Full paper

Assessment of Factors Attracting Waste Recycler Behaviors By Rasch Model

Kian-Ghee Tiew,[a,*] Noor Ezlin Ahmad Basri,[a] Shahrom M Zain [a], Kohei Watanabe,[b] Wan Nur Ashiqin Wan Mohamad[c]

[a]Department of Civil and Structural Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia
[b]Institute for Environment and Development (LESTARI), Universiti Kebangsaan Malaysia and Teikyo University
[c]Pusat Pengajian Umum,Universiti Kebangsaan Malaysia
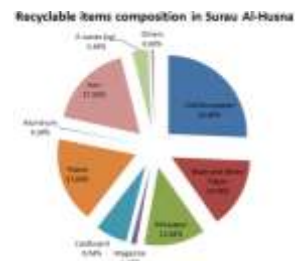
[*]Corresponding author: tiew8585@yahoo.com

Graphical Abstract

Abstract

A sustainable municipal waste recycling program is important to successfully increase the recycling rate in Malaysia. This paper examines the factors attracting recyclers at Surau Al-Husna community recycling centre. Data were analysed using Wintsteps and Predictive Analytics SoftWare (PASW). Findings indicated that five main factors attracting Surau Al-Husna community in recycling activities, which are environment impacts, charity purpose, easy access of recycling facilities, role of religion, and willingness and environmental awareness to practice recycling. The study has also shown potential of Surau Al-Husna as the example for other religious place to adopt recycling practices in their worship place, especially the Muslim population in Malaysia, which comprises 70% of the total population. In conclusion, Surau Al-Husna could be a role model for recycling practice in Malaysia due to their low cost operation and charity fund-raising for sustainable recycling programs. Hence, charitable ways in recycling practices could be one of the trends in recycling activities and will be an essential way to boost up the recycling rate in Malaysia.

Keywords: Community recycler behavior, social norms, convenience, Rasch Model, PASW

Abstrak

Program kitar semula sisa perbandaran dengan adalah amat penting demi menjayakan dan meningkatkan kadar kitar semula di Malaysia. Penyelidikan ini menyelidik faktor menarik kitar semula di Pusat Kitar Semula Komuniti Surau Al-Husna. Data dianalisis menggunakan perisian *Wintsteps* dan *Predictive Analytics SoftWare* (PASW). Penemuan menunjukkan bahawa lima faktor utama menarik komuniti Surau Al Husna menjalankan aktiviti-aktiviti kitar semula, iaitu kesan persekitaran, tujuan amal, akses mudah kemudahan kitar semula, peranan agama , dan kesediaan dan kesedaran persekitaran berlatih kitar semula. Kajian telah juga membuktikan potensi Surau Al-Husna sebagai contoh untuk tempat keagamaan lain mengambil amalan kitar semula di kawasan tempat sembahyang mereka, terutamanya penduduk Islam di Malaysia, yang mengandungi 70% daripada jumlah penduduk. Kesimpulannya, Surau Al Husna merupakan salah satu teladan untuk amalan kitar semula di Malaysia disebabkan operasi kos rendah mereka dan kutipan derma kebajikan untuk program-program kitar semula mampan. Maka, cara-cara amal dalam pengitaran semula amalan mungkin merupakan salah satu aliran di aktiviti-aktiviti kitar semula dan merupakan langkah yang penting untuk meningkatkan kadar kitar semula di Malaysia.

Kata kunci: Tingkah laku komuniti, sosial norm, mudah, Model Rasch, PASW

■1.0 INTRODUCTION

Waste management is a global environmental challenge. Recycling is an environmentally sustainable waste management method. The United States Environmental Protection Agency (USEPA) defines recycling as the process of collecting and processing waste to produce new products that could benefit the community and the environment.[1] Thus, a municipal waste recycling program could be an environmental sustainable solution to reduce the current burden on landfills. In Malaysia, conventional waste management still disposes of 95% of waste into landfills.[2] Currently, the national-level waste recycling-rate in Malaysia is only 5%, even after launching a recycling program in

1993.[3] Developing a sustainable waste recycling program is important to achieve a national recycling-rate of 22% by 2020.

Many Asian countries have adopted the 3Rs (Reduce, Reuse, Recycle) culture in recycling management practices.[4-6] In response, waste recycling requited to be practiced in the daily life of every citizen. There are numerous factors influencing waste recycling programs. These include the continuous publicity, maintenance and operational income (5-10% from the sales of recyclables), community, continuous training, and enthusiasm and knowledge of program leaders towards environmental protection.[7] However, to attain a sustainable waste recycling program, two main roles are important: practice of the mentioned system within

neighborhoods (community-based recycling management system, CBR) and benchmark learning or modified integrated sustainable waste management to apply to current recycling practices.

