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Housewives Environmental Awareness in Household Solid Waste Management

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Abstract. Waste generation in recent years has been increasing. The main problem is in the lack of environmental awareness. Awareness can be influenced by behavior, knowledge and income. This research wants to find out whether these 3 factors have an influence to the awareness of housewives who manage their household waste that live in residential area partially and fully. Questionnaires using likert scale that have undergone validity and reliability test were distributed online using Google Form to 100 housewives. Data were analyzed using descriptive analysis, Multiple Linear Regression and hypothesis testing in Microsoft Excel. Descriptive analysis showed that the mean age of the respondents is 40.715 while the mean income is 16.145 million Rupiah. Multiple Linear Regression showed that behavior and knowledge have positive influence toward awareness while income has negative influence towards awareness on the respondents. The 3 classical assumptions results showed that there was normality, homoscedasticity and no multicollinearity. Hypothesis testing showed that the model was significant as a whole. Value of behavior and knowledge were significant, but the value of income was insignificant.

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1 Introduction

Waste generation in recent years has been increasing annually. It is a natural product of and population growth [1], economic development and urbanization [2]. In 2016, the waste generated reached 2.01 billion tons worldwide. It was projected that in 2050, 3.40 billion tons of waste will be generated. From this huge amount of waste, 44% of it are food organic waste [2].

Indonesia has 261,115,456 people with a waste generation reaching 65,200,000 tons in 2016 [3]. A report by World Bank Group [4] in 2018 stated that 63.18% of Indonesia's municipal waste is organic waste. Indonesia had enforced the law on solid waste management in UU no. 18/2008, which states that solid waste has to be controlled by reduction and handling. However, are not attempting to reduce it [5].

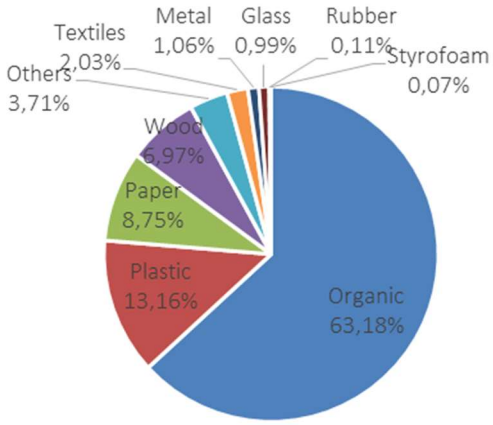

Fig. 1. Indonesia Municipal Waste Composition in 2018 [3]

World Bank Group [4] stated waste awareness in Indonesia is low even though waste management services are offered. This is due to the lack of local leadership, monitoring and law enforcement on illegal dumping and burning. In general, the lack of information and awareness in forms of campaigns and public information plays an important role in the waste issues in Indonesia.

Some areas in Indonesia, especially near the tidal zones, are aware of waste separation and collection. However, most areas with lower economic status are only

facilitated with inadequate waste services. Thus making the community around those areas unaware of waste management in general. And this lack of awareness caused people to stick with negative perceptions that at the end separated waste will be mixed by collectors, stockpiling waste will invite pests and recyclables materials are low-priced and not worth the effort [4].

Most of the time, waste management are controlled by lowest level of government, the RT/RW or local communities. In some areas, waste are disposed in dumpsters and will be collected by the next level of government periodically. In other areas, waste collection is based on fee-for-service basis, where waste is collected in waste carts drawn by humans weekly or monthly. Unfortunately, neither of these systems make the community separate their waste [4].

To have a good system, a person from the community has to take the lead. In addition to that, constant monitoring and law enforcement are needed to prevent more waste problems. In general, the cause of these issues is the lack of awareness from the community due to lack of public campaigns and information on waste problems [4]. According to [6], knowledge increases awareness and thus increases one's participation. Thus, community participation in waste management will start after the community realize the importance of it [7].

Based on the research done by [8], behavior also plays an important part in environmental issues. Behavior is defined as what a person does whether environmentally appropriate or not [9]. This shows the level of awareness a person has. In addition to that, income also becomes a factor affecting awareness on waste management [10, 11]. People with higher income have better conditions in fulfilling their basic needs, thus making them more aware of environmental issues.

