
The environmental resource management paradox in an impoverished urban population: a case study from Malaysia

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Abstract: This study is an attempt to investigate the poverty-environment paradox from the perspective of an emerging country, namely Malaysia. To test the paradox, this study assesses attitude and behaviour of the urban poor with reference to solid waste management and their willingness to pay for an improved solid waste collection and disposal service in their residential areas. Empirical results nullify the null hypothesis, favouring urban poor as their attitude and behaviour are found to be environmentally sound and surprisingly ethical. Also, their willingness to pay for improving environmental conditions is considered to be good news for local governments, who could use this strategy in their efforts to improve the environmental conditions related to household waste management and to reduce urban poverty. Policies and initiatives, which are aiming at improving living conditions of urban poor and raising awareness among stakeholders, are crucial for reducing both the environmental degradation and urban poverty.

Keywords: poverty-environment paradox; waste management; urban poor; willingness to pay; environmental attitude and behaviour; Malaysia.

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1 Introduction

There is a paradox in attempting to draw a solid conclusion on the link between poverty and environmental degradation. Since the 1970s, scholars around the world have agreed that poverty and environmental degradation are inextricably linked, and they suggested that the alleviation of poverty has to come first before implementing any effective environmental policy. Whilst many studies have recently argued very specifically that poverty is the principal or only cause of environmental degradation, findings from other reports support the contention that environmental degradation is the principal cause of poverty. This section briefly describes a few of those recent studies which debated the paradox between poverty and environmental degradation in developing countries. Grossman and Krueger (1995) contend that, in impoverished countries, people are encouraged to use more and more resources to assist their basic necessities and livelihoods. As a result, their pro-poor actions actually make things worse for the environment and can be destructive.

The study by Swinton and Quiroz (2003) reports that poverty is likely to degrade the soil and forest, as the poorest households in Peru tend to harvest fuel wood for cooking and heating, and these activities will affect the sustainability of natural resources. Similarly, the analyses by Onwuka (2005) and Saliu et al. (2007) report that poverty contributed to a large amount of carbon emissions and land degradation because millions of people are forced to engage in environmental destruction for the sake of survival. On the other hand, empirical findings in work done by Murad et al. (2007), Murad and Siwar (2006), Murad (2002) and Holmberg and Thompson (1991), suggest that causality between poverty and environmental is actually the other way. These studies assert that poor people instead manage their environments in sophisticated and sustainable ways, and poverty can serve to limit their impact on the environment.

There is a third group of researchers who are cautious enough in drawing a solid conclusion on the link between poverty and environmental degradation, as they are still not convinced about that link due to unexplained conditions or extents. For example, Reardon and Vosti (1995) argue that it is the level of poverty that influences the link and that it is the type of environmental problem that shapes this connection. Similarly, a very recent study by Masron and Subramaniam (2018) report that the affiliation between poverty and degradation is still not fully understood. Several countries which successfully

reduced their countries' level of poverty such as Bulgaria, Costa Rica, Malaysia, Tajikistan, and Uzbekistan are also able to at least maintain the quality of their natural environment. Similarly, Binns et al. (2012) report empirically that in developing countries environmental problems reflect the very lack of economic development and poverty.

Looking at the poverty-environment paradox in Malaysia may give us important insights into the issue from a developing as well as an emerging country perspective. Malaysia's socioeconomic transformation has resulted in both positive and negative environmental outcomes in terms of its populations' health, especially for the urban poor and low-income communities (Murad et al., 2014). Since the country's economic activities are located largely in urban areas, a disproportionate increase in the population in these zones has resulted in congestion, inadequate housing, the problem of squatters and marginal settlements as well as poor household waste management and other basic services. The Department of National Solid Waste Management, established in 2007, has been promoting sustainable waste management practices through reducing, reusing and recycling municipal solid wastes and using appropriate technologies, facilities and equipment. The Department is also responsible for implementing the full privatisation of solid waste management to businesses that are approved and licensed to do so. However, the problems related to solid waste management especially in low-cost areas where squatters, the urban poor and low-income households mainly reside; still persist to an alarming level. This crisis has been well noted by researchers who argue that poor people live in deplorable environments and conditions where socio-economic facilities and services such as solid waste management are virtually non-existent (Myers, 2005; Couth and Trois 2012). A recent study by Kubanza and Simatele (2016) reports that in the poverty-environment nexus, whereby the urban poor bear a huge burden of removing or recycling solid wastes and face multiple challenges associated with poor management of solid waste. The end result is poor and unhealthy living conditions for the majority of urban residents.