Studies covering integrated sustainable waste management can provide a benchmark and be further adopted to develop a sustainable waste recycling program. This is because a recycling management system is unlikely to be integrated with sustainable waste management. Hence, factors that influence the sustainability of waste recycling programs could include stakeholders, elements of management, and technical management requirements.[4] Stakeholders include the local authorities (LAs), private sector (formal and informal), Non-Government Organizations (NGO), and consumers. Each stakeholder plays an important role in sustaining a waste recycling program in the community. The second factor that could influence the sustainability of waste recycling program is the management of elements such as the generation of waste, the 3Rs culture, the operation of the recycling process (collection, transportation, treatment and disposal) and the storage of waste. The third factor is the technical management of the process covering environmental, health, financial, socio-cultural, institutional, managerial, and policy aspects. Overall, these three factors influence the waste recycling program. Therefore, when the cooperation and interaction between each stakeholder breaks down, the other two factors, the management of specific elements and technical process, would highlight the influence of this strained relationship on the rate of recycling.

Ramayah et al. (2012) had pointed out several factors affected Malaysia waste management i.e.: lack of coordination among the waste stakeholders and duplication of the same work in waste management, lack of sustainability and continuity of waste management programmes and resources, lack of participation and initiative from society, inadequate waste collection vehicle or equipment, and inadequate legal provisions and enforcement.[8] To overcome these affected factors is a challenge for the Malaysian government. National recycling campaign had been launched as early as in 1993 and again re-launched in December 2003.[9] Yet, the effectiveness of the programs towards national recycling rate is still much lower than what government expected. Therefore, an assessment of the recycler behaviours is needed to evaluate and assess factors attracting them.

In the light of the discussion above, and because waste recycling practices in Malaysia are facing problems on sustainability and participation of the community; this paper attempts to assess the factors attracting community recycling practices in daily life. The study focused on Surau Al-Husna communities recycling centre, Shah Alam, Selangor, Malaysia, as a case study, where the community were assessed through survey questionnaires concerning their understanding on the factors that led them to engage in recycling behaviour.

■2.0 OVERVIEW OF WASTE RECYCLING PROGRAM AT SURAU AL-HUSNA

Surau Al-Husna is an Islamic place of worship located in Shah Alam, Selangor, Malaysia (3.056011 N, 101.53618 E). Surau Al-Husna was established in 2003 and is supported by the local community. The facility was initially a steel container. In 2011, a new building housing the Surau Al-Husna was constructed. Approximately 2,000 people reside in the neighborhood. The majority of the local community is Muslim with ages ranging from 30- to 70-years old.

In Surau Al-Husna, a recycling program was established in July 2005.[10] Their objectives are to nurture the local community' love of nature, generate income for mosque maintenance and to operate and enhance charity works. Initially, this recycling program faced challenges associated with the lack of human resources to handle the process of recyclable segregation and a lack of awareness in the local community of the recycling program. Some people assume that recyclable bins function as garbage bins dropping off used diapers and other garbage at the center or disposing of them in recyclable bins. These initial challenges were mitigated after promoting education awareness of the recycling process by the Surau Al-Husna. The initial challenges are summarized and discussed below, and may potentially serve as a case study for other organizations initiating a recycling collection/center:-

i.   The residents did not separate recyclable materials by type.
ii. Recyclable items were packed or mixed with garbage.
iii. Unpleasant odor occurred if recyclable items were stored for a long period.
iv. Community involvement was not exhaustive.
v.   The market selling price for recyclable items is unstable.
vi. A general lack of participation from members and community because of a gap in knowledge about the importance of environmental conservation to society and religious worship.

Table 1 details the amount of the collection of recyclable items by Surau Al-Husna. The program collected 4,986 kg in 2005; in 2009, it successfully collected 20,400 kg, which is approximately four times the amount collected in 2005 (409%). The average monthly income from 2005 to 2009 generated by collecting recyclables was (Malaysian Ringgit) RM 464. The community waste recycling program at Surau Al-Husna successfully managed 69 tons (5 years) of waste generated by the community and lowered the overall waste disposal costs paid by local authorities. Additionally, the recycling program generated income for the facility.

The dominant collected recyclable items in Surau Al-Husna were paper (approximately 60%), followed by plastic and iron (17% and 16%, respectively) (Fig 1). These three items are common recycled items collected in Malaysia, and their market price is stable compared to other recyclable items.

The management of Surau Al-Husna publicizes this program through various activities: posting flyers or banners, sending mass SMSs to the community, talking after prayer sessions and posting on blogs and Facebook. Community members can easily drop-off recyclable items at any time. Furthermore, Surau Al-Husna also promotes several motivational programs, such as continuous education and awareness programs, to the members and community such as the recycling of used cooking oil, zoo volunteering, love the river partnership and beach coastal cleanup programs.