The objective of this paper will try to see the influence of the 3 factors, knowledge, behavior and income, toward environmental awareness of housewives living in residential area partially and fully. The scope of this research is using behavior, knowledge and income as an independent variables and awareness as a

dependent variable. This research limit for housewife that live at residential area in Jakarta and Bekasi and their manage their solid waste by themselves.

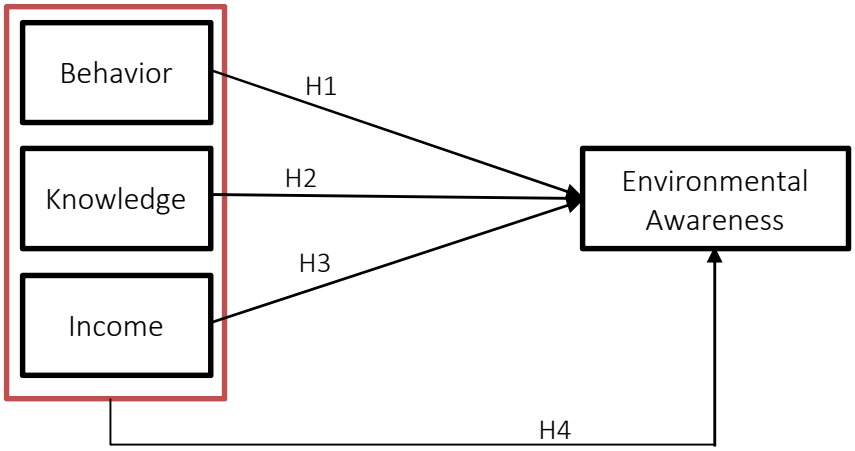

Fig. 2. Factors Affecting Awareness

Fig. 2 shows the framework of this research. Based on the figure, H1 to H4 are hypotheses of this research. This will be the foundation of the research and will later be checked whether the results are the same with the hypotheses. The meaning of each hypothesis is described as:

H1: Behavior has a significant influence on environmental awareness
H2: Knowledge has a significant influence on environmental awareness
H3: Income has a significant influence on environmental awareness
H4: Behavior, Knowledge and Income as a whole, has a significant influence on environmental awareness

2 Method

2.1 Population and Sample

The population of this research is housewives (*Ibu Rumah Tangga*) living in a residential area in Jakarta and Bekasi. The sampling unit of this research is the housewives living in residential area and who manage the household waste. The sampling method is purposive sampling because respondents have to meet the

criteria of being a housewife, who manage their household waste and lives in residential area. Housewives are those who mostly spend their time at their houses and usually those who manage the waste in their houses. This survey is specifically targeted to housewives living in a residential area because that is where people with more access to knowledge presumably lives.

2.2 Data Collection

This research used survey as a research strategy. One method used in survey is questionnaire. Questionnaire has several advantages which becomes the reason for it being used in this research. Questionnaires are cost-effective, especially with more questions. They are easy to be analyzed by respondents. They decreases bias as the researcher's opinion is not given. And they are a less intrusive method to be used compare to face-to-face and telephone interviews. [12]

According to [13], there are 7 points to be considered in determining required sample size for a research, nature of universe, number of classes proposed, nature of study, type of sampling, standard of accuracy and acceptable confidence level, and other considerations. Based on those points, it is concluded that this research should have a relatively large number of sample. Therefore, the sample size for this research will be 100.

The questionnaire is made using Google Form online. There are 9 sections in the questionnaire. The 1st until the 3rd section is the introduction and screening part. The 4th section is an extra section to know the characteristics of the respondents. The 5th until the 8th section is where the min questions are found. Questions are asked in a likert scale from 1 to 5 with 1 being 'strongly disagree' and 5 being 'strongly agree'. The 9th section is the free-response section. In total, there are 29 questions, with 19 main questions and 10 questions for screening and knowing the characteristics of the respondents (labelled questionnaire can be found in Appendix 1).

The next step is the validity and reliability test. This research will use Pearson's product moment correlation (also called Pearson's r) test to evaluate the

questionnaires validity. While reliability will be evaluated using the Cronbach's Alpha method. Both tests are done in PSPP as a statistical tool.