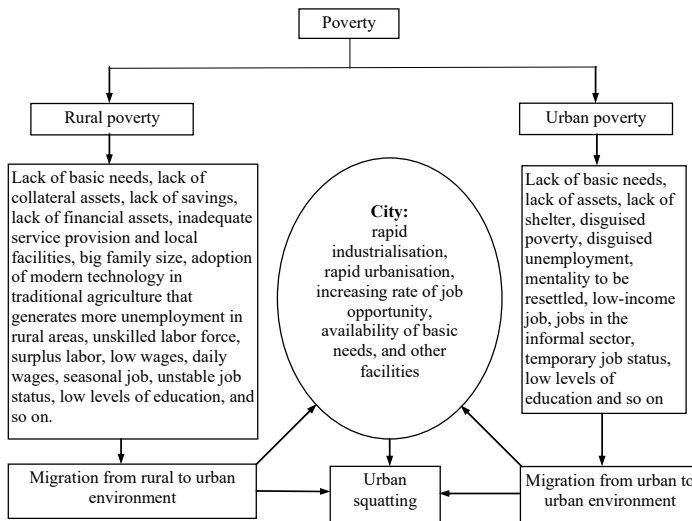
1.1 Conceptual framework

In Malaysia, the environmental problems originating from improper solid waste management are closely connected to population clusters living in urban underdeveloped/low-cost areas and informal settlements. The government has been working to minimise economic disparity throughout the country and resettle the urban poor in low-cost flats and longhouses, in the expectation that the problems of urban poverty and resulting solid waste management are expected to decline in the next decade. Currently, over 23,000 tons of waste are produced each day in Malaysia, and this amount is expected to rise to 30,000 tons by the year 2020 (Global Environment Centre, 2018). Whilst the functioning of solid waste management in Malaysia is deemed to be generally satisfactory, the poor and low-income communities living in urban areas and low-cost flats still suffer from inadequate service provisions of household waste disposal and collection.

For most population groups in Malaysia, urban areas have been a means for improving their quality of living and obtaining better jobs and incomes. This, in contrast to the deteriorating economic conditions in the rural areas, has generated a considerable flow of migrants to cities, particularly in the last three decades. Conceptually, big cities

attract not only rural migrants who have high expectations of bettering themselves in the city, but also migrants from smaller towns and cities. This is because with the traditional rural industry sector being unable to generate enough business and employment opportunities for farming people, an unprecedented shift from rural to urban areas has taken place. People are pulled to urban areas in search of jobs and a better life or pushed from rural areas by poverty and lack of cultivatable land, etc., which have been conceptualised in Figure 1.

Figure 1 Nature and extent of urban poverty in Malaysia

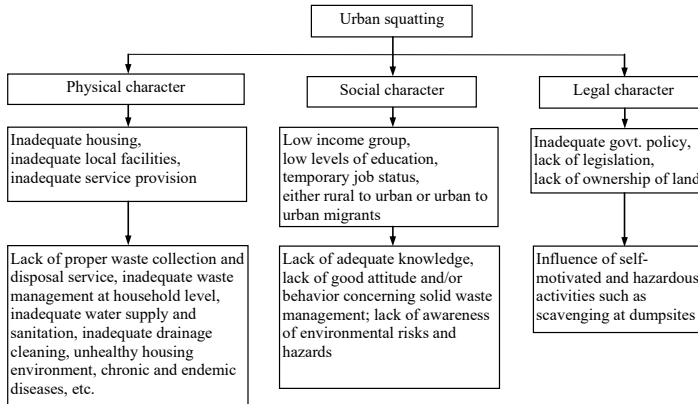


Source: Authors' conceptualisation

The characteristics of squatter settlement vary widely from country to country and depend on a variety of defining parameters. Squatter settlements in Kuala Lumpur are mainly either located in peripheral areas with sparse or non-existent services such as education, health, transport, waste disposal, water supply, sanitation and so on, or in high-risk inner-city areas. Squatters and low-cost flat dwellers are generally categorised as the urban poor because the majority of the city's poor and low-income groups live in hovels and low-cost flats. The physical, social and legal characteristics of the squatter settlements in Kuala Lumpur are summarised in Figure 2.