Table 1 Recyclables and income generated in Surau Al-Husna (Bin-Ibrahim, M.T., Personal communication, March 22, 2013)

Year	Amount (kg)	Average (kg per month)	Income (RM[a])	Average Monthly Income (RM)
Year 1 : Jul-Dec 2005	4,986	800	1,516	250
Year 2 : Jan-Dec 2006	11,545	900	4,714	375
Year 3 : Jan-Dec 2007	15,167	1,250	6,290	520
Year 4 : Jan-Dec 2008	17,001	1,400	6,979	580
Year 5 : Jan-Dec 2009	20,400	1,700	5,607	467
Total	69,099	1,280	25,104	464

[a] Malaysian Ringgit
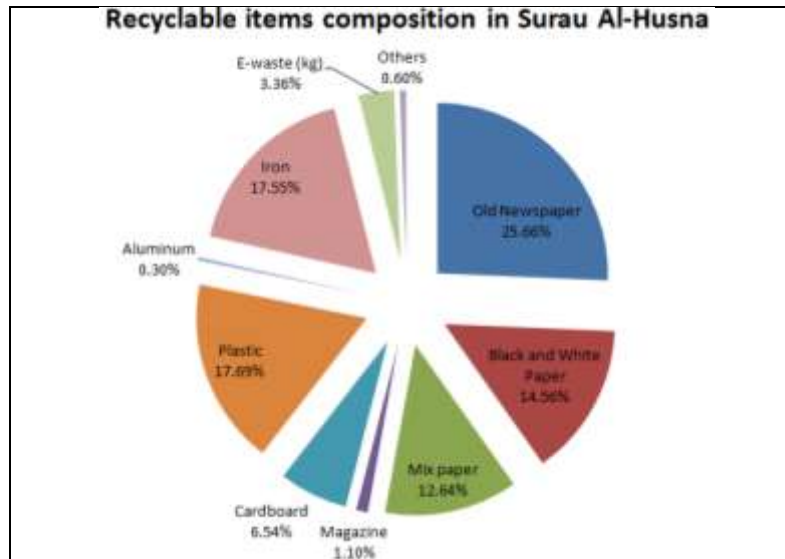
Figure 1 The composition of recyclables in the Surau Al-Husna (Bin-Ibrahim, M.T., Personal communication, March 22, 2013)

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■3.0 METHODOLOGY

3.1 Background Information of Rasch Model

Rasch model is developed by Georg Rasch and can be applied in wide range of disciplines as especially social sciences.[11-13] Huda Abdullah et al. (2012) stated that Rasch model is a new paradigm research tool.[14] In Rasch analysis, the maximum likelihood estimate (MLE) of an event outcome and the pattern of an event that is present in nature can be predicted and resolves the problem of missing data.[14] Therefore, Rasch model could present more accurate analysis. Furthermore, Rasch model also can measure the reliability of an instrument.[15] The assumption of this model is the uni-dimensionality of items and application of the Rasch model aims to statistically fit the data set to the model. Although the early Rasch model had some limitations on it but they have been solved by extended Rasch models. On the other hand, Rasch model analysis had been successfully developed and validated by the researchers. For example, Kazeem (1988), Abdel Fateh El Korashy (1995) utilized Rasch model on constructed achievement test and mental test.[16-17] At the same time, Boone (1997), Ludlow (2001) and Salzberger (2002) use Rasch Model in education research and Heinemann et al. (1997) in medical research and also other significant empirical studies including Baylor et al., 2009, Forkman et al., 2009, Gothwal et al., 2009 , Heinz et al., 2009, Muis et al., 2009 etc.[18-26] Huda Abdullah et al. (2012) summarised some advantages of using a Rasch analysis; (a) the results are easy to read and clearer to understand (b) a parameter estimate (personal profile) for each of the individuals from the data (c) comparisons between individuals become independent of the instrument used (d) comparisons between the stimuli (items) become independent of the sample of individuals.

3.2 The Rasch Model Application

This study is a survey using 27 item questionnaire with a seven point Likert scale answer selection. The items in the questionnaire were concern about factors attracting community willingness to do recycle in daily life such as:-

a) Environmental impacts/Environmental Protection and Preservation
b) Willingness and Environment awareness
c) Role of religion
d) Easy access recycling facilities
e) Charity Purpose
f) Home recycling facilities
g) Cost of recycling
h) Cash and Reward

   The questionnaire was comprised of two sections.. The first part was perceptions of issues and factors attracting community recycler and willingness to recycling. The second part was respondent's profile. A purposive sampling was conducted for Surau Al-Husna community members. A total of 47 community members responded to the questionnaire. A Rasch analysis was carried out to measure the factors attracting recycler in their daily life.