In validity test, the critical value is very important. This can be found by using the r table (Appendix 2). Firstly, find the degree of freedom (df) which is equal to total sample subtracted by 2. Next, set the alpha (α) to 0.05 as it is the most commonly used value and it is considered acceptable [14]. Since 30 samples is the minimum value to run a validity and reliability test, the critical value used in this research will be 0.361007 [15]. A question is considered valid if its r value is greater than the critical value [16]. Table 1 shows the result of the test.

Table 1. Value of Pearson's r Coefficient for Each Questions

Label	r Value	Label	r Value	Label	r Value
A1	0.58	B3	0.69	D1	0.87
A2	0.55	B4	0.62	D2	0.68
A3	0.80	B5	0.74	D3	0.88
A4	0.74	C1	0.81	D4	0.84
A5	0.63	C2	0.88	D5	0.82
B1	0.41	C3	0.92	r Critical Value	0.361007
B2	0.73	C4	0.90		

In reliability test, there is a set of ranges of alpha that determines how reliable the questions are, this set of ranges is called the rule of thumb (Appendix 3). The acceptable value of alpha is from 0.7 to 0.95. This table represents the rule of thumb of interpreting alpha for dichotomous or likert scale questions [17]. Table 2 shows the results of the test. From both validity and reliability tests, it is concluded that there will be no changes to the questionnaire. All questions were proven valid and reliable. Therefore the questionnaire is further distributed. Direct results from PSPP were shown in Appendix 4 and 5.

Table 2. Value of Cronbach's Alpha for Each Variable

Label	Cronbach's Alpha	Consistency
A	0.68	Questionable
B	0.64	Questionable
C	0.90	Excellent
D	0.87	Good
All	0.83	Good

2.3 Data Analysis

2.3.1 Descriptive Analysis

The respondent's characteristics are analyzed based on their age and household monthly income. Frequency of the results are going to be counted and shown in a pie chart. Then the mean of each category is calculated to find out the average age and household income per month among the respondents.

Also, the mean result of each questions are calculated to roughly figure out whether the respondents in average have a high, moderate or low level of each variable. Table 3 shows how these levels are categorized based on the mean result. The mean will be calculated based on the frequency of each questions (frequency table can be found in Appendix 6)

Table 3. Interpretation of Mean Results

Range	Interpretation
<2.5	Low
2.5 to 3.5	Moderate
>3.5	High

2.3.2 Multiple Linear Regression

The data will then be analyzed using multiple linear regression method. Multiple linear regression shows the relationship of more than 2 variables to a dependent variable [18]. This method was chosen because awareness is not only affected by 1 variable, but 3 variables. The formula of a linear regression is shown below. This

research will use Microsoft Excel as a statistical tool in calculating the multiple linear regression.

$$y = \beta 0 + \beta 1\, x1 + \beta 2\, x2 + \ldots. \beta k\, xk + \varepsilon \quad (1)$$

y = dependent variable
x = independent variable
β0 = value of y when x is 0 (y-intercept)
β1, β2 … βk = slope of corresponding variable
ε = residual terms

After analyzing with Multiple Linear Regression, there will be 3 classical assumption tests, normality test, heteroscedasticity test and multicollinearity test, to show whether the regression model is valid or not. Normality test is testing whether the regression model is normally distributed or not. It is done by using the Normal Probability-plot (P-plot). If the residual data is normally distributed, then the line that represents the actual data will follow a diagonal line [19]. Heteroscedasticity test shows whether or not there is unequal variance in the regression model of one observation to another observation. This test will use the scatterplot graph to represent the results. If plots form a pattern of a fan-like or cone-like shape, it means that it is heteroscedasticity-positive, which is undesirable. Meanwhile, if the graph shows no particular pattern, it means that it is heteroscedasticity-negative, which is desirable [19]. Multicollinearity test is done by comparing the variance inflation factor (VIF) to the required value. It is desirable to have a value of VIF at less than or equal to 10 [19]. These 3 tests will be done in Microsoft Excel.

