SUSTAINABLE SOLID WASTE MANAGEMENT: AN INVESTIGATION OF THE SYMBIOTIC RELATION IN UNDERSTANDING SUSTAINABLE INITIATIVE AMONG HOUSEHOLDERS

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ABSTRACT

Household waste management in Malaysia is currently progressing slowly this due to the disparity in awareness among households and the facilitation of waste movement is inadequate or unsustainable which is dire need of improvement. Furthermore, the growth of Malaysia's population and the greater growth of residential areas in suburban as well as rural areas have contributed to innate pressure for the local authorities/ municipalities to address the limited landfill areas and inadequate recycling waste processing plants. Sustainable initiatives included recycling as a sustainable form of improving the environment from the household. However, recycling activities are behavioral in nature. Hence, many indicators have direct influence or mediate the recycling behaviour from the households. The main indicators are the situational factors that included the logistical capacity and an innate driven policy. Therefore, the study aims to seek the relationship between situational and behavioral factors using symbiosis effect perspective model to examine sustainable initiatives among households. It is found the model accessible to assist the sustainable waste operators as well as local authorities to develop an innovative recycling waste model that contribute to inclusivity community network.

Keywords: Recycling; recycling behaviour; reverse logistics; symbiosis; waste management.

INTRODUCTION

Malaysia is progressing as a Newly Industrialized Country (NIC). A NIC status is due to many credentials of Malaysia performance within micro and macro economy. One of them is the incremental of urbanization that catapult systematic residential areas and accessibility to hub and spokes of modernization. Thus, with heavy investment of urbanization leads to incremental urbanites and suburbia populous, the same goes to waste generation. In Malaysia, solid waste generation increased from 19,100 tonnes daily in 2006 to 33,000 tonnes daily in 2012 [1] which exceeded the projected generation of 30,000 tonnes by 2020. Households waste is the main contributor to municipal solid waste (MSW). With more than 80% of the MSW comprised of recyclable materials, it is only logical that Malaysian carryout waste separation [2]. However, Malaysian households were not accustomed to systematic waste separation from the source [3]. Public participation in the recycling program in Malaysia is very low. Malaysia targeted 22% of recycling rate by the year 2020, but the recycling rate was only 12.8% in 2015 [4]. Even though, the national government had reformed the Act 672 and Act 673 to ensure uniformity of the management of solid waste throughout the country however, there is more to be done from the local constituents as well as the local authorities' roles in mandating the act.

Recycling waste is considered a voluntary action in contributing to minimal impact on the environment [5]. The effects of situational factors such as reverse logistics (RL) attributes (accessibility and availability and convenience) occur at temporal and geographic scales detectable to people provide immediate, local, or visual evidence of environmental impact [6]. Much work has been done on reverse logistics or product recovery management concepts since the late 1990s [7]. In particular, the studies suggested there are two main streams discussing handling end-of-life products or outbound flows, commercial management and local authority (LA) management particularly MSW management [8]. These streams or channels can also be sub-divided as having inbound flows from commercial and domestic origins [9]. In the latter classification, there are situations where end-users (actors from the waste source) form a key stage in the RL system as both a recipient of inbound flows and initiator of outbound flows. Recycling can be defined as "A method of recovering waste as resources that include the collection, and often involving the treatment, of waste products for use as a replacement of all or part of the raw material in a manufacturing process (European Environment Agency, 2013" in [10]. Recycling is basically a reverse logistic option for retrieving product returns and waste to the forward channel by 'reuse, recycle and reduce' in managing the returnable, recyclates and waste [11]. Guiltinan and Nwokoye's research had discovered that recycling played a major role in RL processes and there were three key areas (legislation, operation capabilities and marketing) with significant influences on the key performance of sustainable practices [12]. This paper outlines the discussion on the investigation of symbiosis effect perspective model examines sustainable initiatives among households in particular recycling behaviour (RB).

LITERATURE REVIEW

Initiation of Recycling Behaviour (RB)

Recycling behaviour is influenced by situational and personal factors. The projection (elicitation/ manifestation) of the recycling behaviour is derived mainly within the households' [13] personal state of mind. There are many factors that contribute to RB. Among them are

a. Reverse logistics (types of disposals, accessibility, method of disposals, the level of difficulty, the level of

separation or sorting) [14],
b. Marketing (awareness, information, advertising, household engagement) [15, 16],
c. Social Norms (Values) (perceived pressure such as neighboring householders are avid recyclers, community intervention, local interest group, public pressure) [17],
d. Individual [Demographic Background (age, education, income, location), Knowledge (product, package, environmental impact, product life cycle, recycling method) and Self Efficacy] [16, 18] and
e. Policy Instruments (directives and economic incentives or benefits) [19]

