	30.8%	69.2%		
		Unemployed	12.7%	87.3%		
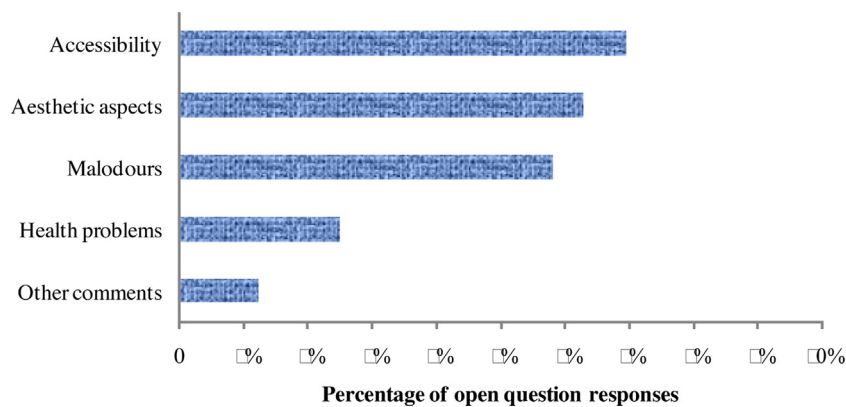
Fig. 3. Detailed reasons for residents' disagreement toward establishment common stationary containers in main and sub-main streets for comingled SW collection.

4.4. Waste collection service satisfaction

On the question of respondents' satisfaction towards waste collection services, this study found that the vast majority (72.3%) of respondents was 'unsatisfied' with their SW collection system, and the rest (27.7%) were 'satisfied'. The results of this study will now be compared to the findings of previous works. The 81% of southern province of Sri Lanka (Vidanaarachchi et al., 2006), 73% of Dublin city (Purcell and Magette, 2010) and 49% of Chittagong city Corporation of Bangladesh (Sujauddin et al., 2008) were satisfied with their existing SW collection system. We think inefficient use of container system and its low public acceptance might be of possible reasons for low satisfaction level of Abadan citizens with their waste collection service. In accordance with our hypotheses, Purcell and Magette (2010) reported that the type of collection containers can influence respondents' satisfaction with collection service.

Chi-square test results (Table 3) revealed a statistically significant difference between satisfaction with SW collection service and respondents occupation (p-value = 0.044). Unemployed respondents were more satisfied than self-employed and governmental employed ones, as well.

4.5. Payments for waste collection

A waste charge paid by residents of the community is an important and influential factor for source separation and recycling plans (Slavik and Pavel, 2013). In this sense, charge incentives are provided for citizens to recycle more, thereby generating less waste. Therefore respondents in this survey were asked for expressing their views of paying charges for waste management. At the end of this survey, of the 2400 householders, only 35% of respondents were willing to pay for SW services. The observed consequence in our study is less than the mean value reported in the extensive survey of Allahabad people ($45.6 \pm 3.5\%$) (Sharholy et al., 2007), but more than Southern Province of Sri Lanka (16%) (Vidanaarachchi et al., 2006). Respondents were further asked to explain their beliefs about who should pay for waste management services. The majority of respondents replied that government should pay for it. Accordingly, respondents showed low tendency to pay for SW services.

In our study, a statistically significant difference was found between education level and WTP for SW services (p-value <0.0001), as higher educated respondents (92.3%) paid more willingly than diploma holders (34.7%) and under diplomas (17.6%) for SW services. Similarly, occupation provided the largest set of significant clusters of WTP (p-value <0.0001). Respondents with governmental occupations (65.5%) were more interested to pay than unemployed (12.7%) and self-employed ones (30.8%). Better

understanding of the problem by educated people and greater ability of occupied ones to pay may be noted as potential reasons for this result. This is consistent with other studies exploring the relationship between these two variables and WTP, where it was found that income and education levels displayed better a positive effect on WTP (Afroz et al., 2009; Basili et al., 2006; Danso et al., 2006). These findings relating to the WTP are consistent with another study where factors such as education level, per capita income, age, extent of municipal services and respondents' knowledge about scientific recycling method could affect their willingness to pay for SW services (Chakrabarti et al., 2009).

Despite the fact that implementation of PAYT system created a financial incentive for people to reduce SW generation through source separation, recycling and composting, respondents did not show marked tendency to pay for SW services. Although, residents' education level and occupation were found to be the most noteworthy features affecting WTP, promotion of public awareness and change in their attitude, owing to minority public interest in pay, were required to implement PAYT system successfully.

5. Conclusions

The analysis of the data collected from this study largely reaffirms the consensus which has been reached to date, that in spite of public attitudes towards solid waste source separation and recycling, the majority of the respondents showed inadequate knowledge and practice related to them. The vast majority of respondents were 'unsatisfied' with their SW collection service and, as a result, they were less willing to pay for SW services.

Thus, providing public with MSW infrastructures and improving citizens' awareness about SW source separation and recycling in order to promote SW recycling programs seems to be necessary. It should also be emphasized here that in view of the current consensus of opinion a better environment starts with (local) government providing the MSW infrastructure and it ends with citizens separating MWS and putting it in the right containers. Because if the infrastructure to collect MSW is not there, there is not much citizens can do. However, more research on this topic needs to be undertaken before the association between household wastes source separation and recycling programs and its affecting variables are more clearly understood. Further studies which take the implementation of needs-based training programmes into account are therefore suggested, with more focus on females. Moreover, there is abundant room for further progress in determining municipality needs to offer proper services to citizens considering financial incentives.

Conflict of interests

Acknowledgement

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at http://dx.doi.org/10.1016/j.resconrec.2015.06.014

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