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Factors affecting the sustainability of solid waste management system—the case of Palestine

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Abstract Understanding the predictors of sustainability in solid waste management (SWM) systems can significantly contribute to eliminate many waste management problems. In this paper, the sustainability elements of SWM systems of interest are (1) attitudes toward separation at the source, (2) behaviour regarding reuse and/or recycling and (3) willingness to pay for an improved service of SWM. The predictors affecting these three elements were studied in two Palestinian cities: Ramallah and Jericho. The data were collected via structured questionnaires and direct interviews with the respondents, and the analysis utilized a logistic regression model. The results showed that the place of residence and dwelling premises are the significant factors influencing attitudes toward separation at the source; the place of residence and age are the significant factors explaining behaviour regarding reuse and/or recycling; while the dwelling premises, gender, level of education and being received education on waste management are the significant factors affecting willingness to pay for an improved service of SWM.

Keywords Solid waste management · Sustainability · Attitude · Behaviour · Willingness to pay · Palestine

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Introduction

The sustainability of solid waste management (SWM) systems is one of the major challenges in most developing countries including Palestine. Any sustainable SWM system depends, to a large extent, on available financial resources and cooperation of local population to apply waste minimization principles. As for Palestine, the common way of waste management is disposal at landfills, and the 3R principle of waste management (reduce, reuse and recycle) is still not applied on reality nor forced by legislations. Moreover, the budgets allocated for SWM need to be increased and public awareness regarding SWM problems has to be raised (Al-Khatib et al. 2007). Therefore, an evaluation of the Palestinian SWM system was recently conducted (Salah 2016) and the practice and attitude of Palestinians toward SWM issues were also further studied (Arafat et al. 2007; Al-Sari et al. 2012). In spite of both the low generation rate and the high collection service

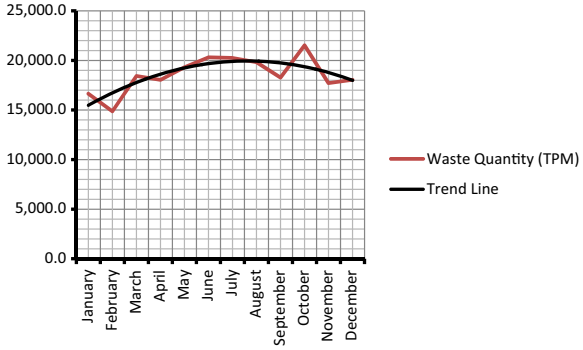

Fig. 1 Waste production in ton per month (TPM) and seasonal variation during 2015 in southern West Bank of Palestine (source: JSC-H&B monthly reports)

coverage of solid waste, there are still many opportunities to improve sustainability of the SWM system of Palestine (Al-Khatib and Arafat 2010).

The waste production in Palestine could differ from one place to another and from one season to another. For example, In Southern West Bank of Palestine, a study performed by the International Finance Cooperation (IFC) showed that solid waste generation per capita per day is about 0.69 and 0.79 for Hebron and Bethlehem districts, respectively (IFC 2012). In addition, a trend from the statistics at the Joint Services Council for Solid Waste Management for Hebron and Bethlehem Governorates (JSC-H&B) showed that in 2015, the waste production during summer is higher than that during winter, as shown in Fig. 1 (JSC-H&B 2015).

In effect, the pillars of a sustainable SWM system can be identified by three elements: (1) attitudes toward waste separation at the source, (2) behaviour regarding solid waste reuse and/or recycling and (3) willingness to pay (WTP) for an improved service of SWM. These three elements of interest, which are mutually correlated, are of great importance to the Palestinians. Addressing these particular elements will help assess the capacity of the Palestinian community to respond to the three Rs of the environment; i.e., reduce, reuse and recycle.

Segregation at the source can facilitate waste reuse and recycling and enhance waste reduction as well. Afroz et al. (2011) found that a community's willingness to separate waste is a significant predictor of waste generation. Waste minimization does not only reduce management cost but it also mitigates environmental pollution and its impacts on public health. Recycling has gained an increasing attention as a means of protecting the environment, since it offers one of the most tangible solutions both economically and ecologically to managing solid waste (Omran et al. 2009). It is worth mentioning that recycling behaviour in the developing countries has received a little attention (Li 2003; Tang et al. 2011). Also, the community's willingness to pay the waste management fees can provide a financial support and ensure an active system of SWM. The willingness to pay for waste management services or facilities indicates a successful participation of the community in SWM programs. The willingness to pay or not to pay could have a direct impact (positive or negative) on the success and reliability of any SWM system or strategy (Epp and Mauger 1989; Rahman et al. 2006; Afroz et al. 2011).