   In Rasch analysis, calibration of the instrument is needed by using Wintsteps software. First step, items that do not fit the criteria set will be removed. After that, other items that do not fit the criteria will also be removed. These two steps will be repeated

until the instrument that contains items that all fit the criteria. This instrument is thus suitable to be used to measure factors attracting recycling in daily life. In measurement, scaling of the items is carried out where an item person map is produced. This map locates persons based on ability and also locates items based on difficulty on a scale. And hierarchy of factors attracting community recycling in their daily life had been identified. In Rasch context, statistic fit observation through infit, outfit, mean-square and standardised mean, show obedience data to expectation modelled. Fit overall tested by initially observe measure point any correlation that negative, of which the value should a positive value that is clear[27] and followed by observation[28] as shown as following:

1. Outfit before Infit;
2. Mean Square (MNSQ) before Z-Standard (ZSTD); and
3. High value before low or negative value.

According to Linacre (2002), MNSQ values from 0.5 to 1.5 is productive for measurements, and ZSTD value from -1.9 to 1.9 shows that data have reasonable predictability. These values will be used to determine the statistical fit of items and person. Finally, In order to compare the results of the Rasch model analysis, the raw data of survey were also analysed in mean values of all the factors using Predictive Analytics Software (PASW).

■4.0 RESULTS AND DISCUSSION

4.1 Demographic of Respondents

In summary, 78.7% of the respondents were male and 21.3% were females. The range of age in the survey was from 24 to 60. Most of the respondent's education was from secondary school till university degree. About 68.1% are working in either government agency or private company. About 74.5% respondents are staying in terraced house. The range of household members is from 3 to 10 people in the house. The further details demographic information of respondents is as shown in Table 2.

Table 2 Demographic of respondents

Gender		Frequency	Percent	Valid Percent	Cumulative Percent
	Male	37	78.7	78.7	78.7
Valid	Female	10	21.3	21.3	100.0
	Total	47	100.0	100.0	

Age		Frequency	Percent	Valid Percent	Cumulative Percent
	Below 17	8	17.0	17.0	17.0
	18-23	2	4.3	4.3	21.3
Valid	24-35	11	23.4	23.4	44.7
	36-45	9	19.1	19.1	63.8
	46-60	17	36.2	36.2	100.0
	Total	47	100.0	100.0	

Highest level of education		Frequency	Percent	Valid Percent	Cumulative Percent
	PMR/SPM	25	53.2	53.2	53.2
	Degree	11	23.4	23.4	76.6
Valid	Master	3	6.4	6.4	83.0
	Others	2	4.3	4.3	87.2
	Diploma	6	12.8	12.8	100.0
	Total	47	100.0	100.0	

Occupational		Frequency	Percent	Valid Percent	Cumulative Percent
	Government staff	15	31.9	31.9	31.9
	Private company staff	17	36.2	36.2	68.1
Valid	Unemployed	2	4.3	4.3	72.3
	Student	9	19.1	19.1	91.5
	Own Business	4	8.5	8.5	100.0
	Total	47	100.0	100.0	

Living house style		Frequency	Percent	Valid Percent	Cumulative Percent
	Terrace house	35	74.5	74.5	74.5
	Semi-D	2	4.3	4.3	78.7
Valid	Condominium/Apartment/Flat	9	19.1	19.1	97.9
	Others	1	2.1	2.1	100.0
	Total	47	100.0	100.0	

Household number		Frequency	Percent	Valid Percent	Cumulative Percent
	1-2 people	4	8.5	8.5	8.5
	3-5 people	22	46.8	46.8	55.3
Valid	6-10 people	20	42.6	42.6	97.9
	More than 10 people	1	2.1	2.1	100.0
	Total	47	100.0	100.0	

4.2 Attracting Factors by Rasch Analysis

In this analysis, total number of person items had been excluded as shown in Table 3. Figure 2 shows the result after the item calibration process. Items that are higher up on the scale means that there is a lower probability of persons who will agree to these items (Fig. 2). Figure 2 shows several items placed at the highest level which have persons mapped at the same level. These are items that some respondents agree with. Towards the bottom of the scale are items that have a higher probability of people agreeing with these items.