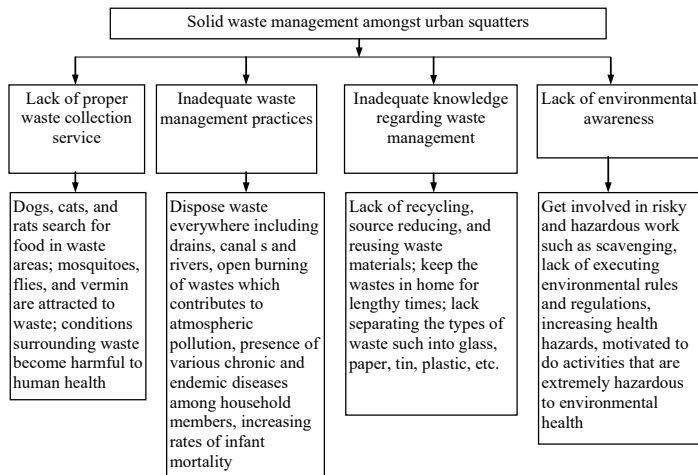
Deficiencies in the management of solid wastes are very often pronounced in the cities and towns of developing countries. Squatter settlements in Kuala Lumpur, however, are generally characterised by the non-existence or severe lack of basic waste collection and disposal services. This is because squatter settlements are considered illegal and thus they are not generally served with any public amenities including collection and disposal of household wastes. Due to the nature and characteristics of squatter settlements, inadequate household waste management is perceived to be the norm (see Figure 3).

Figure 2 Physical, social, and legal characteristics of squatters in Kuala Lumpur



Source: Authors' conceptualisation

Figure 3 Conceptual framework of solid waste management amongst squatters in Kuala Lumpur



Source: Authors' conceptualisation

1.2 Hypothesis and objective

The above literature and theoretical framework provide a mixed understanding of the link between poverty and environmental resource management, which is why we call it paradoxical. We believe that household solid wastes, if recycled, reused and

source-reduced, are widely considered environmental resources as these practices are meant to protect the environment and increase poor people's incomes or save them costs. Yet poor people are usually blamed for degrading the environment, which we found is not true in our study, and hence the paradox of poverty-environment attracts debate. We believe that the root cause of environmental degradation is not poverty but is in fact due – to name a few – rapid but unregulated development, corruption, lack of democracy and law and order. In Malaysia, for example, the percentage of people living in hardcore poverty conditions was 3.8% in 2008 and it declined to 3.4% in 2014 (World Bank, 2016a, 2016b). Whilst the hardcore poverty rate fell, Malaysia's carbon dioxide emissions rose from 7.6 ton per capita in 2008 to 8.0 ton per capita in 2014 (United Nations, 2016). Obviously, some carefully selected 'snapshots' by development researchers from around the world show some unreliable and questionable propositions that poverty is the root cause of environmental degradation and/or environmental degradation but is in fact the outcome/effect of poverty.

Both authors of this paper contend that judging by what they have seen among the urban poor communities in Malaysia is something which we believe would nullify the above propositions. The present study is empirical in nature, and hence we hypothesise that poverty is the root cause of environmental degradation and/or environmental degradation is the outcome/effect of poverty, particularly in the case of household solid waste management. To test the above hypothesis our key objective is to empirically investigate whether poverty causes environmental degradation and/or environmental degradation is the outcome/effect of poverty. Particularly, in this study, we look at the attitude and behaviour of the urban poor concerning their household waste management practices, which we then assess in line with acceptable environmental practices and standards as outlined by the environmental practitioners and policy-makers.

2 Data and technique of analysis

A total of 300 household heads were interviewed and these people resided in the three parliamentary areas of Kuala Lumpur. In total, 100 households were selected from each area and the squatters represented 60% while the low-cost dwellers made up 40% of the participating sample. All interviews were conducted by trained enumerators guided by a well-structured questionnaire. Selection of these three areas was based on the criterion that the poverty groups, which were observed to exist within the federal territory of Kuala Lumpur, are predominantly concentrated in the squatter settlements and low-cost flats.