The situational factors are related to reverse logistics system and the facilitation of the situational factors impact on recycling behaviour. On the contrary, social norms and individual are designated as personal factors (in the following the general term "personal factors" will be used) and are considered as another influencing factor affecting RB. In which this study uses personal factors as a representation of RB. In a recent study, household recycling behaviour is significantly influenced by both factors interactively [20] whereby, both factors are equally important to enculturate sustainable practices [5]. The personal factors that investigated by few studies included attitude, knowledge, demographic, social norm, and personality variables [21]. Situational factors included time, space, money, and convenience which became a motivating factor for recycling behaviors [22].

Symbiosis Effect (SE) Perspective

Ehrenreich exercised this SE perspective on understanding the concept of mutual support in subordinating system [23] in the organizational setting, whereas Fennel and Weaver [24] focused more on tourism and sustainability under the SE perspective [25]. Generally, the SE perspective aids to grasp the participants' views on altruism (moral inclination) [26] behaviour and the connection with the surrounding. Hence, this perspective enlightens the most relevant recycling issues awareness to the householders, and that their involvement and participation are critical to the success of the recycling performance. Whereas, both householders and councils are concomitants and their roles in HRWS are important to provide insights on the perceived barriers that keep householders from having to recycle effectively and frequently. The symbiosis effect, as to date, has rarely been explored in interactions between concomitant households and the recycling system. However, to understand the interactions between people and situations, Fennell and Weaver investigated the symbiosis between tourism and conservation [24] and argued that in order for the ecosystem to be sustainable, many factors should be considered and one of them is community engagement. Both studies concluded that interactions and interdependencies as important elements in a symbiotic relationship. Therefore, this study defined symbiosis as two entities having a mutually close relationship and living together in complete benefit with each other [27].

METHODOLOGY

In this study, a quantitative approach has been applied. Whereby, a quantitative approach is considered relevant to address the research objectives and the quantitative approach can compute numerical data and then the data can be transformed into a relevant statistic [28]. The survey design using questionnaire to seek opinion from the householders and the questions are adapted from [20] and adjusted to address the Malaysian respondents. All the key factors: Situational; Personal; Symbiosis and Awareness level were the main items measured by 5-Likert scales. Respondent were randomly selected consisted of householders in Kedah region. Table 1 provides a socio-demographic profile of respondents.

Table 1. Demographic Background (n=1000)

Item	No	%
AGE		
below 25 years old	727	72.7
between 26-29 years old	142	14.2
between 30-39 years old	98	9.8
between 40-49 years old	22	2.2
above 50 years old	11	1.1
GENDER		
Female	603	60.3
Male	397	39.7
RESIDENTIAL AREA		
Urban	462	46.2
Suburban	271	27.1
Rural	267	26.7
NUMBER OF HOUSEHOLD		
Less than 2	48	4.8
Between 3-5	473	47.3
More than 5	479	47.9

INCOME LEVEL		
Below MYR 1500	423	42.3
MYR 1501 – MYR 2000	178	17.8
MYR 2001 – MYR 3000	191	19.1
MYR 3001 – MYR 4000	103	10.3
Above MYR 4001	105	10.5
THE RESIDENTIAL RECYCLING SERVICES		
Existence	505	50.5
Non-Existence	495	49.5

Based on Table 1, it is evident that the majority in this sample is consists of female household (60 percent) and most of them are households aged below 25 years old that is 727 households. Most of the respondents also resided in urban area that has recycling services that approximately of 462 households (46.2 percent) and the majority of the households are B40 income group.

RESULTS

Correlation Analysis

A Pearson's correlation was used to analyses the relationship between awareness level with situational and personal factors. Firstly, all items that constituted personal or situational factors were formed into relevant composite factors. Then a statistical correlation was applied between these composite factors including all demographic items. Those representing more than a 0.05 significance level were omitted from further analysis. Table 2 demonstrates the correlation between these two composite factors and households' awareness level. It shows that personal factors have a significant relation to situational factors ($p < 0.01$) and vice versa; with positive correlation ($r\ (1000) = +0.163$). However, Age differences have negative relation with awareness level and personal factors ($r\ (1000) > -0.07$) and correlation between personal factors with age group has significant relation ($p < 0.01$). However, household age differences have significant influence at ($p < 0.01$) on situational factors, thus households' gender and income level were at ($p < 0.01$) significant level with only relation with households' awareness level.

