Factors Affecting Householders' Acceptance to Adopt Reduce, Reuse and Recycle - 3Rs Program in Domestic Waste Management in Mekong Delta, Vietnam

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Abstract Reduce, reuse and recycle (3Rs) is one of the elements contributing to the success of launching the integrated solid waste management recommended by the United Nations Environment Program. A survey of 360 urban and suburban household respondents was conducted in the Mekong Delta, Vietnam to understand how domestic solid waste managed at household level, to experience respondents' knowledge, awareness and their acceptance participating 3Rs program if it is introduced in the Mekong Delta. Results show that 78% respondents sold recyclable waste and listed activities meaning reducing, reusing and recycling solid domestic waste. More than 70% respondents supported this program when it is launched. The results of the logit model reveal the significant difference in factors affecting urban and suburban respondents' acceptance this program. Age, gender and educational attainment of respondents, household income, respondents' knowledge on reduce, reuse and recycle their solid domestic waste and community participation are factors affecting household acceptance involving in 3Rs. They also propose how to organize successful 3Rs program, namely the collaboration between household and local community in organizing this program, upgrading households' awareness on environmental protection and the support in propaganda of local authorities and social media.

Keywords domestic solid waste, 3Rs, reduce, reuse, recycle, Mekong Delta

INTRODUCTION

Domestic solid waste has increased rapidly in Vietnam and other Southeast Asian countries (Rathi, 2006; Visvanathan and Tränkler, 2003; Bai and Sutanto, 2002). However, it has not been managed properly, especially in Vietnam (Trang, 2012; Hoang and Viet, 2011 and Thanh et al., 2010). In the Mekong Delta, Vietnam, solid waste increases about 10 - 16% annually and about 5,3 million tons of domestic solid waste is generated per day in the Mekong Delta (about 0.3 kg per capita per day) (Hoang and Viet, 2011 cited from MONRE, 2010). However, only 65 -72% of them is collected that most of them are dumped at the landfill.

Reduce, reuse and recycle – 3Rs is one of the suggested solutions for the integrated solid waste management recommended by the United Nations Environment Program (Bernstad, 2014; Tai et al., 2011; Uyen and Hans, 2009). The purpose of 3Rs is to minimize waste generation or disposal and it is a waste hierarchy, the first step, in managing domestic solid waste at source. However, 3Rs has not been widely propagandized and practiced in the Mekong Delta, Vietnam. Thus, this case study was conducted in the Mekong Delta, Vietnam to understand how domestic solid waste is managed at a

household level to experience respondents' knowledge, awareness and their acceptance participating 3Rs program if it is introduced in the Mekong Delta, Vietnam.

METHODOLOGY

Study Sites and Methods of Data Collection

A survey of 360 respondents was conducted in six urban and suburban wards/town in four provinces and cities in the Mekong Delta, Vietnam (Fig 1). Domestic solid waste in those urban sites have been collected for many years while solid waste collection service has just been provided in three suburban areas recent 2-3 years. The respondents are the persons in the households that fully understand how their domestic waste generation and management. Purposive sampling technique was applied with the guide of the head of each ward/town to avoid bias.
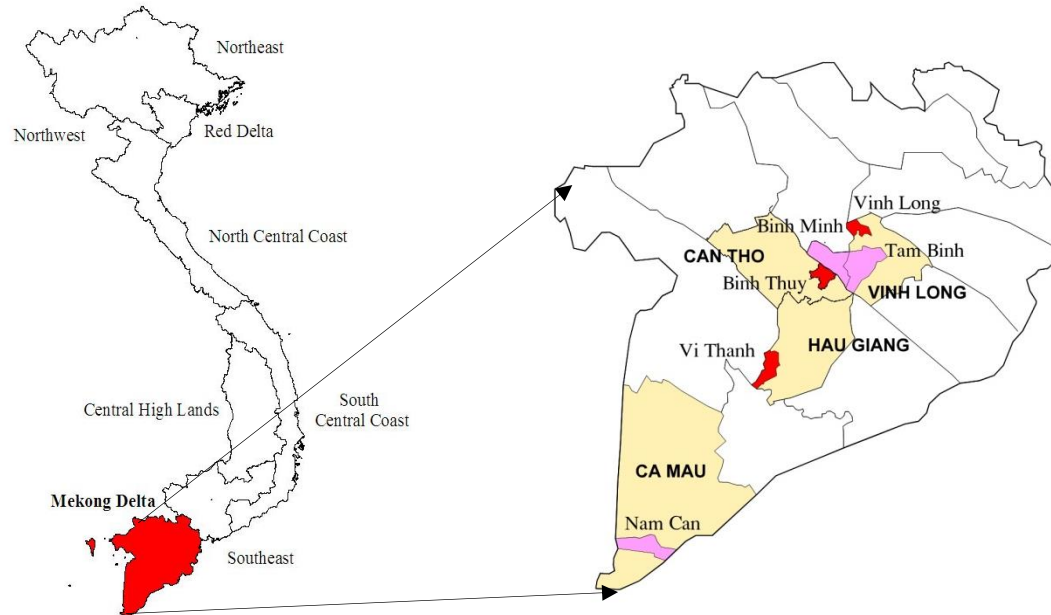