2.3.3 Hypothesis Testing

Hypothesis testing is done last as it will show the whether the hypotheses in the beginning of this research are correct and also answers the objective of this research. The first test is the t-test, followed by the F-test, and finally finding the R-squared of the model. These 3 tests are done in Microsoft Excel.

The t-test shows how significant the differences between the group means are [20]. This test shows the significance of the coefficients of each independent

variables toward the dependent variable. While F-test shows the significance of the joint independent variable towards the dependent variable [21]. Both tests will achieve a certain p-value, which is needed to be low to be considered acceptable. The p-value shows the probability of the result happen by chance. The R-squared is used to predict future outcomes or to test the hypotheses. It gives a measure of how well the model represents the observed outcomes [22].

3 Results and Discussion

3.1 Descriptive Analysis

The measured characteristics of the respondents in this survey are the age and income. From 100 total respondents, the mode of age group is 41 to 50, which represents 41% of the respondents (**Figure 3**), while the mode of household income group is 10 to 20 million Rupiah, which represents 39% of the respondents (**Figure 4**).

Fig. 3 shows that the 41-50 age group dominates the sample. Below that is the 31-40 age group with 24%. This means that 65% of the sample are housewives with ages 31 to 50. The mean of the sample cannot be calculated as it is since there is a range. So, the average of its range is calculated first, 25.5, 35.5, 45.5, 55.5 and 67. It is found that the sample mean of age is 40.715.

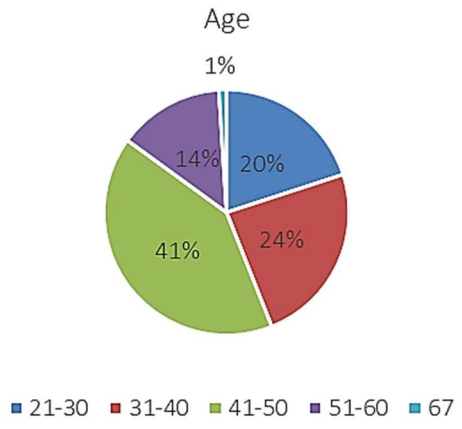

Fig. 3. Respondent Distribution Based on Age

Fig. 4 shows that the household income group of 10 to 20 million Rupiah per month dominates the sample with 39%. Below it is the household income group of ≤9 million Rupiah with 32%. If the 2 groups are going to be combined, it almost reaches 75%. By using the same technique in finding mean in the age group case, it is found that the mean of household income per month is 16.145 million Rupiah.

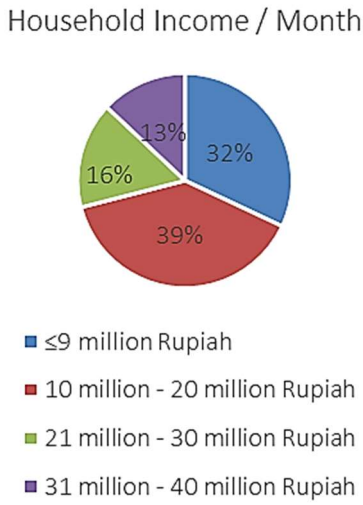

Fig. 4. Respondent Distribution Based on Income

The mean results of the 4 main variables of the questionnaire is shown in Table 3. The mean results show that only 4 questions have a mean of under '4', while the rest have a mean of above '4'. This shows that in average, all respondents are aware of waste management in general. Table 3 shows that the respondents have already some understanding about waste management and thus are aware of environmental problems. However, this research focuses on the influence of behavior, knowledge and income on the level of awareness, so further analysis was done.

Table 3. Mean Test Result

Variables	Labels	Frequency (%)					Mean	Variables	Labels	Frequency (%)					Mean
		1	2	3	4	5				1	2	3	4	5	
A	1	1	0	1	31	67	4.63	C	1	2	0	3	14	81	4.72
	2	0	0	5	27	68	4.63		2	0	0	3	31	66	4.63
	3	0	1	3	22	74	4.69		3	0	1	6	26	67	4.59
	4	0	0	2	17	81	4.79		4	1	1	12	23	63	4.46
	5	0	0	0	21	79	4.79	D	1	1	4	20	31	44	4.13
B	1	0	0	2	37	61	4.59		2	5	4	26	35	30	3.81
	2	0	1	5	40	54	4.47		3	0	6	25	34	35	3.98
	3	0	0	18	33	49	4.31		4	9	9	30	25	27	3.52
	4	0	0	7	25	68	4.61		5	6	4	27	39	24	3.71
	5	0	0	0	18	82	4.82								