The study used descriptive statistics such as means, ranges, and frequency distributions for selected variables that were created for use in multivariate analysis. The statistical significance of three types of differences between and among variables was determined by three different types of tests. For example, the significance of differences for continuous variables between pairs of means by 't-tests of equality of means' and between more than two means such as differences among the three areas by 'one-way analysis-of-variance' (ANOVA) tests. The significance of differences for discrete variables between and among observed and expected frequencies was examined by Chi-square 'likelihood ratio' tests. Finally, a multiple linear regression model was developed to identify and analyse the factors that could potentially affect the willingness

of households to pay for better access to solid waste collection and disposal services in their residential areas.

3 Empirical results

3.1 Respondents' 'attitude' toward solid waste and related matters

3.1.1 Satisfaction with waste collection and disposal services

Of all the respondents interviewed, 47.4% indicated they are 'satisfied' and 5.8% 'very satisfied' with the waste situation in their residential areas. On the other hand, 37.5% indicated that they are 'dissatisfied' and 9.2% 'very dissatisfied' with local waste conditions. Differences in householders' views on local waste conditions differ significantly among areas ($p < 0.01$), with the most dissatisfied householders being reported in Jinjang Utara (83.0%), followed by 22.9% in Datuk Keramat and only 5.2% in Sentul.

Table 1 Chi-square test results showing percentages of 'yes' responses by respondents to possible waste collection problems within individual areas

Waste collection problem	Jinjang Utara	Sentul	Datuk Keramat	Total
	Percentage			
People in this area dispose of waste everywhere	87.0	90.9	93.9	88.9 NS
When waste collectors collect waste, they do not collect all the waste	30.0	63.6	84.8	45.1***
Too infrequent collection of waste	80.0	54.5	87.9	79.9*
Time of waste collection is not fixed	89.0	54.5	87.9	86.1***
No dust-bins for my waste	100.0	45.5	42.4	82.6***
Dust-bins provided too small	46.0	45.5	84.8	54.9***
Dust-bins supplied not covered	50.0	54.5	75.8	56.3**
Public dust-bins are too far from my house	83.0	72.7	60.6	77.1**
Areas around public dust-bins are dirty	100.0	54.5	87.9	93.8***
No way to dispose of bulky waste, e.g., furniture, refrigerators	52.0	45.5	84.8	59.0***
Dogs, cats, and/or big rats search for food in the waste	100.0	63.6	84.8	93.8***
Mosquitoes or flies are attracted to waste	100.0	54.5	81.8	92.4***
Street cleansing services are not good	67.0	72.7	39.4	61.1**
Drainage cleaning services are not good	99.0	81.8	57.6	88.2***
Waste compactor lorries come here too often	18.0	36.4	12.1	18.1***

Notes: 1 – no respondent reported 'other reasons' to possible waste collection problems.

2 – ***Indicates significant difference among areas at 0.01 level. 3 – **Indicates significant difference among areas at 0.05 level. 4 – *Indicates significant difference among areas at 0.10 level. 5 – NS Indicates not significant at 0.10 level.

3.1.2 Sources of dissatisfaction with local waste conditions

Of the 137 respondents who are either 'dissatisfied' or 'very dissatisfied' with local waste conditions, the two problems with the same highest perceived percentages are 'areas around public dust-bins are dirty' and 'dogs, cats, and/or big rats search for food in the waste' (93.8%). Differences among areas in terms of the perceived percentages of the above-mentioned problems are found to be statistically significant at the same level ($p < 0.01$). The other 14 possible sources of dissatisfaction with local waste conditions, to which respondents reacted, are summarised in Table 1.