Table 3 List of persons item excluded in analysis

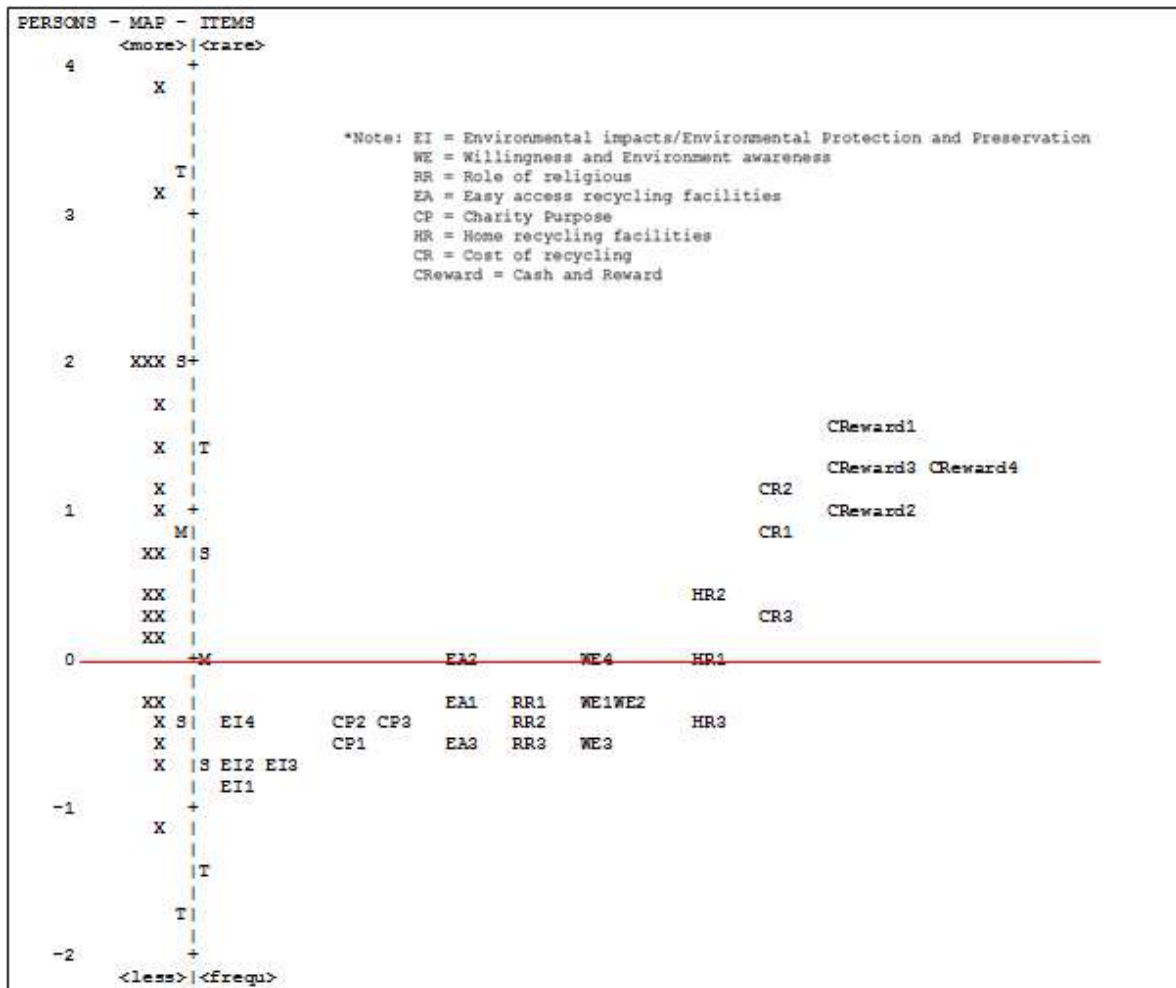| Items of calibration	Persons Item had been excluded in analysis
Extreme Person	24
Negative point measure correlation	15, 5, 14, 35, 9, 32, 36 & 33
Mean Square Outfit	28, 31, 1, 26 19, 23, 34 & 8
Mean Square Infit	12, 38, 40, 7, 22, 46 & 10

Figure 2 Person map of items

The summary statistics shown in Table 4 revealed that the items and the person reliabilities are high. This indicates that the instrument has high reliability and validity to measure factors attracting recyclers at Surau Al-Husna. A good instrument can differentiate between two groups for example a high ability group and a low ability group. The Rasch Model analysis can produce an index which indicates the number of groups that respondents can be divided into. This refers to the person separation index

with the minimum cutting point of two. The person separation value of 4.57 in this study suggests that the respondents can be categorized into four distinct groups.