Understanding the predictors of human behaviour and attitudes might not only assist decision-makers to solve many SWM problems but also guide them to set up the appropriate remediation policies. Many researchers suggested that for a recycling program to be successful, the policy makers must have a thorough understanding of the consumers' behaviours toward recycling and their perceptions of barriers to recycling (Knussen et al. 2004; Tonglet et al. 2004; Chen and Tung 2010). Understanding of why individuals undertake pro-environmental behaviour is essential for policy makers and researchers seeking solutions to environmental problems that require behavioural changes (Witzke and Urfei 2001; Clark et al. 2003; Pirani and Secondi 2011).

However, the residents' socio-economic conditions can further influence the aforementioned three elements of a sustainable SWM system. In the residential sector, both socio-economic status and housing characteristics affect not only the amount of municipal waste generated but also how to manage it (Emery et al. 2003; Arafat et al. 2007; Purcell and Magette 2010). Human characteristics may also affect society and household behaviour concerning SWM. Knowledge, attitudes, skills, awareness status and aspirations determine an individual's behaviour and his ability to change this behaviour (Bennett 1975; Desa et al. 2011). Kurz et al. (2007) and Tang et al. (2011), for instance, illustrated that the socio-economic

status of a community is the strongest predictor of its recycling behaviour. Boldero (1995) argued that recycling behaviour is likely to be influenced by situational factors such as the amount of effort exerted, inconvenience, storage space and access to recycling schemes. Apparently, the human behaviour is a function of both the personal and the situational characteristics (D'Souza and Taghian 2005; Lee 2013).

In a study conducted by Subhan (2001), the willingness to pay (WTP) of an individual depended on his income, age, gender, race, education level, recycling behaviour, environmental protection tendencies and type of household. The study conducted by Tanrivermis (1998), however, found that the factor of socio-economic status had a significant influence on the WTP for any improved environmental quality. Other studies found links between income level and WTP but not necessarily for environmental concerns (Ubilava et al. 2010; Laidley 2013). Household income is one of the factors that significantly affect waste minimization (Afroz et al. 2011). Aside from being a technical issue, municipal SWM in Palestine is strongly influenced by political, legal, socio-cultural, environmental and economic factors as well as available resources (Al-Khatib et al. 2010).

In accordance with the National Strategy for Solid Waste Management (NSSWM 2010), Palestine generates 1.1 million t, on average, of solid waste annually. All of these wastes have been either sent to landfills or dumpsites. The waste management systems in Palestine face many financial (e.g., collection of service fees) and technical (e.g., application of waste minimization principles) challenges, which cause service interruptions. Prior studies (e.g., Al-Khatib et al. 2007, 2010; Arafat et al. 2007; Al-Sari et al. 2012; Salah 2016) on SWM in Palestine had covered various sectors of waste management and institutions, but none of them had looked for how human elements and socio-economic conditions affect the different sustainability elements of the SWM system. This paper determines the main factors that influence attitudes and human behaviour toward the SWM and the WTP for an improved SWM service. Two cities in the West Bank of Palestine, namely Ramallah and Jericho, were selected for this purpose due to the difference in socio-economic conditions and lifestyles between the two cities, while place of residence was taken as an independent factor to evaluate its effect. The main purpose of this study is to assist decision-makers and SWM specialists to design a sustainable SWM system taking into account the sustainability predictors.

Research methods

Data collection

The proposed study areas of research were Ramallah and Jericho cities in the West Bank of Palestine. The survey method was used to collect data at household level. The population surveyed had been assumed to be normally distributed with a confidence level of 95%. The population sample had been randomly selected, and sample size had been estimated as per Eq. (1).

$$n = \frac{NZ^2p(1-p)}{Nd^2 + Z^2p(1-p)} \quad (1)$$

where n = sample size, N = total number of households (sample frame), Z = standardized value corresponding to the 95% confidence level (Z = 1.96), p = proportion of success (assumed to be 50%) and d = allowable margin of error (assumed to be 5%). Based on the demographic information of Ramallah and Jericho cities from the Palestinian Central Bureau of Statistics (2009), the sample size is 370 as depicted in Table A in the supplementary material.