Table 2 ANOVA test results showing the reasons for households choosing to collect and recycle waste materials

Possible reason ^a	Jinjang Utara	Sentul	Datuk Keramat	Total
	Mean score ^b			
Protect the environment	1.62	2.00	3.70	1.88***
Protect human health	1.82	1.57	3.70	1.92***
Avoid waste	2.33	2.50	3.30	2.45 NS
Improve appearance of my area	1.75	1.43	3.50	1.82***
I feel good because I have done something to improve my community/the environment	1.63	1.43	2.90	1.69**
Save resources	3.36	1.71	2.00	2.86***
Reduce total amount of waste that has to be burned or placed in dumpsites	2.30	3.07	3.50	2.58**
My religion tells us to use resources carefully	1.07	1.43	3.80	1.39***
Encouragement from family members	2.22	1.32	1.90	1.98**
Reduce costs of waste collection and disposal	1.70	1.79	2.60	1.80 NS
Social pressure from family members	1.58	1.18	1.70	1.50 NS
Receive payment for materials recycled	4.89	4.25	4.10	4.67***
Social pressure from neighbours	1.14	1.11	1.40	1.15 NS
Encouragement from neighbours	1.14	1.11	1.40	1.15 NS

Notes: 1 – ^aIndicates that no respondent reported any 'other reasons' for which he/she collects and recycles waste materials. 2 – ^bIndicates mean scores of relative importance, where 1 = not very important, 2 = not important, 3 = medium important, 4 = important and, 5 = very important. 3 – ***Indicates significant difference among means at the 0.01 level. 4 – **Indicates significant difference among means at the 0.05 level. 5 – NS Indicates not significant at the 0.10 level.

3.1.3 Reasons for households to recycle

The most common reason for households recycling items is to 'receive payment for materials recycled'. The relative importance of this reason differs significantly among areas ($p < 0.01$), with the greatest importance being reported in Jinjang Utara but the least

importance is evident in Datuk Keramat. The other 13 reasons for recycling, to which respondents reacted, have been summarised in Table 2.

Table 3 ANOVA test results showing personal and social reasons for households recycling in squatter settlements versus low-cost flats

<i>Personal and social reason</i>	<i>Squatter</i>	<i>Low-cost flat</i>	<i>Total</i>
	<i>Mean score^a</i>		
Personal			
Improve appearance of my area	1.84	1.79	1.82 NS
I feel good because I have done something to improve my community and the environment	1.38	2.23	1.69***
My religion tells me to use resources carefully	1.28	1.58	1.39 NS
Encouraged by members of my family	1.57	2.72	1.98***
Social pressure from members of my family	1.25	1.93	1.50***
To receive payment for materials recycled	4.74	4.56	4.67 NS
Personal reasons means	2.01	2.47	2.18**
Social			
Protect the environment	1.52	2.51	1.88***
Protect human health	1.52	2.61	1.92***
Avoid waste	2.07	3.14	2.45***
Reduce total amount of waste that has to be burned or placed in sanitary landfills (dumpsites)	2.86	2.09	2.58**
Reduce costs of waste collection and disposal	1.50	2.33	1.80***
Social pressure from neighbours	1.24	1.00	1.15 NS
Encouragement from neighbours	1.24	1.00	1.15 NS
Social reasons means	1.83	2.23	1.97***

Notes: 1 – ^aIndicates mean scores of relative importance, where 1 = not very important, 2 = not important, 3 = medium important, 4 = important and, 5 = very important.
 2 – ***Indicates significant difference among means at the 0.01 level.
 3 – **Indicates significant difference among means at the 0.05 level.
 4 – NS Indicates not significant at the 0.10 level.

3.1.4 Motivations for households to recycle

The empirical results of this study reveal that recyclers are significantly more strongly motivated by personal than social reasons to recycle (Table 3). This result is supported in that the 'personal reasons means' of 2.01 in squatter settlements, 2.47 in low-cost flats, and 2.18 for all householders collectively in the two community groups are significantly greater than the respective 'social reasons means' of 1.83, 2.23, and 1.97 for the two communities individually and collectively ($p < 0.05$). Table 3 also shows householders in low-cost flats are more strongly motivated to recycle waste materials than those residing in squatter settlements. However, in terms of trying to gain economically from recycling, the mean scores for both communities do not differ significantly ($p \geq 0.10$). It means that the reasons for recycling waste materials are mainly economic, and this attitude has been observed to be the same for both squatters and low-cost flat communities. The economic

reason means (to receive payment for materials recycled) is the most important for both communities (squatter: 4.74 versus low-cost flat: 4.56) compared to all other extrinsic and intrinsic reasons.