3.2 Multiple Linear Regression

Based on the result of multiple linear regression, the model of this research will be:

Awareness = 10.806 + 0.332 Behavior + 0.312 Knowledge – 0.0304 Income

The next analysis is the 3 classical assumption tests. The normality test proves that the data is normally distributed as the graph shows a normal pattern (Fig. 5). The heteroscedasticity test also proves that the data are not heteroscedastic. The graph

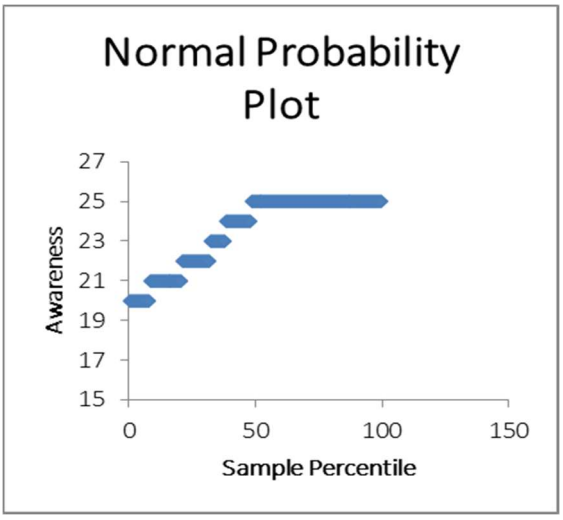

Fig. 5. Normal Probability Plot

shows an ambiguous pattern so it is hard to determine the result based on the graph only (Fig. 6). Thus, ANOVA analysis with the residuals square as the dependent variable instead of awareness was done. The result states that the P-value of F is 0.100335392. This value is greater than the significant value of 0.05, thus, null hypothesis that states the data set is homoscedastic is accepted. The multicollinearity test also proves that all variables have a VIF of below 10, which means the data are acceptable (Table 4).

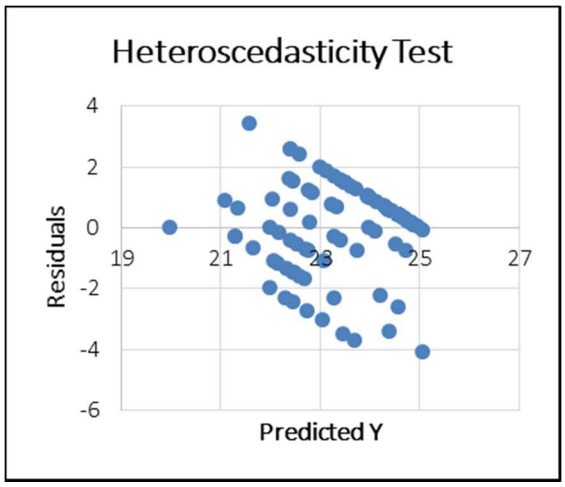

Fig. 6. Heteroscedasticity Test Result

Table 4. Multicollinearity Test Result

	VIF	Criteria	Comment
Total A	1.6618990	<10	OK
Total B	2.0267304	<10	OK
Total C	2.0183827	<10	OK
Total D	1.0877173	<10	OK

3.3 Hypothesis Testing

From the linear model mentioned earlier, we can assume that increasing behavior and knowledge will also yields better awareness, but with more income, awareness

decreases. However, the significance of this model has to be checked first. Table 5 and 6 shows the results of the ANOVA test.

Table 5. ANOVA F-test

	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	129.4047472	43.13491575	21.1807706	1.30036E-10
Residual	96	195.5052528	2.03651305		
Total	99	324.91			

Table 6. ANOVA T-test

	Coefficients	P-value
Intercept	10.80569535	$3.77*10^{-9}$
Behavior	0.331591711	0.0005813
Knowledge	0.312328924	0.0026163
Income	-0.03043543	0.3723865

Based on the ANOVA F-test result, the model in general achieved a P-value of 1.3*10-10, which is less than 0.05 and thus proves to be significant (Table 5). As shown in Table 6, the intercept, behavior and knowledge proved to be significant, however, income does not proved to be significant. This meant that the first assumption is not fully correct. Although income has a negative correlation with awareness, the result proves to be not significant, which means that there is in fact no correlation between awareness and income. However, it has to be kept in mind that this result only applies to the population of housewives in residential area who takes care of their household waste.