Fig. 1 Map of study sites in Mekong Delta, Vietnam
Note: Red is urban sites and pink is suburban sites

Data Analysis

The surveyed data were analyzed descriptively using frequency, descriptive and cross tabulation, T-test and chi-square to describe the socio-demographic characteristics of respondents and households, households' solid waste generation and management, respondents' awareness and acceptance 3Rs in the urban and suburban areas in the Mekong Delta, Vietnam.

Model to Identify Factors Affecting Respondents' Acceptance 3Rs Program

An assumption was created that 3Rs program will be launched to those six urban and suburban sites in the Mekong Delta. Full introduction about the meaning and examples how householders practice 3Rs at home were carefully explained to respondents. Then, they were asked whether would they accept to

adopt this program when would be launched. The follow-up questions were the reasons why they accepted or not to adopt this program and how to organize successfully this program.

The binary logistic regression model was applied to find out the factors affecting respondents' acceptance to practice 3Rs program. The model is as follows.

$$Yi = \ln \frac{(Pi)}{(1 - Pi)} = \beta i Xi + \alpha$$

Where Y_i is respondents' acceptance to apply 3Rs program when it is introduced to their sites. Y_i = 1: accepted and Y_i = 0: not accepted). i =1 is represented for 360 respondents i= 2 and 3 are urban and suburban sites respectively (180 respondents). βi are the coefficient of the explanatory variables (Xi). The explanatory variables are defined in Table 1. The explanatory variables were based on households' socio-demographic characteristics, respondents' knowledge and awareness how to practice 3Rs at household solid waste management are major factors influencing 3Rs practices (Bernstad, 2014; Miafodzyeva and Brandt, 2014; Singhirunnusorn et al., 2012; Banga, 2011; Farley, 2011; MoEF, 2010; Uyen and Hans, 2009; Shafeeqa et al., 2009; Gamba and Oskamp, 1994).

Table 1 Description of variable in the logit model

Var.	Description	Expected signs	Characteristics
X_1	Area of survey, X_1 = 1: urban area, otherwise, X_1 = 0: rural area	+/-	50% urban area
X_2	Age of respondents (years)	+	45.2±11.9 years
X_3	Gender of respondents, X_2 = 1: male, otherwise X_2 = 0: female	+/-	40% male respondents
X_4	Educational attainment of respondents, X_4 = 1: attended high school (grade 10) or higher, otherwise X_4 = 0	+/-	64% respondents' educational attainment equal or higher high school (grade 10)
X_5	Gross household income (VND/month)	+/-	10±8 million VND/month ~ 450±374 USD/month
X_6	Aware using friendly products means reducing waste, X_6=1: yes, otherwise X_6=0	+	44% respondent's awareness of reduce
X_7	Reuse carton boxes means reuse waste, X_7=1: yes, otherwise X_7=0	+	58% respondent's awareness of reuse
X_8	Household selling recycle waste, X_8 = 1: yes, otherwise X_8 = 0		78 % household selling recycle waste
X_9	The participation of the local community and government contribute to the success of 3Rs program, X_9 = 1 yes, otherwise X_9 = 0	+	49% respondents reveal that collaboration between local community and government will contribute to the success of 3Rs program