3.1.5 Motivations for environmentally sound solid waste management

A very interesting finding of this study is that householders are significantly more strongly motivated by economic reasons to practice environmentally sound solid waste management. This finding is supported by the economic reasons, for which householders practice environmentally sound solid waste management, such as selling waste to an 'itinerant' buyer ($p < 0.01$), collect and recycle waste materials ($p < 0.01$), separate waste materials into categories ($p < 0.05$), reuse waste materials ($p < 0.05$), and source-reduce waste ($p \geq 0.10$). These activities are significantly more critical among householders with low levels of income. They occur due to the fact that economic hardship forces low-income people to engage in environmentally sound waste management practices at the household level.

3.2 Respondents' 'behaviour' concerning solid waste management

3.2.1 Quantity of households' waste generation

All the households covered in the survey generate, every three days, an average of 5.66 kg of waste. Of all respondents, the following percentages generate the following quantity every three days: 28.3% up to 4.00 kg, 46.0% from 5.0 to 6.0 kg, 12.6% from 7.0 to 8.0 kg, 11.7% 10.0 kg, and 1.3% from 12.0 to 15.0 kg. The quantity of waste generation differs significantly among the areas surveyed ($p < 0.01$), with the highest average being reported in Sentul (6.92 kg), followed by 5.83 kg in Jinjang Utara, and 4.22 kg in Datuk Keramat.

3.2.2 Length of time waste is stored in the house

More than 74% of all householders reported that they are storing household waste in their homes for 1–2 days before placing it outside for collection, 18.3% for as long as 3–4 days, and 2.0% for as long as 5–7 days. Compared to Jinjang Utara and Datuk Keramat, significantly ($p < 0.01$) more householders in Sentul are storing their waste in their homes for 1–2 days before placing it outside for collection (87.0% versus 79.0% and 57.0%).

3.2.3 Method of source reduction

Of the households who have practiced 'source-reduction' of waste, the most common methods for 'source-reduction' are reusing waste materials (92.9%) and repairing and reusing things that are damaged (85.7%). Other methods of 'source-reduction' all involve considerations by householders when deciding whether to buy particular products. The most important consideration is the durability of the product (57.1%), followed by whether the products' packaging can be reused (50.0%), possibilities for reusing the products (28.6%), amount of packaging included with the products (17.9%), and whether the products are made from renewable resources (17.9%). Except for the third, fourth,

and fifth above-mentioned methods, percentages of householders for all other methods differ significantly among the designated areas ($p < 0.01$).

3.2.4 Methods of reusing waste materials

The following percentages of households reported they are reusing materials that otherwise would be disposed as waste, in the following ways: nearly 86.0% of households repair used materials, 83.0% use materials for a different purpose, 63.0% sell used materials for reuse or to others, and nearly 42.0% of households give used materials to other people. All the above-mentioned methods of reusing waste materials differ significantly among areas ($p < 0.01$, except for the latter way, which is significant at the 'p < 0.05' level), with above-average percentages of households in both Jinjang Utara and Sentul. People in both Jinjang Utara and Sentul have been repairing used materials (92.0%), in Datuk Keramat giving used materials to other people (45.0%), in Jinjang Utara selling used materials to others (100.0%), giving used materials to other people (50.0%), and using materials themselves for a different purpose (96.0%).

3.2.5 Length of time of recycling waste materials

Of the 119 householders who recycle, 58.0% have been doing so for more than one year, 13.0% for six months to one year, 5.0% for one to six months, and more than 23.0% respondents indicated that they cannot remember for how long they have been recycling waste materials. Length of time of recycling differs significantly among areas ($p < 0.01$), with householders in Jinjang Utara being the most 'seasoned' recyclers while those in Sentul are the most recent. A significant number of householders who recycle indicated that they could not remember the length of time they have been recycling waste materials for.

3.2.6 Incidence of waste materials recycling

Of all the recyclers, 91.0% recycle newspapers, 80.0% tin, 79.0% aluminium, 30.0% plastic, 25.0% glass, and 8.0% paper-based material. In addition, 36.0% of recyclers indicated that they recycle 'other materials'. Among these other materials, leather items are significant and the percentage of recyclers that recycle such items is limited to Jinjang Utara (53.0%) ($p < 0.01$). The percentages of householders recycling various waste materials in different areas differ significantly ($p < 0.01$), except for the first and fifth above-mentioned items, which are not statistically significant ($p \geq 0.10$).