The survey questionnaire focused on demographic characteristics and socio-economic conditions (gender, marital status, family size, education level, income and profession) of the respondents, SWM in the study area, environmental concerns, awareness status, waste separation (sorting) at the source, recycling and reuse and willingness to pay for an improved SWM service. The questionnaires were completed through personal interviews with the targeted sample group.

Data analysis

It is worth mentioning that the methodology used for analysis by Al-Sari et al. (2012) is adopted in this study, and therefore, the reader may refer to it for further information and explanation. The analysis of the data was carried out using the Statistical Package for Social Sciences software (SPSS Inc., Chicago, IL, USA), version 15. In addition to simple frequencies tests, a logistic regression model (LRM) was employed to investigate

Table 1 Summary of the independent variables in the LRM

Variable	Description	Definition
X_1	Place of residence	1 = Ramallah and 2 = Jericho
X_2	Dwelling	1 = villa; 2 = apartment; and 3 = house
X_3	Age (in years)	1 = less than 20; 2 = from 20 to 30; 3 = from 31 to 40; 4 = from 41 to 50; and 5 = more than 50
X_4	Gender	1 = male and 2 = female
X_5	Level of education	1 = secondary; 2 = diploma; 3 = university; and 4 = others
X_6	Family size (number of people)	1 = less than three; 2 = from three to seven; and 3 = more than seven
X_7	Monthly income (USD)	1 = less than 395; 2 = from 395 to 920; 3 = from 920 to 1450; 4 = more than 1450; and 5 = no answer
X_8	Received education on SWM	1 = yes and 2 = no

significant effects of the explanatory (independent) variables in the study areas (Begum et al. 2009; Al-Sari et al. 2012; Ali et al. 2012; Ittiravivongs 2012). The explanatory variables in the LRM are as shown in Table 1. The LRM is summarized as follows in Eq. (2):

$$\mathrm{Log}\frac{P_i}{1-P_i} = \beta_0 + \beta_i X_i + e \quad (2)$$

where P_i = the dependent variable, X_i = the explanatory (independent) variables (Table 1), β_0 = a constant term, β_i = a coefficient of the independent variable, X_i = the error term and i = 1, 2,…, n which is the number of independent variables in the LRM. Now, P_i = 1 if the respondent attitude toward waste separation at the source is positive, waste reuse and recycling behaviour of respondent is satisfied and the respondent has the willingness to pay more for an improved solid waste service, and P_i = 0 if not. The direction of the relationship between the dependent variable P_i and the independent variable X_i is determined by the sign of the coefficient β_i.

The dependent variables were carefully selected by the authors to understand and explain the attitudes and behaviours of the respondents. Place of residence is important to distinguish between respondents from each city and whether it affects decisions made by respondents. Since Ramallah city is an urbanized area compared to Jericho, it is expected that respondents form Ramallah have positive responses to environmental issues. Dwelling reflects levels of lifestyle of the respondents. It is expected that respondents who live in villas have the willingness to better cooperate to solve environmental challenges and keep surrounding areas as clean and tidy as possible. Aesthetic issues might not highly matter for respondents living in apartments compared to others. As for the age, it is believed that the older the respondent is, the more dedicated to waste reuse and recycling he/she is.

Gender is a challenging variable, and expectations about the role of gender in this regard are still vague in Palestine. Further studies have to be conducted to investigate if there is a statistically significant difference between both genders regarding environmental threats and how to reduce their impacts. Level of education is an important factor to consider in this study. There is no doubt that respondents of higher education level are supposed to act positively when it comes to environmental issues and their role in social responsibility.

Family size, however, can be inversely correlated to environmental protection. A family of a larger size may have less commitment and control toward proper separation of waste as well as waste reuse and recycling. Nevertheless, monthly income plays a key role in willingness of respondents to pay for improved SWM services. Having the respondent received education (awareness and training) on SWM increases the potential of higher commitment to the environment. All these

independent variables (or characteristics) undoubtedly influence the decision made by the respondent to promote environmental health and improve household sanitation.