The residual terms in this model is almost equal to zero, which is why it is not included in the model. Residual terms are the deviations of the observed values with their means [23]. The sum of the residual terms of all observed values is -7.816*10-14, which is insignificant, thus concluding the residual term is equal to zero. With this, the new model for this research will be:

Awareness = 10.806 + 0.332 Behavior + 0.312 Knowledge

The R-squared of this model is 37.95%, which is considered to be very low. However, this does not mean that our model is not significant. In fact, the reason the R-squared can be low is because human is hard to predict [24]. There are a lot of other factors that are not discussed in this research which may be present among the respondents when answering the questionnaire, thus giving a low R-squared value.

Based on the results, the respondents are generally aware of waste management. All questions regarding awareness have a mean value of more than 4.5, proving that the respondents are aware indeed. This suggests that the majority of the respondents are very aware [25]. According to *Badan Pusat Statistik* [25], ages of 15 to 64 is the productive age where people can still learn new things easily. The age groups of this research are included in the productive age range, thus making them aware of new environmental issues.

The model shows that behavior is linearly correlated in a positive way to awareness. This can be proven by looking at the mean of each question in the behavior variable. The means are not far off the means of the awareness section, ranging from 4.31 to 4.82. This means that good (high) behavior resulted in high awareness of the environment and vice versa. There are almost no literature in the effect of behavior to awareness in housewives, however, there are several literatures on students. It was found that behavior is in fact insignificant to awareness level in students, but high environmental behavior is a result of a high environmental attitude, which is also a result of a high environmental awareness [26]. This research did not find the influence of environmental attitude towards awareness, but based on this literature, the high environmental behavior in the respondents was a result of high environmental attitude and awareness as well.

In terms of knowledge, the model also shows a positive linear correlation to awareness. The mean result of the knowledge aspect was not far off the awareness aspect, ranging from 4.46 to 4.72. A lot of previous studies had stated that

knowledge is one of the biggest contributor to awareness level [26, 27, 28]. This research once again strengthen the fact that knowledge is indeed an important factor.

In terms of income, without considering its significance, the result of the ANOVA test shows that income is negatively correlated to awareness. Moreover, it is shown in the mean result that the means of the income variable are quite far off the awareness variable. Due to its insignificance, this research concludes that income does not have any significance or influence towards the awareness level of the respondents. A lot of other literatures stated that income actually does influence awareness level, however, the term income in other literatures meant the amount of income and not the activities done in relation to income level [26, 28]. Thus explaining the different expected result. This means that whether or not the income level influence the awareness of housewives in residential area, their action in spending money for environmental issues has no relation to it.

In general, the results of this research shows that awareness is influenced by behavior and knowledge, but income-related actions has no significance towards awareness level. In addition to the results of this research, there are several notable external factors that may play a role in the results. Women in general are found to be more environmentally aware than male [26, 28]. Also, people living in residential area have a relatively higher awareness towards environment [26, 29]. Finally, the hypotheses made in the beginning of this research can now be accepted or rejected. Based on the results, H1, H2 and H4 should be accepted while H3 should be rejected.

4 Conclusions

In conclusion, the results of this research shows that awareness of housewife in city is indeed influenced by behavior and knowledge, but not income. By looking at the model, it is clear that both behavior and knowledge is positively related to awareness. Results of classical assumptions show that the model is normal,

homoscedastic and has no multicollinearity. This means that the model found in this research is statistically valid.

5 Recommendations

Based on the result of this research, some recommendations may proposed:

1. Socialization about household solid waste could useful to increase the awareness
2. Training about household solid waste management may increase knowledge of housewife
3. For future research, the research could use same method of analysis and variables but towards different population, different variables or more detail variables.

6 Acknowledgement

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