Table 4 Summary statistics

Item	Value
Item Reliability	0.88
Item Separation	2.69
Person Reliability	0.95
Person Separation	4.57

In the summary, five main factors attracting Surau Al-Husna to adapt recycling in daily life were environment impacts, charity purpose, easy access of recycling facilities, role of religious and willingness and awareness to practices recycling. From the observations, sustaining of recycling facilities is due to their proper management and education to the community. Besides that, there was a high participation of the community in environment programs organized by Surau Al-Husna management. Easy access to recycling facilities also is a key influencing community to practices recycling activities. This is because they often worship at Surau Al-Husna and at the same time can bring their recyclable items to Surau Al-Husna. Fig 3 shows the hierarchy of factors attracting recycling practices at Surau Al-Husna.
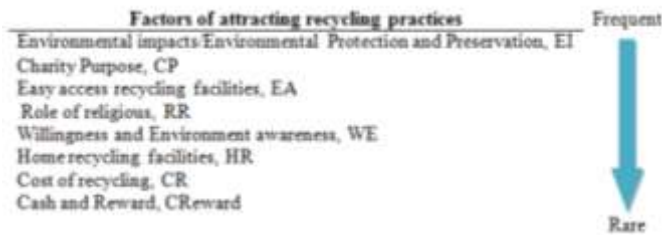

Figure 3 Hierarchy of factor attracting recycling practices at Surau Al-Husna

4.3 PASW Analysis

The results of PASW analysis are shown in Table 5. The mean value is the main concern to analyse and compare the results of Rasch model analysis. In summary, Table 6 is picturing the factors attracting recycling practices at Surau Al-Husna.

Table 5 Descriptive Statistics of All Variables Used in the Surau Al-Husna Survey Variables

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
EA1	47	1	7	5.77	1.463
EA2	47	1	7	5.62	1.453
EA3	47	3	7	6.28	1.077
HR1	47	1	7	5.09	1.943
HR2	47	1	7	4.57	1.964
HR3	47	2	7	5.91	1.396
CR1	47	1	7	4.30	1.841
CR2	47	1	7	4.32	1.682
CR3	47	1	7	4.68	1.889
WE1	47	4	7	6.30	1.102
WE2	47	4	7	6.15	1.063
WE3	47	2	7	6.17	1.291
WE4	47	4	7	6.28	1.117
EI1	47	3	7	6.32	1.045
EI2	47	1	7	6.21	1.215
EI3	47	3	7	6.40	.925
EI4	47	3	7	6.38	.990
RR1	47	1	7	5.91	1.380
RR2	47	1	7	5.85	1.560
RR3	47	1	7	6.00	1.367
CReward1	47	1	7	3.70	2.053
CReward2	47	1	7	4.23	2.077
CReward3	47	1	7	3.94	2.068
CReward4	47	1	7	3.94	2.068
CP1	47	1	7	5.91	1.516
CP2	47	1	7	5.49	1.666
CP3	47	1	7	5.74	1.510
Valid N (listwise)	47				

Table 6 Factors of attracting recycler at Surau Al-Husna

Factors attracting	Mean Value
Environmental impacts/Environmental Protection and Preservation, EI	6.32
Willingness and Environment awareness, WE	6.22
Role of religious, RR	5.92
Easy access recycling facilities, EA	5.89
Charity Purpose, CP	5.71
Home recycling facilities, HR	5.19
Cost of recycling, CR	4.43
Cash and Reward, Creward	3.95

The results of the Rasch model analysis and mean value of PASW tool showed that the five main factors attracting recycling practices at Surau Al-Husna are environment impacts, charity purpose, easy access of recycling facilities, role of religious and willingness and environment awareness to practices recycling. Hence, the significant result between of Rasch model analysis and PASW tools show that the main factors attracting Surau Al-Husna Communities in recycling practices has been confirmed.

4.4 Surau Al-Husna Recycling Practices Model to Nationwide

The Malaysia society does not practice recycling activities in their daily lives even with environmental knowledge.[29] Thus, the Malaysian recycling rate is considered low, approximately 5%. This rate is compared to countries such as Singapore (11%), Thailand (14%), Japan (40%), China (13%) and Germany (53%).[30] However, the government established two waste agencies, the National Solid Waste Management Department (JPSPN) and the Solid Waste Management and Public Cleansing Corporation (PPSPPA), federalize the management of waste disposal. Thus, a successful waste recycling program at Surau Al-Husna could serve as a role model.

One important point is that the Malaysian population consists, in terms of religious affiliation, of nearly 70% of the population practicing the Islamic faith.[31] Therefore, Islamic places of worship are omnipresent in the nation. Worship places are a regular place the community visits and are easily accessed for recycling practices. The number of Islamic worship places in Selangor state is 2,425 (Table 7). For example, assume that 2,000 units in Surau applied the waste recycling program based on the Surau Al-Husna model. Assuming a total of 1.3 tons per month which is similar to the amount of items collected by-Surau (according record of Surau Al-Husna in Table 1), 2,600 tons per month would be recovered, preventing its disposal to a landfill. Additionally, the cost of operation is lower at around RM 3,000.

