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A Study on Factors Toward Household Willingness on E-Waste Recycling in Seremban

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***Abstract*—E-waste recycling is a method of recycling electrical and electronic equipment as e-waste may harm the environment and human health if it is not discarded properly. The amount of e-waste generated in Malaysia has increased over the years due to rapid increases in technology and economic development. Many households have an irresponsible attitude and are not committed to e-waste recycling even though they have knowledge and awareness of e-waste. This study focuses on psychological models, econometric models and demographic variables to measure e-waste recycling behaviour based on the Theory of Planned Behaviour (TPB) theoretical framework of previous studies to explore factors related to the household willingness on e-waste recycling through an online questionnaire survey distributed to Seremban households. Based on the empirical analysis of 226 valid online survey responses from Seremban households, the results show there is a significant positive correlation of attitude, subject norms and perceived behavioural control over the willingness of Seremban households to participate in e-waste recycling. Moreover, researchers further analyses the moderating effect of income on economic motivation and also moderating effect of education level on subject norms. The findings of this study indicate that only attitudes have an impact on households' willingness to recycle e-waste and, in contrast, the moderating effect of income on economic motivation and education levels on subject norms is not significant, indicating that they have no impact on households' willingness to participate in e-waste recycling. Finally, it is recommended to promote and enhance e-waste recycling to support households in the recycling of e-waste.**

Keywords*—*e-waste, household, recycling behaviour, recycling willingness

I. INTRODUCTION

The market of electrical and electronic equipment (EEE) continues to grow rapidly and bring many benefits to today's lifestyle, however, they are contributing to the growing pile of waste of EEE or e-waste. Nowadays, due to the fashionable trend, an advanced function of the system has increased consumption and the short lifespan of electrical and electronic equipment generates large amounts of e-waste.

The Malaysian government had regulated the Environmental Quality (Scheduled Wastes) since 2005 that aimed to enforce the public not to dispose of e-waste in landfills. The proper disposal practice of e-waste had been widely practiced by industrial sectors, but in households, small-sized electronics can end up in normal waste bins and disposed of with municipal solid waste [4]. Material Recovery Facilities revealed that at a household level only 5 percent of the e-waste was recycled because no obligation for householders to dispose of their electronic products to the right platform [1]. E-waste management in Malaysia had not been efficiently employed because of poor household willingness in recycling e-waste [3].

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The Department of Environment Malaysia stated that the overall household e-waste management system was lacking at the moment and also facing many challenges in developing proper systems for household e-waste management. Furthermore, some household e-waste had a low value of recyclable materials and recyclers or collectors were interested in more valuable materials.

The previous study suggested that socioeconomic variables such as education and income were the crucial factors in recycling behaviour [7]. Likewise, attitudinal also affects household willingness to recycle e-waste, specifically attitude, subjective norm, perceived behavioural control, and economic motivation. Thus, the household willingness in recycling e-waste was significant to address the factors that influencing willingness in terms of attitude, subjective norm, perceived behavioural control, economic motivation, income and education in this study.

II. METHODS

A. Descriptive Data

The targeted population and sample of this research was the household in Seremban, Negeri Sembilan. This research used the Creative Research System (2012) to determine the sample size and the adequate sample size. The study distributed 230 questionnaires to Seremban's household. A total of 226 samples were received and used for the analysis after data cleaning. The sampling method that was used in this study was snowball sampling. The data collection method was an online questionnaire through a google form that was distributed to the respondents using social media platforms. Each household is limited to the completion of one questionnaire filled by the housing representative.

B. Theoretical Framework

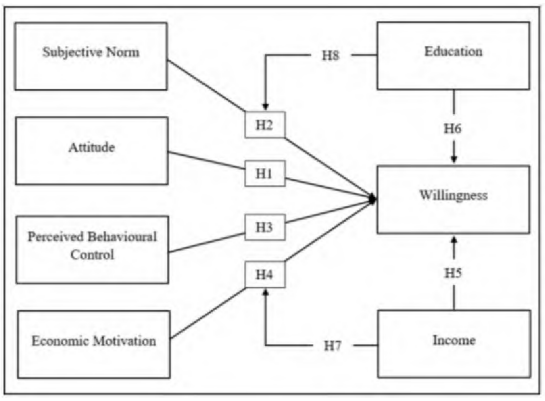

Fig. 1.Theory of Planned Behavior, TPB

The theory of planned behaviour suggested three pillars that affect behavioral intention, which is attitude, subjective norm, and perceived behavioral control. A survey of citizens in Wuhan proposed that consumers with higher incomes, social status, and levels of education are more likely to participate in recycling activities [6]. Household educational level and income may play a moderating role in behaviour intentions. The moderating variable can influence the strength of the correlation in the relationship [2]. Thus, this research proposes a theoretical model of the factors that influence the household willingness on recycling e-waste which shown in Fig. 1.

C. Multiple Linear Regression and Hierarchical Regression

In this study, multiple linear regression analysis was used to identify which variables have an impact on household willingness in participating in e-waste recycling. There are a few assumptions to build a multiple linear regression model in which the relationship between dependent and independent variables must be linear, the error term must be normally distributed, the error variance must be constant, the error terms are independent and there are no outliers [5]. The transformation of variables is done to make the model adequate for making inferences if any assumptions are not fulfilled. Researchers run a hierarchical regression to check if the interaction items are significant. The significant result indicates that there is a moderating effect.