Parameters (or coefficients) in the LRM are estimated by the maximum likelihood method. The probability of a certain event occurring is estimated by a logistic regression through calculating the changes in the logarithm of the dependent variable. The likelihood function expresses the values of the coefficient βs in terms of known and fixed values of y ($\beta$is related to$P$), as shown in Eq. (3). The function is derived from the probability distribution of the dependent variable so that the values of the coefficient βs that maximize the output of this equation are the maximum likelihood estimates (Begum et al. 2009).

$$L\left(\frac{\beta}{y}\right) = \prod_{i-1}^{N} \frac{n_i!}{y_i!(n_i - y_i)!} P_i^{y_i}(1-P_i)^{(n_i - y_i)} \quad (3)$$

The statistical significance of each coefficient is evaluated using Eq. (4) of the Wald test (Begum et al. 2009).

$$W_i = \left(\frac{\beta_i}{SE_{\beta_i}}\right)^2 \quad (4)$$

where SE = standard error and $i = 1, 2, \ldots, n$.

The model is evaluated using four different tests: the log-likelihood function, the omnibus test, Cox and Snell R^2 and Naglekerke R^2 (Al-Sari et al. 2012). The log-likelihood function, used to measure how the model fits the data, is defined as

$$\text{Log}-\text{likelihood} = \sum_{i-1}^{n} \left[Y_i \ln\left(Y_i\right) + (1-Y_i) \ln\left(1-Y_i\right) \right] \quad (5)$$

where Y_i= the actual result and Y_i = the predicted probabilities of this result (Begum et al. 2009). This is also quoted as −2log likelihood, because it has an approximate chi-squared distribution. Theomnibus test, which is a likelihood ratio chi-squared test, indicates the goodness of fit if the coefficients of the variables in the model are all jointly equal to zero. Cox and Snell R^2 is used to evaluate the goodness of fit too; however, it determines the proportion of the variation in the dependent variable made by the independent variables of the model. Since Cox and Snell R^2 cannot achieve a maximum value of one, Nagelkerke R^2 is used as well. Nagelkerke R^2 also determines the variation proportion in the dependent variable made by the independent variables of the model (Al-Sari et al. 2012).

Table 2 Socio-economic characteristics of the respondents

Variable	Description	No.	Percent
Place of residence	Ramallah	235	63.5
	Jericho	135	36.5
	Total	370	100.0
Dwelling	Villa	32	8.6
	Apartment	174	47.0
	House	164	44.3
	Total	370	100.0
Age (years)	<20	4	1.1
	20–30	76	21.0
	31–40	120	33.1
	41–50	114	31.5
	>50	48	13.3
	Total	362	100.0
Gender	Male	161	43.5
	Female	209	56.5
	Total	370	100.0
Level of education	Secondary	132	35.7
	Diploma	95	25.7
	University	96	25.9
	Other	47	12.7
	Total	370	100.0
Family size (number of people)	<3	10	2.7
	3–7	302	82.1
	>7	56	15.2
	Total	368	100.0
Monthly income (NIS)	<1500	36	9.7
	1500–3500	199	53.8
	3500–5500	113	30.5
	>5500	13	3.5
	No answer	9	2.4
	Total	370	100.0

Results and discussion

Socio-economic characteristics of the respondents

The socio-economic characteristics of the respondents are shown in Table 2. In Table 2, the

following points should be highlighted: (1) Around two thirds of the respondents were from Ramallah city due to its larger population in comparison with Jericho (Table A in the supplementary material); (2) The number of respondents of high lifestyle was relatively low (8.6% in villas); (3) Almost two thirds of the respondents aged between 31 and 50 years; (4) There was no real difference between the number of male (43.5%) and female (56.5%) respondents; (5) One third of the respondents had education level of secondary school (35.7%); (6) 82.1% of the families had a size of three to seven members; And (7) half of the respondents' (53.8%) monthly income ranged from US$395 to US$920.

Attitudes toward waste separation at the source

Attitudes toward waste separation at the source are generally negative since 81.6% of the respondents have no willingness to exercise separation of food waste from other wastes, while only 18.4% of them have the willingness. This could be due to the lack of knowledge about the benefits of waste separation as a raw material and how we can convert food waste into a good resource at home (e.g., composting). Another reasons of influence are the absence of waste separation law and the lack of motivations by local authorities. In effect, waste separation at the source should be combined with legislations that enforce collection and disposal authorities to adopt dissimilar options of treatment to the different types of waste.