Table 7 Number of Mosque and Surau in Selangor state, 2012. Source: Department of Selangor Islamic Religious, JAIS (2013)[32]

No	Type of Mosque	Petaling	Sepang	Hulu Selangor	Klang	Kuala Selangor	Sabak Bernam	Gombak	Hulu Langat	Kuala Langat	Total
1	Mosque	78	23	23	42	56	47	43	46	34	392
2	Surau Surau	365	73	158	192	154	224	220	342	126	1854
3	Solat Jumaat	49	14	9	21	4	1	19	53	9	179

The essential key of the waste recycling program at Surau Al-Husna is their purpose for the program: fund-raising for a new surau building and charity. Surau Al-Husna is a potential role as a model in waste recycling program operation for nation-wide implementation because of the similarly in the Malaysia culture and socio-economic patterns. Hence, the community waste recycling program at Surau Al-Husna could potentially be scaled to a nationwide process. This is because the program is sustainable, the effect to the neighbors/community is positive and the cost of operation is low (which also can be considered a zero cost). Additionally, the factors attracting community doing recycling activities in their daily life are environment impacts, charity purpose, easy access of recycling facilities, role of religious and willingness and environment awareness to practices recycling according to the questionnaire survey. The survey reflecting positively to attracting community practices recycling activities through Surau Al-Husna recycling practices model. Therefore, could be practices this model to the nation.

■**5.0 CONCLUSION**

Adopted recycling practices in society daily life is main key of sustaining the environment and reducing the waste disposed into landfill. The main five factors attracting recycling activities at Surau Al-Husna community recycling practices are environment impacts, charity purpose, easy access of recycling facilities, role of religious and willingness and environment awareness to practices recycling. The positive result is that recycling practices at Surau Al-Husna is not affected by cash and rewards of recyclable items. This could be due to the initial education by their management which involved fund raising for charity and worship place building. However, the environmental work will not end up here. The improvement is still going on, feedback from community always is the way to improve and their suggestions and feedbacks during survey as concluded as below:-

- Lack of coverage of recycling containers and facilities
- Increase size of storage and size up the recycling place
- Involvement of local authority in awareness and education programs
- Ensure the cleanliness of storage place
- Learn how to set up a recycling system in school and conduct an audit of school waste materials or find out green school initiative
- Difficulty to sell glass bottles due to glass products not being collected by recycle collector
- Start early on recycling education, accessible recycling centre and more recycling centres

In conclusion, Surau Al-Husna could be a role model in Malaysia which has good continuous recycling collection and sustainable recycling management. The most important points of Surau Al-Husna could be a role model to scale up recycling practices to nation-wide in Malaysia due to their low cost operation and charity fund-raising to sustaining recycling programs. Charitable ways in recycling practices could be one of trend in recycling activities at Malaysia and will be an essential way to boost up recycling practices rate in Malaysia.

References

[1] United States Environmental Protection Agency, USEPA. 2013. *Recycling basics.* http://www2.epa.gov/recycle/recycling-basics. Accessed 23 June 2013
[2] MHLG - Ministry of Housing and Local Government. 2012. Lab Pengurusan Sisa Pepejal 26 Mac - 13 April 2012. http://www.kpkt.gov.my/kpkt/fileupload/hebahan/lab_sisa_pepejal.pdf. Accessed 11 September 2013
[3] Agamuthu P, Fauziah SH, Khalil K. 2009. Evolution of solid waste management in Malaysia: impacts and implications of the Solid Waste Bill. 2007. *Journal of Material Cycles and Waste Management* 11: 96–103
[4] Van de Klundert A, Anschütz J. 2001. Integrated sustainable waste management - the concept. WASTE, the Netherlands. http://www.wastekeysheets.net/pdf/tools_iswm_concept_eng_ebook.pdf. Accessed 18 May 2013
[5] Shekdar AV. 2009. Sustainable solid waste management: an integrated approach for Asian countries. *Waste management.* 29: 1438-1448
[6] Memon MA. 2010. Integrated solid waste management based on the 3R approach. *Journal of Material Cycles and Waste Management.* 12: 30 – 40.
[7] Kenn EL. 2009. Turning trash to treasure: recycling bank programme in tow schools in Balik Pulau, Penang. Department of National Solid Waste Management, Ministry of Housing and Local Government and Danish International Development Assistance (DANIDA), Kuala Lumpur, Malaysia.
[8] Ramayah T, Lee JW. 2012. Sustaining the environment through recycling: an empirical study. *J. Environ. Manage.* 102: 141–7.
[9] National Solid Waste Management Department, JPSPN. 2012. Projected average solid waste collection disposed by state from January to June 2012 report.
[10] Zeeda FM, Norshahzila I, Azizan B, Amran M, Nik MNS. 2012. The role of religious community in recycling: empirical insights from Malaysia. *Resources, Conservation and Recycling.* 58: 143– 151
[11] R. Mead. (N.A.) "A Rasch primer: The measurement theory of Georg Rasch ". unpublished.
[12] Olsen LW. 2003. *"Essays On Georg Rasch And His Contributions To Statistics".* Unpublished PhD thesis. Institute of Economics, University of Copenhagen.
[13] Anon. 2013. http://www.rasch-analysis.com/rasch-analysis.htm. RUMMLaboratory Pty Ltd. [19 November 2013]
[14] Huda Abdullah, Norhana Arsad, Fazida Hanim Hashim, Norazreen Abdul Aziz, Nowshad Amin, Sawal Hamid Ali. 2012. Evaluation of Students' Achievement in the Final Exam Questions for Microelectronic (KKKL3054) using the Rasch Model. *Procedia - Social and Behavioral Sciences.* 60 (2012) 119–123
[15] Green K.E and Frantom CG. 2002. *"Survey Development And Validation With The Rasch Model".* Paper presented at the International Conference