Table 2. Correlation Table (n=1000

Factors	**PEARSON CORRELATION**							**Sig. (2-tailed)**
	Awareness Level	Situational	Personal	Symbiosis	Age	Gender	Income Level	
Awareness Level	1	0.238	-0.054	0.321	-0.074	0.168	-0.211	0.01
Personal	-0.054	0.163	1	0.378	-0.129	n.s	n.s	0.00
Situational	0.238	1	0.163	0.380	0.114	n.s	n.s	0.01

Regression Analysis

In order to examine the SE perspective model (the interaction between personal factors with situational factors and the awareness level as the dependent variable), the study applied multiple regression analysis to question these assumptions. This analysis is relevant as it addresses assessment of various relationships, using the information from independent variables to improve the accuracy in predicting values for the dependent variable as recommended by Greene and Field [29]. These analyses reveal the existence of symbiotic relation where in association with either personal or situational. Thus, when awareness level was predicted; it was discovered that RRS ($\beta = -2.33$, $p < 0.01$), situational factors ($\beta = +0.12$, $p < 0.01$), and personal factors ($\beta = -0.20$, $p < 0.01$) were significant predictors of recycling behaviour (Table 3). Furthermore, gender ($\beta = +1.54$, $p < 0.01$), and income level ($\beta = -0.55$, $p < 0.01$), are considered as a strong predictor on influencing the changes in awareness level.

Table 3. Coefficients Table (n=1000)

Model 1	**Unstandardized Coefficients**		**Standard Coefficients**	**t**	**Sig.**
	B	**STD.ERROR**	**BETA**		
(Constant)	18.61	1.96		9.52	0.000
Gender	1.54	0.32	0.14	4.84	0.000
Income Level	-0.55	0.11	-0.14	-4.82	0.000
Residential Recycling Services (RRS)	-2.33	0.31	-0.22	-7.59	0.000
Situational Factors	0.12	0.03	0.12	4.07	0.000
Personal Factors	-0.20	0.04	-0.14	-4.63	0.000
Symbiosis Factors	0.31	0.04	0.25	7.65	0.000

The overall model fit was R^2= 0.508. The main effect of all situational factors was significant, F (12, 987) = 28.55 MSE = 21.75, p< 0.01. And that, in a nutshell, the multiple regression analysis has met its required assumptions. These analyses have shown that both situational and personal factors operate interactively to manifest RB.

DISCUSSION

The findings corresponded with quantitative approaches in extant literature and previous empirical studies that discussed the importance of the facilitation of situational factors (convenience, engagement, accessibility and availability) in promoting RB [10,30, 31]. Households' personal factors are triggered by their awareness level henceforth it is important for the LAs to develop a sustainable recycling programs that relevant to their constituents. Therefore, the findings fully explained the existence of interactions (symbiosis effect) between personal factors and situational factors which coincided with Norm Activation Model [17] as well as in [32]; when the personal factors interacted with situational factors; the recycling behaviour can then be transformed in accordance with how effective the situational factors were established [20]. This supported the illustration of the dotted arrow in Figure 1.

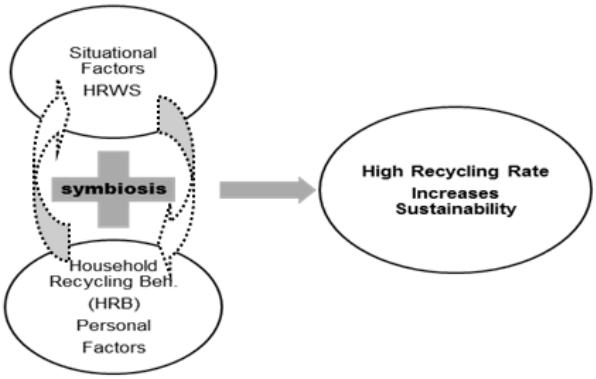

Figure 1. Proposed Symbiosis Effect Perspective Framework

CONCLUSION

The findings indicated that a symbiosis effect do exist between the two major factors supporting the local authorities' household recycling performance. The analysis demonstrates that: (i) the awareness level of household is depending on the changes made by local operators' recycling schemes; (ii) the higher interactions and engagement will result in increases of sustainable initiatives; (iii) the higher coverage of RRS will increase the local authorities' performance in recycling waste initiatives. The coexistence between households and local operators are mutually affected by their engagement in pursuing sustainability, therefore giving birth to the symbiosis effect showing the interactions between the system and behaviour in preserving a triple bottom line. The findings could assist to a better understanding on each factor explaining the role of engagement and interaction. Further research is required to explore in-depth on enablers of symbiosis effect, and longitudinal studies are required to examine RB between different states in Malaysia.

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