IA-7 THE EFFECTIVENESS OF E-MONEY INCENTIVE MECHANISM IN PROMOTING SEPARATION OF RECYCLABLES AT SOURCE IN MALAYSIA

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1. Introduction

In order to reduce residual waste generation and to improve recyclables collection, Malaysian Government had introduced separate collection at source by phases and had made it mandatory from 1st September 2015. Despite all campaigns and facilities to collect recyclables at curb side were provided by the government, the amount of recyclables separated at source is considered to be still low.

In accordance to Malaysian National Sanitation Policy, Environment Idaman Sdn. Bhd. (EI), waste collection concessionaire had took their own initiative by introducing a new concept of reward system by two e-money incentive systems; "Recycle for Life (RFL) system" and "Barcode system". However, there are still no academic research that evaluate and clarify the effectiveness of the new systems yet.

2. Malaysian E-Money Incentive Systems

- **Recycle For Life (RFL)- Smart Card System**

- EI had officially launched the RFL system in the state of Kedah on 20th March 2018 and extended the system to the state of Perlis on 14th of March 2019.

- As showed in Fig.1, RFL system is a monetary incentive system for waste generators, who bring their segregated recyclables to the designated points. Here, the recyclables will be weighted, and waste generators will be rewarded based on recyclables' weight and type.

- The e-money will be credited to their smartcard. The smartcard can be used at the participate retailers or service providers in e-Money redemption. The recyclables then will be sent to manufacturers as resources

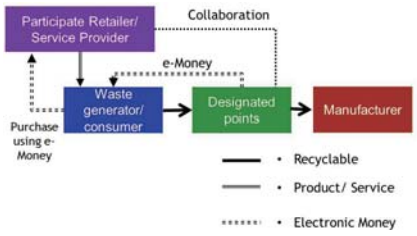

Fig. 1: RFL System' Recyclables & E-Money Flow

- **Barcode System**

- The system had been introduced as a pilot program at Taman Desa Rotan Phase I, Taman Desa Rotan Phase II and Taman Seri Makmur on 13th July 2018 involving 250 residential premises. The program was later extended to Taman Kubang Rotan and Taman Tunku Sarina. The pilot program uses a barcode system to identify recyclables ownership.

- The barcode system allowed residents, who separate their recyclables at source, to be rewarded by e-money **without need them to bring their recyclables to the designated points**.

- As showed in Fg.2, the participant just needs to put their recyclables at the curb side according to their collection schedule. During recyclable collection day, a recyclable collector will scan the participant's bin with a device and print a barcode sticker. Then the recyclables collector will put the barcode sticker on the recyclable's bag for identification of recycling ownership.

- Then, the recyclables will be weighted at the recycling or collection centres and the amount of incentive will be credited through a smart card of each household. Credited e-Money can be use at retailers/service providers collaborating to this program.

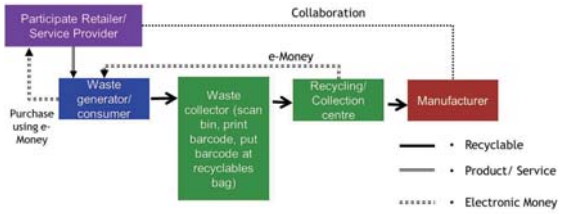

Fig. 2: Barcode System' Recyclables & E-Money Flow

3. Research Purpose

- To evaluate the effectiveness of e-money incentive mechanism in promoting source separation in Malaysia.

- The study is the first analysis to clarify the effectiveness of the new e-money incentive mechanism in Malaysia which will help policy making on promotion of recycling to reduce the amount of wastes going to landfill sites.

4. Methodology

- **Data collection**
  - Data on RFL system and Barcode System was provided from EI on the actual implementation of the RFL system through few questionnaires from September 2019 to January 2020. The obtained data includes both systems coverage area, residence participation, amount of collected recyclables, list of collaborating retailers and service providers and amount of incentives received by participants.

- **Estimation of Residual Waste Reduction**

Residual waste reduction for the RFL system, RWR_{RFL} [kg/capita/day] was used to estimate the effectiveness of RFL system towards residual waste reduction as follow:

$$RWR_{RFL} = \frac{I_{sep2019}}{ARI\ X\ X(N_{kedah}+Nperlis)30days} (1)$$

$I_{sep2019}$ [MYR]:	Incentive in September 2019: MYR28,139.53
ARI [MYR/kg]:	Average recyclable incentive
N_{kedah} [persons]:	Citizen of Kedah: 2,185,000(1)
N_{perlis} [persons]:	Citizen of Perlis: 254,600(1)

Residual waste reduction for the Barcode system, RWRbs [kg/capita/day] was used to measure the effectiveness of Barcode system towards residual waste reduction. It is estimated as follow:

$$RWR_{bs} = \frac{TCRbs}{N_h\ X\ HS\ X\ Nod} (2)$$

TCR_{bs} [kg]:	Total collected recyclable: 4,500 kg
N_h [households]:	Number of households: 250 households
HS [persons/household]:	Household size: 4.31 persons/household(2)
N_{od} [days]:	Number of objective days: 105 days

5. Results

(1) As showed in Figure 3, the total collected recyclables on the second 9 months (From January to September 2019) of implementation of the RFL system had increased **25%** when the system expanded to the State of Perlis. After implementation of the RFL system, in just **18 months**, the **total 838 t** of recyclables had been collected, resulting in successful reduction in the amount of residual waste directly going to landfill sites.

(2) Figure 4 showed, during pilot program, when Barcode System was introduced, the amount of collected recyclables increased **up to 3000%.**

(3) Using assumption and eq. (1), residual waste reduction of **RFL system** estimated at 0.0009 kg/capita/day or **0.075% reduction** from current waste generation of 1.17kg/capita/day(3)

(4) While using assumption and eq. (2), residual waste reduction of **Barcode System**, was estimated 0.04 kg/capita/day, meaning **3.4% reduction** from the current waste generation

Fig. 3: Total Recyclable Collections (RFL System)
The first 9 months (March-December 2018): only the State of Kedah
The second 9 months (January-September 2019): the States of Kedah and Perlis

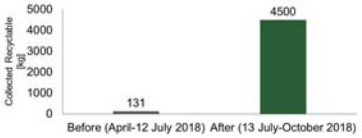

Fig. 4: Total Recyclable Collections (Barcode System)

6. Discussions

(1) As showed in Figure 5, E-money incentive through the **RFL system** was **effective to reduce residual waste generation** to **0.08%.** The impact can be seen increase tremendously when the incentive is given to the residents for their recyclables that collected at source through **Barcode system** that **reduce residual waste generation to 3.4%.**

(2) Barcode system is more effective since it solved logistic issues such as transportation and storage.

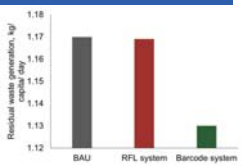

Fig. 5: Estimated Residual Waste Reduction

7. Conclusions

- E-money incentive systems effective to reduce residual waste generation and increase collection of recyclables.

- However, there is a need to investigate others mechanism to further improve waste management in Malaysia

Reference

1) Department of Statistic Malaysia (DOSM 2019) Exhibit 1: Demographic statistic by state, third quarter 2019
2) Department of Statistic Malaysia (DOSM 2010) Table 3: Average Household Size by State, 1980-2010
3) GSR (2012) Survey on SW Composition, Characteristic & Existing Practice of SW Recycling in Malaysia

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