Factors affecting attitudes toward waste separation at the source

The LRM output (Table 3) suggests that both the place of residence and the dwelling type are the two significant factors influencing the respondent attitudes toward waste separation at the source. The resident of Ramallah city has more willingness to practice segregation of food waste from other wastes than the resident of Jericho. Hence, Ramallah is a perfect home for any initiative toward waste separation in Palestine. The dwelling type, which reflects the lifestyle, negatively affects the respondent attitudes: so the lower the lifestyle, the more intention to waste separation. The limited space available, lack of knowledge and absence of recycling schemes are all representing a barrier and reducing intention to waste separation.

The model summary and the results of the tests used to measure how the model fits the data are summarized in Table 4. The results show that the model fits the data well and the socio-economic characteristics of the respondents explain their attitudes toward waste separation.

The analysis of the remaining factors is summarized as follows:

- Age: the older the respondent, the more likely to exercise waste separation;
- Gender: female respondents are less likely to exercise waste separation;
- Level of education: the higher the level of education, the more positive attitudes toward waste separation;
- Family size: the higher the number of family members (family size), the more positive attitudes toward waste separation as humans are social beings by nature;
- Income: the higher the income, the more negative attitudes toward waste separation. It seems that residents of high income are not looking to saving in cost of living through waste sorting and potential reuse of some fractions. Also, residents of high income are definitely of high lifestyle who showed negative attitude toward waste sorting.
- The larger the number of people who received education on SWM, the more positive attitudes toward waste separation.

Education on waste management promotes environmental protection practices and increases the understanding of the potential application of waste fractions and recycling schemes. Various problems in SWM have recently arisen in many developing countries where there is a little history of environmental awareness education (Ojeda et al. 2000; Karout and Altuwaijri 2012) and where many members of the community are illiterate and unaware of the problem of solid waste accumulation (Li 2003; Karout and Altuwaijri 2012). Surprisingly, environmental awareness education programs have to be set and target younger people, female residents and higher income earners.

In the traditional culture of Palestinians, women are typically responsible for cooking and waste separation will be to a large extent of her responsibility. Due to the

Table 3 LRM output of factors affecting attitudes toward waste separation

Variable	Estimated coefficient (β)	Standard deviation (SD)	Wald statistics	Degree of freedom (df)	Significance (P value)
Place of residence (X_1)	−1.589	0.360	19.484	1	0.000**
Dwelling (X_2)	−0.707	0.298	5.635	1	0.018*
Age (X_3)	0.108	0.162	0.438	1	0.508
Gender (X_4)	−0.479	0.365	1.715	1	0.190
Level of education (X_5)	0.014	0.136	0.010	1	0.921
Family size (X_6)	0.087	0.385	0.051	1	0.821
Monthly income (X_7)	−0.191	0.178	1.147	1	0.284
Received education on SWM (X_8)	0.557	0.572	0.950	1	0.330

*Significant at P value ≤0.05; **Significant at P value ≤0.01

women's pivotal role at home, they concern more than men about health risks and environmental threats and this concern sometimes leads women to have negative (or conservative) attitudes toward these issues (Ma 2003). In waste separation, efforts and resources are needed not only to separate food (or perishable) waste from other types of solid wastes but also to reuse or recycle (dispose) food waste which is of high content of organic matter that may shortly decompose and emit foul smell. At household level, the cooperation of all family members to making waste separation a success is required. There is no clear strategy of waste separation at the level of society.

Therefore, female respondents were more transparent and pragmatic when they reveal their negative attitudes as waste of all types will be eventually mixed up even if waste separation was practiced at household level. If more than half of municipal solid wastes of Palestinians are organic matters (AbdAlqader and Hamad 2012), mixing up wastes will unnecessarily limit landfill capacity and shorten its lifetime. The entails local communities and solid waste management institutions to enact robust waste separation policy that promotes environmental protection practices and better use available resources.

Behaviour regarding solid waste reuse and recycling

In general, the behaviour regarding waste management is unsatisfactory, as the vast majority of the respondents had never practiced reuse or recycling of solid waste, as shown in Table 5. The materials usually considered in reuse and recycling schemes are bottles, cans, glasses, plastics, papers, metals, clothes, organics and old furniture. The common waste management practices that suffer from lack of formal recycling schemes as well as absence of education on waste management could both be the main reasons behind this poor knowledge and behaviour concerning waste management. In comparison with other developing countries, Omran et al. (2009) found that 59.9% of the households did not participate in recycling activities in Malaysia. Whereas Ittiravivongs (2012) found that 60.6% of the respondents reported that they had the intention to recycle in Thailand. It is known that having the intention to reuse or recycle solid waste does not

Table 4 Model summary and goodness of fit tests

Test	Result		
Model summary	−2 log likelihood	Cox and Snell R^2	Nagelkerke R^2
	281.184	0.151	0.247
Omnibus test of model coefficients	Chi-squared	Degree of freedom	Significance
	58.826	8	0.000

Table 5 Behavior regarding solid waste reuse and recycling

Reuse and recycling of solid waste	No.	Percent
Yes	22	6.0
No	347	94.0
Total	369	100.0

necessarily guarantee the people's desirable behavioural change (e.g., practicing or participating solid waste reuse and recycle) on waste management.