RESULTS AND DISCUSSION

Respondents and Households' Characteristics in the Mekong Delta, Vietnam

Among 360 respondents, 50% of them is from urban areas and 40% of them is male (Table 1). The average age is 45.2 ± 11.9 years and 64% reach high school or higher. There are 4.2 ± 1.4 members in a household with 2-3 members are in the working age. The average gross household income is about 10 million VND per month (~ 450 USD/month).

Management of Households' Domestic Waste in the Mekong Delta, Vietnam

The waste quantity is generated about 1.9 ± 1.0 kg per household per day and more waste is disposed in the urban than in the suburban areas (Table 2). The persons who dispose their household waste to the common trash bin or waste truck are more female (61%) than male (16%) and 23% both male and female in the household takes turn to dispose their waste. Plastic bags and trash bins are the most used for waste containers. Each household has 1-3 trash bins and place them in the kitchen or back-yard. About 78.3% household sell recycle waste. The most recycle waste is used bottles or jars, carton boxes, cans and books or newspapers. They earn about 79,000 ± 83,000 VND per quarter (~3.6 ±3.7 USD).

Table 2 Current situation and management of domestic waste of household in Mekong Delta

Characteristics	Urban	Suburban	Total	
Waste generation (kg/day/household)	n=180	n=180	n=360	
	2.0± 1.1	1.7± 0.9	1.9±1.0	***
% of HH selling recycle waste	79.4	77.2	78.3	
Recycle trash (%)	n=139	n=143	n=282	
Used bottles or jars	73.4	90.2	81.9	***
Used carton boxes	59.7	56.6	58.2	*
Beer cans	58.3	45.5	51.8	**
Used books or newspapers	45.3	29.4	37.2	***
Others	39.6	18.9	29.1	***
Return from selling recycle trash (thousand VND/quarter)	89± 90	105± 90	79±83	***

Note: ***, ** and * mean significant different at 1%, 5% and 10%, respectively

Respondents' Awareness on Reuse, Reduce and Recycle (3Rs) in Domestic Waste Management in the Mekong Delta, Vietnam

Most of respondents listed activities meaning to reduce, reuse and recycle waste (Table 3). Even their understanding is simple, it would contribute to the success of introducing this 3Rs program to the public. The presence of plastic bags and containers are the main causes of increasing waste generation.

Table 3 Respondents' awareness on 3Rs in domestic waste management in the Mekong Delta, Vietnam

Respondents' awareness on 3Rs	Urban (n=180)	Suburban (n=180)	Total (n=360)
How to reduce waste generation (%)			
Only buy necessary goods	71.7	96.1	83.9
Buy endurable products	75.0	89.4	82.2
Buying in bulk rather than individuals	57.2	60.0	58.6
Use environmental friendly products	43.3	45.6	44.4
Bring reusable bags when shopping	42.2	44.4	43.3
Use reusable food containers	36.1	25.6	30.8
Use glasses or bottles for buying drinks	27.8	27.8	27.8
How to reuse waste (%)			
Reuse used plastic bags	71.7	86.1	78.9
Reuse used bottles	62.2	77.2	69.7
Reuse used rubber and plastic bands	66.7	61.1	63.9
Donate used clothes, shoes or notebooks	71.1	49.4	60.3
Rese carton box to keep things	53.3	61.7	57.5
Others	31.7	5.0	18.3
How to recycle waste (%)			
Recycle is selling recycle trash	56.7	75.6	66.1
Recycle is to recreate useful things from trash	51.7	64.4	58.1
Residents cannot do recycling by themselves	34.4	40.6	37.5

People do not bring containers or reusable bag when go shopping or buy food and drink. The convenience of small containers also causes more waste. Providing plastic bags to buyers is perceived politeness and care by sellers as results from our study.