III. RESULTS AND FINDINGS

A. Demographic Profile

This research illustrates the respondent's gender, household gross monthly income and education level using a demographic profile. In the distribution of gender, 68.1 percent of the respondents were female and only 31.9 percent were male. More than half of the respondents, 54 percent, have income less than RM2500, followed by income from RM2500 to RM6999 with 31 percent while the rest of 15 percent are from respondents that have an income of RM7000 and above. As for educational level,

respondents with Degree level of education conquered the educational level with slightly more than half of the respondents with 50.4 percent and 27.4 percent belongs to the respondent with STPM/Diploma/A Level. Only 15.5 percent of the respondents had SPM/SPMV/MCE/O Level while the respondents with Master were only 6.6 percent.

B. Awareness and Knowledge of Electronic Waste

This study also tested Seremban households' awareness and knowledge of e-waste. The result from the analysis showed that 65 percent of respondents were aware of e-waste and 58.8 percent of respondents have the knowledge that e-waste needed special treatment before it was disposed of. In addition, most respondents, 83.2 percent, know that e-waste is harmful to the environment if it is not disposed of properly and 80.6 percent of respondents are aware that e-waste contains harmful substances. About 69 percent of respondents reported that they were aware of the health risks associated with e-waste and, shockingly, only 23.5 percent of respondents from Seremban households received e-waste education. This study also found that 89.4 percent of respondents expressed the opinion that e-waste sorting is important.

C. Multiple Regression Analysis and Hierarchical Regression

Multiple linear regression analysis was used to test H1 to H8 in this study. Throughout all of the assumptions that were built for multiple regression analysis, the variables used in this research fulfilled all of the assumptions. The hierarchical regression and moderation analysis result was reported in Table 3.1 and attitude was the only significant variable that will give an impact on the household willingness to participate in e-waste recycling as the p-value was less than 0.05. Therefore, only hypothesis H1 has been supported. Next, results discovered that the variance in the willingness of the household to participate in e-waste recycling shown in R^2 value for model 1, accounts for 31 percent, then increased to 31.3 percent in model 2 and accounted for additional 31.5 percent in model 3. Moreover, the proportion of incremental variance in Model 1 is statistically significant because of the other model statistical significance value greater than 0.05. Therefore, this research can conclude that income does not moderate the relationship between economic motivation and the willingness of the households in Seremban to participate in e-waste recycling. In addition, the relationship between subject norms and the willingness of households in Seremban to participate in e-waste recycling is not moderated by education.

Table 1. Hierarchical Regression and Moderating Effect Analysis

Model	Variable	B	Standard Coefficient	t	Sig.	Co-linear Statistics		R^2	Statistics Change		Sig. F Change
						Tolerance	VIF		R^2 Change	F Change	
1	(Constant)	2.704		1.657	.099			.310	.310	16.395	.000
	Attitude	.313	.485	7.643	.000	.782	1.279				
	Subject Norm	.033	.071	1.001	.318	.623	1.604				
	Perceived Behaviour	.050	.089	1.222	.223	.596	1.679				
	Economic Motivation	-.087	-.076	-1.198	.232	.791	1.264				
	Income	.098	.025	.425	.672	.931	1.074				
	Education	.270	.078	1.318	.189	.910	1.099				
2	(Constant)	2.837		1.731	.085			.313	.003	.825	.365
	Attitude	.309	.479	7.508	.000	.774	1.292				
	Subject Norm	.036	.077	1.075	.283	.619	1.616				
	Perceived Behaviour	.046	.081	1.108	.269	.588	1.702				
	Economic Motivation	-.082	-.072	-1.131	.259	.787	1.270				
	Income	.091	.023	.396	.693	.930	1.075				
	Education	.276	.079	1.346	.180	.909	1.101				
	Economic Motivation*Inc	-.029	-.052	-.908	.365	.971	1.029				
3	(Constant)	2.964		1.801	.073			.315	.003	.891	.346
	Attitude	.305	.473	7.360	.000	.765	1.308				
	Subject Norm	.040	.086	1.196	.233	.607	1.648				
	Perceived Behaviour	.042	.074	.997	.320	.581	1.722				
	Economic Motivation	-.078	-.068	-1.069	.286	.784	1.275				
	Income	.065	.016	.0279	.781	.917	1.091				
	Education	.282	.081	1.371	.172	.908	1.036				
	Economic Motivation*Inc	-.027	-.047	-.827	.409	.965	1.036				
	Subject Norm*Edu	-.077	-.055	-.944	.346	.941	1.062				

IV. CONCLUSIONS

The main aim of this research is to study the factor towards households' willingness to participate in e-waste recycling which is based on the theory of planned behaviour methods. Following the analysis, this research discovered that attitude positively manipulates the households' willingness to participate in e-waste recycling. This research also found out that the moderating effect of education and income is not significant which indicates that the household with different income and education levels did not have an impact on their willingness to participate in recycling e-waste. Thus, this research needs to add more samples to obtain a better result regarding this topic in the future.

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