Factors affecting the residents' behaviour regarding reuse and recycling of solid waste

Table 6 presents the output of the LRM to analyze respondent behaviour regarding waste reuse and recycling. It seems that the place of residence and age are the significant factors determining the respondent behaviour regarding solid waste reuse and recycling. The residents of Ramallah city have a better behaviour regarding reuse and recycling of solid waste. Older people have negative behaviour regarding reuse and recycling of solid waste. This is in line with the findings of Ebreo and Vining (2001) who found that the household recycling behaviour is negatively affected by the age. On the contrary, Li (2003) found that the age is a significant factor positively affecting the household recycling behaviour. Overall, age is a significant factor that negatively influences environmental attitudes of people as shown in many survey studies (e.g., Hamilton 1985; Jones and Dunlap 1992; Ma 2003).

The rest of model outputs can be summarized as follows:

- Lifestyle: the higher the lifestyle (dwelling type), the more negative behaviour regarding solid waste reuse and recycling;
- Gender: women behaviour regarding solid waste reuse and recycling is negative. However, the gender was found to be a significant factor positively affecting household recycling behaviour (Tang et al. 2011; Li 2013);
- Level of education: the higher the level of education, the more positive behaviour regarding solid waste reuse and recycling;
- Family size: the larger the family size, the more positive behaviour of solid waste reuse and recycling; and
- The people who received education on SWM have more positive behaviour as they are practicing reuse and/or recycling of waste materials.

The goodness of fit data shown in Table 7 indicates that the model fits the data well.

Willingness to pay for an improved service

Around two thirds of the respondents in the study area (63.2%) have the willingness to pay for an improved solid waste service, as shown in Table 8. The residents share the responsibility to improve the solid waste service with its provider (Desa et al. 2011). Comparing the situation in Palestine

Table 6 Factors affecting behavior regarding solid waste reuse and recycling

Variable	Estimated coefficient (β)	Standard deviation (SD)	Wald statistics	Degree of freedom (df)	Significance (P value)
Place of residence (X_1)	−2.231	0.695	10.290	1	0.001**
Dwelling (X_2)	−0.432	0.501	0.744	1	0.388
Age (X_3)	−0.703	0.283	6.156	1	0.013*
Gender (X_4)	−0.503	0.596	0.712	1	0.399
Level of education (X_5)	0.375	0.215	3.050	1	0.081
Family size (X_6)	0.022	0.609	0.001	1	0.971
Income (X_7)	0.060	0.267	0.050	1	0.822
Received Education on SWM (X_8)	0.760	0.770	0.974	1	0.324

*Significant at $P \leq 0.05$; **Significant at $P \leq 0.01$

Table 7 Model summary and goodness of fit

Test	Result		
Model summary	−2 log likelihood	Cox and Snell R^2	Nagelkerke R^2
	125.775	0.091	0.253
Omnibus test of model coefficients	Chi-squared	Degree of freedom	Significance
	34.201	8	0.000

Table 8 Willingness to pay for an improved service

Willingness to pay for an improved service	No.	Percent
Yes	234	63.2
No	136	36.8
Total	370	100.0

with other countries, a study at New Bangi Town in Malaysia showed that 85.5% of the respondents were willing to pay for an improved solid waste service (Ali et al. 2012). The confidence of the community members in SWM institutions is a key parameter in this regard. The reason why some residents are not willing to pay could be either their beliefs that this is another way to increase fees for nothing or simply their limited financial resources. In the shadow of the great economic recession the Palestinian areas experience, the percentage of residents willing to pay for an improved service is still significant.