3.2.7 Disposition of recycled materials

Of all the recyclers, 97.0% sell their recycled materials to itinerant buyers who come to their homes, 6.0% take them to public recycling collection centres, 2.0% place them in their own dust-bins, and 1.0% gives them to their children who take them to school for recycling. Outside the above-mentioned dispositions of recycled materials, 10.0% indicated that they have 'other purposes' for their recycled materials. Of these other purposes, 'recyclers take their particular recycled materials to the nearest recycling shop for selling them at a reasonable price' is important. All the above-mentioned percentages differ significantly among the areas ($p < 0.01$ and $p < 0.05$).

3.3 *Householders' willingness to pay for improved waste collection and disposal services*

The multiple linear regression technique has been used to analyse the relationships between householders' monthly willingness to pay and several related demographic and environmental factors. The estimated regression model is considered to fit well as reflected by the adjusted R^2 value, which is found to be significant at the $p < 0.01$ level, confirming the model's overall goodness of fit. A summary of the results of the estimated regression model of householders' willingness to pay is shown in Table 4.

Table 4 Results of multiple regressions model showing the factors affecting householders' monthly willingness-to-pay (dependent variable, Y in MYR) for an improved waste collection and disposal service in their residential area

<i>Variable</i>	<i>Estimated coefficient (β)</i>	<i>Standard error</i>
Constant (β_0)	-7.779 (-2.660)***	2.925
Dummy variable considering householders' satisfaction with the present waste collection and disposal services (X_1) (1 if satisfied, 0 for otherwise)	-7.384 (-7.987)***	0.925
Monthly income of head of households (in MYR) (X_2)	0.005 (5.024)***	0.001
Number of earning members in householders' family (X_3)	1.776 (4.891)***	0.363
Dummy variable considering householders' perception on the privatised solid waste collection and disposal service to determine whether or not it could improve the local waste condition, (X_4) (1 if yes, 0 for otherwise)	3.094 (3.065)***	1.010
Dummy variable representing gender status of head of households (X_5) (1 for male, 0 for otherwise)	2.214 (2.378)**	0.931
Length of stay of householders in the house (in years) (X_6)	-0.154 (-3.160)***	0.049
Dependency ratio (X_7)	1.436 (2.533)**	0.567
Age of head of households (in years) (X_8)	0.107 (2.421)**	0.044
Dummy variable representing the type of house of households (X_9) (1 for squatter, 0 for low-cost flat)	2.016 (2.296)**	0.878
$R^2 = 0.443$		
Adjusted $R^2 = 0.426$		
Standard error of the estimate = 6.5502		
F-value = 25.615		
Durbin-Watson = 1.694		
Degree of freedom of regression = 9		

Notes: 1 – Figures in parentheses are t-values of the regression coefficients.

2 – ***Indicate significant at the 0.01 level. 3 – **Indicate significant at the 0.05 level.

Table 4 indicates that all the independent variables of the model are significantly influencing householders' monthly willingness to pay. The results of the regression model reveal that the major influence on householders' willingness to pay is likely to be their level of satisfaction with the present waste collection and disposal services. However, the independent factors that have a positive influence on householders'

willingness to pay are monthly income of the head of households, number of earning members in households, householders' opinion of privatised waste collection agencies, householders' gender status, householders' dependency ratio, age of head of households, and types of house that households live in. The regression model shows that only two factors have been found to be negatively associated with the householders' monthly willingness to pay: firstly, householders' level of satisfaction with the present waste collection; and secondly, disposal facilities and length of stay of householders in their residence.

4 Discussion and recommendations

The empirical results, as shown above, suggest that the urban poor residing in squatter settlements and low-cost flats play a very positive role from a sound environmental perspective, as they are the main re-users, recyclers, and source-reducers of solid wastes. In this study, the urban poor also demonstrated a positive willingness to pay for improved access to private waste collection and disposal services in their residential areas. The urban poor people demonstrated a sense of social justice in their willingness to pay as their higher income and large family size are found to be positive in the regression model. This finding is consistent with Longe et al. (2009) and Parfitt et al. (1994) who argued that the average income of the household is a variable that could influence their perception and attitudes on solid waste management system. Also, the results from descriptive statistics show that the poor people are implementing environmentally sound waste management practices motivated mainly by their personal and economic circumstances. Effective and environmentally friendly waste management contributed to employment creation, income generation and poverty alleviation in Abuja, Nigeria as noted by Imam et al. (2008).

