

# **‘Zero Budget System’ A New Mechanism in Promoting Separation of Recyclables at Source in Malaysia**

**Faisal Bin Ariffin<sup>1\*</sup>, Kazuei Ishii<sup>1</sup>, Masahiro Sato<sup>1</sup>, Satoru Ochiai<sup>1</sup>**

1: Laboratory of Sustainable Material Cycle Systems, Graduate School of Engineering, Hokkaido University, Kita 13, Nishii 8, Kita-ku, Sapporo, 060-8628, Japan

\*corresponding author: faisal\_ariffin@hotmail.com

**Keywords:** Source separation, willingness to pay, collection of recyclables, conjoint analysis

## **INTRODUCTION**

In parallel with economic and population growth, the implementation of waste management based on its hierarchy are indispensable as outlined in the Malaysian National Solid Waste Management Policy (2016). In order to reduce residual waste generation and to improve the collection of recyclables, e-money incentive systems had been introduced in the State of Perlis and Kedah of Malaysia, however the systems are only effective to reduce residual waste generation between 0.08~3.4% (Ariffin et.al. 2020). This mean, Malaysian need to consider another mechanism such as pay as you throw (PAYT) or “Zero Budget System” a hybrid system between incentive and PAYT to reduce residual waste generation further. In this study, we will clarify Malaysian willingness to pay for household waste management, willingness to participate with “Zero Budget System” and identify main attributes that influencing citizens acceptance on the charging system. We will also determine the utility function and marginal charge by applying conjoint analysis.

## **Zero budget system**

‘Zero Budget System’ is a new system originated by us, where residents will be charged for their discarded residual waste and will received monetary reward for separated recyclables. Ideally, if residents separated their recyclables at certain level, total cost will be balanced with reward and if they separated more, they may get more money than charge. In another word, there will be no cost increment if residents fully separated their recyclables through this system.

## **METHODOLOGY**

In this study, we applied 2 steps questionnaire. The first questionnaire’s objective is to clarify respondent’s willingness to pay, willingness to participate in “Zero Budget System” and identify attributes that influencing citizens acceptance on the charging system. While second questionnaire’s objective is to determine the utility function and marginal charge.

### **First Step Questionnaire**

The first questionnaires were distributed online on 7<sup>th</sup> September 2020. In the questionnaire’s respondents were asked questions regarding their willingness to pay with multichoice answers.

### **Second Step Questionnaire**

The second questionnaire were distributed online on 28<sup>th</sup> December 2020 to respondents that agree to participate in the second questionnaire during first questionnaire using attributes and level extracted from 1<sup>st</sup> questionnaire as Table 1. In this step we applied choice based conjoint analysis because it can be considered as a trade-off between the charge and attributes level (Ishii et. al. 2013).

## **RESULTS AND DISCUSSION**

### **1<sup>st</sup> questionnaire**

1) 60% of the respondents agree to be charged for their unseparated household waste;

- 2) The supporting percentage increase to 71% towards “Zero Budget System”. "Zero Budget System” maybe can be considered more fairer system where citizens that separated their recyclable will also get benefit for their effort instead of charge alone;

## 2<sup>nd</sup> questionnaire

- 1) As showed in Table 2, concordance of the model is above 0.5 that means that this conjoint analysis model can be considered acceptable.
- 2) All extracted attributes are highly significant in influencing respondents support on charging system except for subsidy on individual bin;
- 3) As predicted, charging amount showed negative coefficient that means, the support will reduce if charging amount is increase;
- 4) Recyclables collection method showed the highest marginal charge of MYR 0.24/kg when recyclables collection method’s change from collection at designated point to door-to door system, followed by incentive amount (MYR 0.21/kg when recyclables incentive increase from no incentive to MYR 0.30/kg) and residual waste collection frequency, MYR 0.12/kg when collection frequency per week increase 1 collection per week.

**Table 1:** Attributes and levels performed in conjoint analysis **Table 2:** Summary of the results of the conjoint analysis

Attribute	Level		
	MYR 0.30/kg	MYR 0.60/kg	MYR 0.90/kg
Incentive (amount)	0%	50%	100%
Individual waste bin	subsidized by govt	subsidized by govt	subsidized by govt
Collection method include incentive for recyclables	Door-to-door	At designated point	
Collection frequency for residual waste	Once per week	Twice per week	3 times per week
Charge amount for residual waste	MYR 15/month (MYR 0.10/kg)	MYR 30/month (MYR 0.20/kg)	MYR 60/month (MYR 0.40/kg)

	Coef, $\beta$	z-value	p-value	- $\beta$ / $\beta$
Incentive, MYR/kg	0.406946	3.122	0.0018 **	0.210652
Bin, % of subsidy	0.003051	0.033	0.9734	0.001579
Recyclable collection method	0.455546	7.928	2.23X10 <sup>-15</sup> ***	0.23581
Residual collection frequency	0.236236	4.464	8.05X10 <sup>-6</sup> ***	0.122286
Charge	-1.93184	-6.06	1.36X10 <sup>-9</sup> ***	-

n=94 respondents, number of events=1128  
Concordance= 0.608

## CONCLUSION

In order to improve residual waste reduction and increase collection of recyclables, “Zero Budget System” can be considered a more significant alternative with a higher support compare to conventional charging system. Prior to implementation of the system and in determining charging amount, recyclables collection method, residual collection frequency and recyclables incentive amount need to be meticulously considered.

## ACKNOWLEDGEMENT

Ministry of Housing and Local Government of Malaysia and its agencies especially National Solid Waste Management Department and Solid Waste Management and Public Cleansing Corporation for their assistant and support during the study.

## REFERENCES

- Malaysian National Solid Waste Management Policy (2016)
- Ariffin, F.B., Ishii, K. et al., The effectiveness of the e-money incentive mechanism in promoting separation of recyclables at source in Malaysia. *Journal of Material Cycle and Waste Management* (2020), <https://doi.org/10.1007/s10163-020-01107-1>
- Ishii K., Furuichi T. et al., A needs analysis method for land-use planning of illegal dumping sites: A case study in Aomori-Iwate, Japan. *Waste Management* 33 (2013) 445-455