Factors affecting the residents' willingness to pay for an improved service

The LRM was developed to explore the influencing factors on the respondents' willingness to pay for an improved solid waste service. The output of the model is shown in Table 9. The results showed that dwelling, gender, level of education and having received education on waste management are the significant factors affecting the respondent willingness to pay. The influences on the respondents' willingness to pay for an improved service can be summarized as follows:

- Lifestyle: as the dwelling indicates the lifestyle, the higher the lifestyle, the more willingness to pay for an improved service;
- Age: old people express more willingness to pay for an improved service than young people. This is in contrary with results found by Ali et al. (2012), who concluded that old people had less willingness to pay for environmental services;
- Level of education: the higher the level of education, the more willingness to pay for an improved service;

Table 9 Factors affecting the residents' willingness to pay for an improved service

Variable	Estimated coefficient (β)	Standard deviation (SD)	Wald statistics	Degree of freedom (df)	Significance (P value)
Dwelling (X_2)	1.463	0.249	34.438	1	0.000**
Age (X_3)	0.248	0.134	3.433	1	0.064
Gender (X_4)	1.581	0.291	29.606	1	0.000**
Level of education (X_5)	0.364	0.125	8.415	1	0.004**
Family size (X_6)	−0.188	0.340	0.308	1	0.579
Income (X_7)	−0.297	0.174	2.906	1	0.088
Received Education on SWM (X_8)	−1.894	0.623	9.250	1	0.002**

*significant at $P \leq 0.05$

**significant at $P \leq 0.01$

Table 10 Model summary and goodness of fit tests

Test	Result		
+6	−2 log likelihood	Cox and Snell R^2	Nagelkerke R^2
	363.118	0.256	0.352
Omnibus test of model coefficients	Chi-squared	Degree of freedom	Significance
	106.648	7	0.000

- Family size: the size of the family is correlated negatively with the willingness to pay for an improved service, unlike both attitudes toward waste separation and behaviour regarding solid waste reuse and recycling;
- Monthly income is negatively correlated with the willingness to pay. This is of no surprise in Palestine when you know that the current average fee of solid waste collection is approximately US$1.6 per household per month (Al-Khatib et al. 2007). On the contrary, Ali et al. (2012) found that when the income of a person increases, it will increase his willingness to pay for an improved service. Again, it sounds that income itself is not the major determinant of people attitudes toward environmental issues; and
- Received education on SWM is negatively influencing the willingness to pay of the respondents for an improved service. This is interesting as it contradicts with trends in both attitudes toward waste separation and behaviour regarding solid waste reuse and recycling.

However, the model fits the data well in accordance with the goodness of fit tests shown in Table 10.

Conclusion and recommendation

Sustainability is a cornerstone in solid waste management systems to insure reliable waste management. The solid waste management system is sustainable if three main elements are recognized by the community: readiness to separate waste at the source, recognition of waste reuse and/or recycling and willingness to pay for the service. In order to improve any waste management system, however, the predictors that influence the three elements (pillars) should be identified and remediation measures should be taken to eliminate any negative effects.

In this study, two cities in the West Bank of Palestine, namely Ramallah and Jericho, were selected due to the difference in socio-economic conditions and lifestyle between the two cities. In the study areas, it is concluded that prevailing attitudes and behaviours toward waste management are negative, while the willingness to pay for an improved service is found positive. Attitudes toward waste separation at the source are significantly affected by the place of residence and the dwelling type. The place of residence and age are both found to be the significant factors affecting behaviour regarding solid waste reuse and/or recycling. The dwelling type, gender, education level and having received education on solid waste management are found to be the significant factors influencing the resident willingness to pay for an improved solid waste service. It is found that Ramallah is a perfect home for any initiatives toward environmental protection in Palestine.

It is highly recommended to design and carry out awareness and education programs taking into consideration age and gender issues to eliminate the negative impacts of both elements on waste management. Further, it is recommended to widen the area where the promotion of waste management and awareness is launched. Since the place of residence and the lifestyle are significantly affecting attitudes toward waste separation at the source, the initiation of such education should be based on geographical areas and socio-economic status of the local population to speed up the progress in recognition and respect the principles of waste management and sustainability of the system as well.

Among the future perspectives to improve the SWM system could be the upgrading of the SWM policy. The policy shall take into account the 3R principles of SWM (reduce, reuse and recycle). In addition, the involvement of the private sector in SWM in parallel with incentives to encourage investments in order to develop collection,

sorting and recycling schemes and marketing of reusable and recycled materials could be one of the effective perspectives to improve SWM.

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