The results indicate that respondents often reuse plastic bags, bottles, rubber bands, clothes, notebooks, shoes and carton boxes (Table 3). More people in suburban reuse those things than in the urban areas. The reuse practice is not only mean saving, but it is also a habit of care users. The convenience and household wealth restrict people to reuse things. That is important point that needs to upgrade residents' behavior in reuse things to reduce waste generation and environmental protection.

The same with the first two Rs – reduce and reuse, recycle is more popular for poor people. Respondents often sell recycle waste and recreate useful things from trash (Table 3). More residents in the suburban sell recycle waste than in the urban areas. Price of recycle waste and household wealth also restrict recycle behavior. Due to the goods cost is low and mostly is not included cost of the waste disposal, their price is lower and thus it leads people lazy to sell recycle waste. Residents recycle waste due to the economic benefit rather than to reduce waste generation or environmental protection.

Factors Affecting Respondents' Acceptance to adopt 3Rs program in the Mekong Delta, Vietnam

After receiving information about the proposed 3Rs program, 72% of the respondents accept to practice this program. More suburban residents (79%) prefer this program than urban residents (66%). The result of the logit models is presented in Table 4.

Table 4 Factors affecting respondents' acceptance to adopt the 3Rs program in the Mekong Delta, Vietnam

	Variables	Total	Urban	Suburban
X_1	Regions	-0.118***		
X_2	Ages of respondents	-0.031**	-0.024	-0.056**
X_3	Genders of respondents	-0.349	-1.114	-1.165**
X_4	Educational attainment of respondents	0.727**	1.226***	-0.066
X_5	Gross household income per month	0.000*	0.000	0.000
X_6	Aware on reduce waste generation	0.262	0.428	-0.146
X_7	Aware on reuse waste generation	0.396	0.675***	0.675***
X_8	Practice selling recycle waste	0.547	0.587	0.587
X_9	Community	0.020***	0.011	0.011
	Constant	0.406	-0.596	-0.596
	No. of observation	360	180	180
	Percentage of acceptance (%)	72	66	79
	Log likelihood	-303.033	-195.057	-94.714
	R^2	0.279	0.251	0.247

Note: Number in the table is the coefficient of the logit model
***, ** and * indicate statistical significance at 1%, 5% and 10% levels, respectively

There are differences in the results in three logit models. More suburban respondents accepting this program if it is introduced. The significant factors of these models confirm the characteristics of respondents and households (age, gender, educational attainment of respondents and household income) affecting the acceptance of this program (Banga, 2014; Miafodzyeva and Brandt, 2013). Besides, the awareness of reduce and reuse waste generation also affect their acceptance (Banga, 2014; Miafodzyeva and Brandt, 2013; Farley, 2011; Uyen and Hans, 2009; Shafeeqa et al, 2009). Lastly, the collaboration between the local residents and the government is the factor affecting for the success of the 3Rs program (Challcharoenwattana and Pharino, 2015; Miafodzyeva and Brandt, 2013; MoEF, 2010).

Besides, respondents recommend that the collaboration between the local residents and government, residents 'awareness on environmental protection and preserve the environment for the future as well as the propaganda for the program are factors contributing to the success when 3Rs program is launched. The most effective modes of communication for this 3Rs program are television, local propaganda, radio/radio station. Besides, local information exchange, newspapers, internet and providing 3Rs information through the basic schools.

CONCLUSION

3Rs program should be introduced and propagandized widely in the Mekong Delta as well as the whole Vietnam. It will be the start hierarchy to improve domestic solid waste management in the Mekong Delta through minimizing waste generation and make use of waste before disposal and dumping. The 3Rs program should incorporate the linkage of individual – community performance and social media to upgrading households' awareness on environmental protection and successfully launch this program in the Mekong Delta and Vietnam.

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