on Questionnaire Development, Evaluation, and Testing, Charleston, SC, November 14-17, 2002.

[16] Kazeem A.M. 1988. *Application Of Rasch Model In The Construction Of Achievement Test In Psychology*. Kuwait City, Kuwait. University Publication.

[17] Abbdel Fateh EL Korashy. 1995. Applying Rasch Model to the selection of items for mental ability test. *Educational And Psychological Measurement*. 5: 753–763.

[18] Boone WJ. 1997. Science attitudes of selected middle school students in China: A preliminary investigation of similarities and differences as a function of gender. *School Science and Mathematics*. 97(2): 96–103.

[19] Ludlow LH & Mahalik JR. 2001. Congruence between a Theoretical Continuum of Masculinity and the Rasch Model: Examining the Conformity to Masculine Norms Inventory. *Journal of Applied Measurement*. 2(3): 205–226.

[20] Salzberger T. 2002. The illusion of measurement: Rasch vesus 2-PL. Rasch Measurement Transactions. page 882.

[21] Heineman A.W, Harvey R.L, McGuire J.R, Inberman D, Lovell L, Semik & Roth EJ. 1997. *Measurement properties of the NIH Stroke Scale during acute rehabilitation*. Retrieved Nov 20, 2013. http://stroke.ahajournals.org/content/28/6/1174.long

[22] Baylor CR, Yorkston K.M, Eadie T.L, Miller R, & Amtmann D. 2008. The Levels of Speech Usage: A self-report scale for describing how people use speech. *Journal of Medical Speech-Language Pathology*. 16(4): 191–198.

[23] Forkmann T, Boecker M, Wqirtz M, Eberle N, Westhofen M, Schauerte P, Mischke K., & Norra C. 2009. Development and validation of the Rasch-based depression screening (DESC) using Rasch analysis and structural equation modeling. *Journal of Behaviour Therapy and Experimental Psychiatry*. 40 (3): 468–478.

[24] Gothwal VK, Wright TA, Lamoureux EL, & Pesudovs K. 2009. Activities of daily vision scale? What do the subscale measures? *Investigating Ophthalmology & Visual Science*. 51(2): 694–700.

[25] Heinz AJ, Smith EV, & Kassel JD. 2009. Caffeine Expectancy: Instrument Development in the Rasch Measurement Framework. *Psychology of Addictive Behaviors*. 23: 500–511.

[26] Muis KR, Winnie PH, & Edwards OV. 2009. Modern psychometrics for assessing achievement goal orientation:A Rasch analysis. *British Journal of Educational Psychology*. 79 (3): 547–576.

[27] Kaseh Abu Bakar. 2012. Introduction to Rasch Model and Winsteps.pp. 5–6. June 2012. UKM Bangi.

[28] Linacre JM. 2009. Patent No. Version 3.68.2.

[29] Moh YC, Latifah AM. 2014. Overview of household solid waste recycling policy status and challenges in Malaysia. Resources. *Conservation and Recycling*. 82: 50–61

[30] MHLG-Ministry of Housing and Local Government. 2011. Ministry of Housing and Local Government Malaysia: Annual Report 2011. http://www.kpkt.gov.my/kpkt/index.php/pages/view/104. Accessed 15 January 2013

[31] Department of Statistics Malaysia. 2013. http://www.statistics.gov.my/portal/index.php?option=com_content&view=article&id=1215%3Apopulation-distribution-and-basic-demographic-characteristic-report-population-and-housing-census-malaysia-2010-updated-2972011&catid=130%3Apopulation-distribution-and-basic-demographic-characteristic-report-population-and-housing-census-malaysia-2010&Itemid=154&lang=en. Population distribution and basic demographic characteristic report 2010. Accessed 8 May 2013

[32] Department of Selangor Islamic Religious, JAIS. 2013. Information about numbers of Mosque and Surau according to district to year 2012. http://e-masjid.jais.gov.my/. Accessed 8 May 2013