Therefore, our empirical findings and the above discussion do not support the hypothesis that poverty is the root cause of environmental degradation and/or environmental degradation is the outcome/effect of poverty, particularly in the case of household solid waste management. However, Adetola and Benedicta (2010) report that poorer households are less willing to adopt an improved method of SWM compared with non-poor households, which is similar to what Das et al. (2008) documented. Our finding on poor people's willingness to pay for environmental improvement also contradicts Siriwardena and Gunaratne (2007), who report that the respondents' willingness to pay was negative and they believe that the government should take care of environmental issues.

Considering the sound environmental practices and willingness of the urban poor in Kuala Lumpur to pay for a better-quality environment where they live, it is believed that pro-poor policies could help curtail environmental degradation in the case of solid waste management. Such policies are expected to do two practical things: reduce environmental degradation and the incidence of urban poverty (Jereme et al., 2015). Kubanza and Simatele (2016) recommended a pro-poor approach in solid waste management as it may present an opportunity for achieving both social and environmental justice. They also argued that pro-poor institutions will not only facilitate the participation of the urban poor in decision-making but also enable them to become involved in the implementation of strategies and systems that make sustainable solid waste management feasible. What the

urban poor contribute in the way of money for environmental quality improvement is affirmative news for local governments who can encourage community participation in environmental management. Baillie et al. (2011) highlighted the importance of community participation in effective waste management in which waste-picking cooperatives are formally integrated and this strategy enables them to create sustainable income streams. Nwosu et al. (2016) emphasised the integration of informal waste management in the socio-ecological productive process and supported with policies that focus on the well-being of workers. They also highlighted the policy-level recognition of informal waste workers as stakeholders in the solid waste management process and contributors to urban economy and poverty reduction. This will in all likelihood be a successful option for achieving sustainable socio-ecological objectives.

Since a considerable number of urban poor householders recycle and reuse waste materials for economic reasons their physical health and economic interests need to be protected. For this reason, they should be properly integrated into the formal waste management sector with clearly designated responsibilities and rights. Yang et al. (2018) report that while informal recyclers contribute to waste recycling and reuse, the relatively primitive techniques they employ, combined with improper management of secondary pollutants, exacerbate environmental pollution of air, soil and water. Therefore, integration of the informal sector with its formal counterparts could improve waste management and alleviate poverty while addressing these serious health and livelihood issues. Linzner and Sallhofer (2014) argue that modernising waste management systems will need to increasingly consider informal waste systems and that displaced informal waste workers need to be either incorporated into new business schemes or be compensated to help alleviate poverty. In this regard, Rebehy et al. (2017) go further by recommending that the determinants of innovative waste collection and poverty alleviation include the following: inclusion of informal waste collectors to reduce poverty; public-private partnerships; and raising citizens' awareness of their co-responsibility regarding environmental education.

Finally, the above findings and recommendations are expected to have greater applicability in areas where the socio-economic characteristics of the sample respondents, the aspects of current waste collection and disposal services and the other related regulations are similar to those in Kuala Lumpur. Since such characteristics, aspects and regulations exist mostly in developing and emerging countries, the empirical findings and recommendations of the study are expected to have the most applicability in those countries.

5 Conclusions

Drawing a conclusion on the link between poverty and environmental degradation has never been straightforward because it is not realistically possible to incorporate all the underlying causes of poverty and environmental degradation into a single study. Therefore, any conclusions must be made with appropriate caution. Empirical evidence suggests that poverty is neither the only cause of environmental degradation and nor does environmental degradation cause poverty. However, in the case of urban poverty, we can conclude that it does protect the environment to some extent rather than degrade it. The urban poor are proven to have demonstrated environmentally sound, if not sustainable, resource management practices with particular regard to their household waste disposals.

This should not, however, be generalised to other sections or segments of the population designated as poor, given that certain countries' and regions' socioeconomic and demographic characteristics or contexts will vary and produce different empirical results.

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